MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

Autonomous Institution – UGC, Govt. of India

Department of COMPUTATIONAL INTELLIGENCE

B.TECH (AI&DS)

B.TECH(R-20 Regulation)

(III YEAR – I SEM)

2023-24

FULL STACK DEVELOPMENT

(R20A0516)

LECTURE NOTES

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

Recognized under 2(f) and 12(B) of UGC ACT 1956

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Maisammaguda, Dhulapally (Post Via. Hakimpet), Secunderabad–500100, Telangana State, India

Department of COMPUTATIONAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE

&

DATA SCIENCE

FULL STACK DEVELOPMENT
(R20A0516)

LECTURE NOTES

Prepared by

MD AZHAR

ASSISTANT PROFESSOR

Department of Computational Intelligence

Artificial Intelligence and Data Science

Vision

To be a premier centre for academic excellence and research through innovative interdisciplinary collaborations and making significant contributions to the community, organizations, and society as a whole.

Mission

- To impart cutting-edge Artificial Intelligence technology in accordance with industry norms.
- To instill in students a desire to conduct research in order to tackle challenging technical problems for industry.
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FULL STACK DEVELOPMENT
(R20A0516)

COURSEOBJECTIVES

1. To become knowledgeable about the most recent web development technologies.
2. Idea for creating two tier and three tier architectural web applications.
3. Design and Analyse real time web applications.
4. Constructing suitable client and server side applications.
5. To learn core concept to both frontend and backend programming.

UNIT -I

Web Development Basics: Web development Basics - HTML &Web servers Shell- UNIX CLI Version control- Git &GithubHTML,CSS

UNIT -II

FrontendDevelopment:Javascriptbasics OOPSAspectsofJavaScript MemoryusageandFunctionsinJS AJAXfordataexchangewithserver jQueryFramework jQueryevents,UIcomponents etc.JSONdataformat.

UNIT-III

REACT JS: Introduction to React React Router and Single PageApplicationsReactForms, FlowArchitecture and IntroductiontoRedux MoreRedux and Client-ServerCommunication

UNIT -IV

JavaWebDevelopment:JAVAPROGRAMMINGBASICS,Model View Controller (MVC) Pattern MVC Architecture usingSpring RESTfulAPI using SpringFramework Building an application usingMaven

UNIT -V

Databases & Deployment: Relational schemas and normalizationStructured Query Language (SQL) Data persistence using SpringJDBC Agile development principles and deploying application inCloud

TEXT BOOKS:

1. Web Design with HTML, CSS, JavaScript and JQuery Set Book byJon Duckett ProfessionalJavaScript for Web Developers Book byNicholas C.Zakas
2. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-StepGuideto CreatingDynamicWebsitesby Robin Nixon
3. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB.Copyright ©2015BYAZAT MARDAN

REFERENCEBOOKS:

1. Full-StackJavaScriptDevelopmentbyEricBush.
2. Mastering Full Stack React Web Development Paperback – April 28,2017 by TomaszDyl ,Kamil Przeorski , Maciej Czarnecki

COURSEOUTCOMES:

1. Develop afully functioning website and deployon aweb server.
2. GainKnowledge about thefrontend and backend Tools
3. Find and use code packages based on their documentation to produce working results in a project.
4. Create web pages that function using external data.
5. Implementation of web application employing efficient database access.

INDEX

What is HTML

HTML is an acronym which stands for **Hyper Text Markup Language** which is used forcreating web pages and web applications. Let's see what is meant by Hypertext MarkupLanguage,and Web page.

Hyper Text: HyperText simply means "Text within Text." A text has a link within it, is ahypertext. Whenever you click on a link which brings you to a new webpage, you haveclicked on a hypertext. HyperText is a way to link two or more web pages (HTMLdocuments)with each other.

Markup language: A markup language is a computer language that is used to apply layoutandformattingconventionstoatextdocument.Markuplanguagemakestext moreinteractiveanddynamic.It can turntextinto images, tables, links, etc.

Web Page: A web page is a document which is commonly written in HTML and translatedby a web browser. A web page can be identified by entering an URL. A Web page can be ofthestaticordynamictype.**Withthe helpof HTML only,wecancreate static webpages**.

Hence, HTML is a markup language which is used for creating attractive web pages with thehelp of styling, and which looks in a nice format on a web browser. An HTML document ismadeof many HTMLtags and eachHTMLtag contains differentcontent.

Let'sseeasimple exampleofHTML.

```
1. <!DOCTYPE>
2. <html>
3. <head>
4. <title>Webpagetitle</title>
5. </head>
6. <body>
7. <h1>WriteYour FirstHeading</h1>
8. <p>WriteYourFirstParagraph.</p>
9. </body>
10. </html>
```

Descriptionof HTML Example

<!DOCTYPE>: It defines the document type or it instruct the browser about the version ofHTML.

<html >:This tag informs the browser that it is an HTML document. Text between html tagdescribesthe web document.It isa containerforall otherelements ofHTML except

<head>: It should be the first element inside the <html> element, which contains themetadata(informationaboutthedocument).Itmustbeclosedbeforethebodytagopens.

<title>: As its name suggested, it is used to add title of that HTML page which appears at thetop of the browser window. It must be placed inside the head tag and should closeimmediately.(Optional)

<body>: Text between body tag describes the body content of the page that is visible to theenduser. This tag contains themain content oftheHTML document.

<h1>:Text between<h1>tagdescribes thefirstlevel headingof thewebpage.

<p>:Textbetween<p>tagdescribestheparagraphofthewebpage.

BriefHistoryofHTML

In the late 1980's , a physicist, Tim Berners-Lee who was a contractor at CERN, proposed asystem for CERN researchers. In 1989, he wrote a memo proposing an internet basedhypertextsystem.

Tim Berners-Lee is known as the father of HTML. The first available description of HTMLwas a document called "HTML Tags" proposed by Tim in late 1991. The latest version ofHTMLis HTML5, which wewill learn later in this tutorial.

HTMLVersions

Since the time HTML was invented there are lots of HTML versions in market, the briefintroductionabout theHTML version is given below:

HTML 1.0: The first version of HTML was 1.0, which was the barebones version of HTMLlanguage,and it was released in1991.

HTML 2.0: This was the next version which was released in 1995, and it was standardlanguage version for website design. HTML 2.0 was able to support extra features such asform-basedfileupload, formelements such as textbox, option button,etc.

HTML 3.2: HTML 3.2 version was published by W3C in early 1997. This version wascapable of creating tables and providing support for extra options for form elements. It canalsosupportawebpage withcomplexmathematicalequations. Itbecameanofficialstandardforany browsertill January 1997.Today it ispractically supported bymost of thebrowsers.

HTML 4.01: HTML 4.01 version was released on December 1999, and it is a very stableversion of HTML language. This version is the current official standard, and it providesaddedsupportforstylesheets(CSS)andscriptingabilityforvariousmultimediaelements.

HTML5 : HTML5 is the newest version of HyperText Markup language. The first draft ofthis version was announced in January 2008. There are two major organizations one is W3C(World Wide Web Consortium), and another one is WHATWG(Web Hypertext ApplicationTechnology Working Group) which are involved in the development of HTML 5 version, andstill,itis under development.

FeaturesofHTML

1) Itisavery**easyandsimplelanguage**.Itcanbe easilyunderstoodandmodified.

2) It is very easy to make an **effective presentation** with HTML because it has a lot offormattingtags.

3) It is a **markup language**, so it provides a flexible way to design web pages along with thetext.

4) It facilitates programmers to add a **link** on the web pages (by html anchor tag), so itenhancesthe interest of browsing of theuser.

5) It is **platform-independent** because it can be displayed on any platform like Windows,Linux,and Macintosh, etc.

6) It facilitates the programmer to add **Graphics, Videos, and Sound** to the web pages whichmakesit moreattractiveand interactive.

7) HTML is a case-insensitive language, which means we can use tags either in lower-case orupper-case.

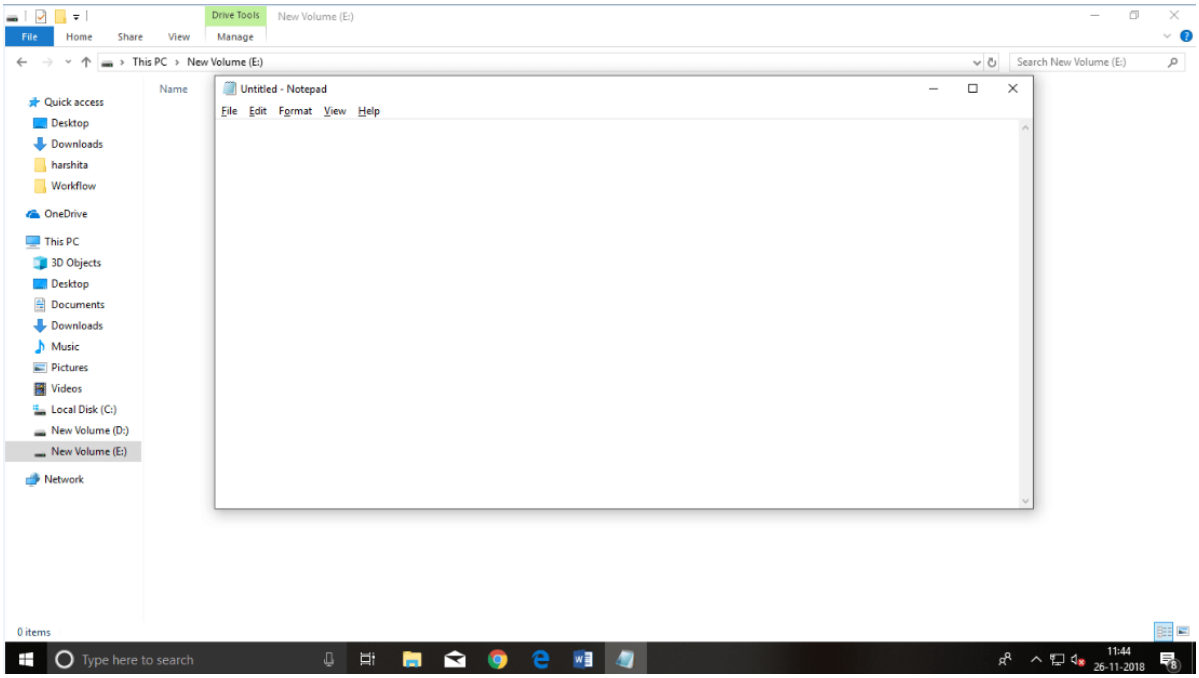
HTMLtextEditors

- AnHTML fileisa text file, soto createanHTMLfilewecanuseany text editors.
- Texteditorsaretheprogramswhichallowediting inawrittentext,hencetocreateawebpageweneed to write ourcodein some texteditor.
- There are various types of text editors available which you can directly download, butforabeginner, thebest text editoris Notepad (Windows)or TextEdit (Mac).
- Afterlearningthebasics,youcaneasilyuseotherprofessionaltexteditorswhichare, **Notepad++,SublimeText,Vim,etc**.
- Inourtutorial,wewilluseNotepadand sublimetexteditor. Followingaresomeeasywaysto create your firstweb pagewith Notepad,and sublimetext.

A. HTML code with Notepad. (Recommended forBeginners)

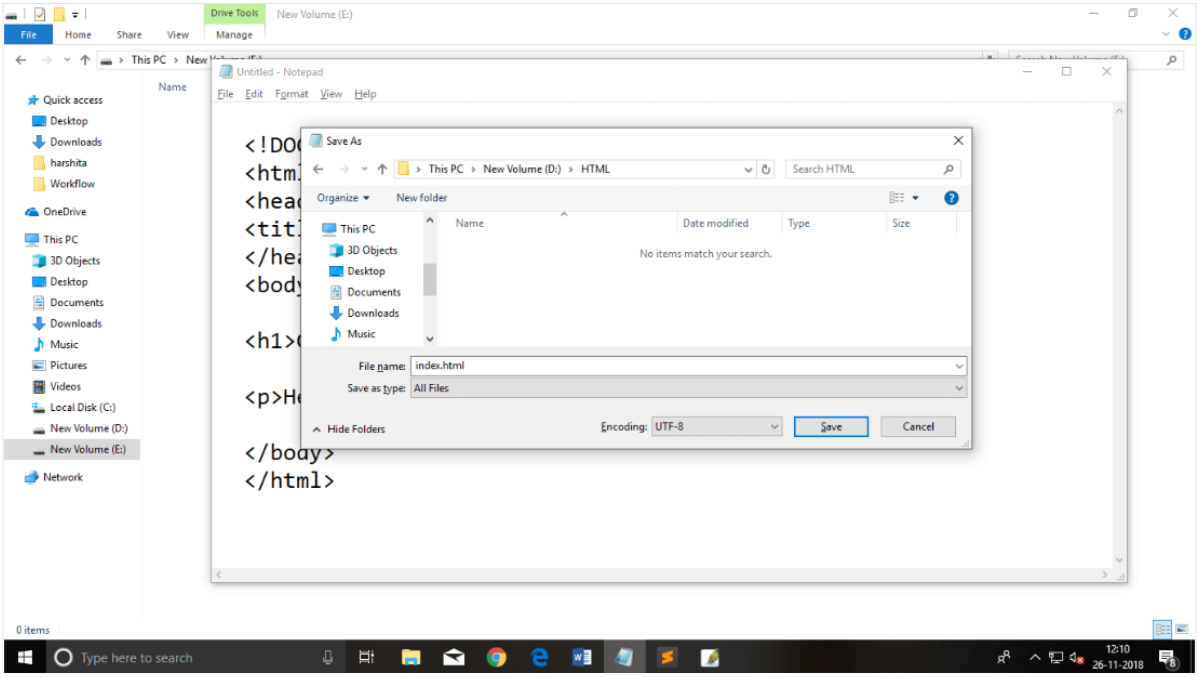
Notepad is a simple text editor and suitable for beginners to learn HTML. It is available in allversionsof Windows, from whereyoueasily access it.

Step1:OpenNotepad(Windows)



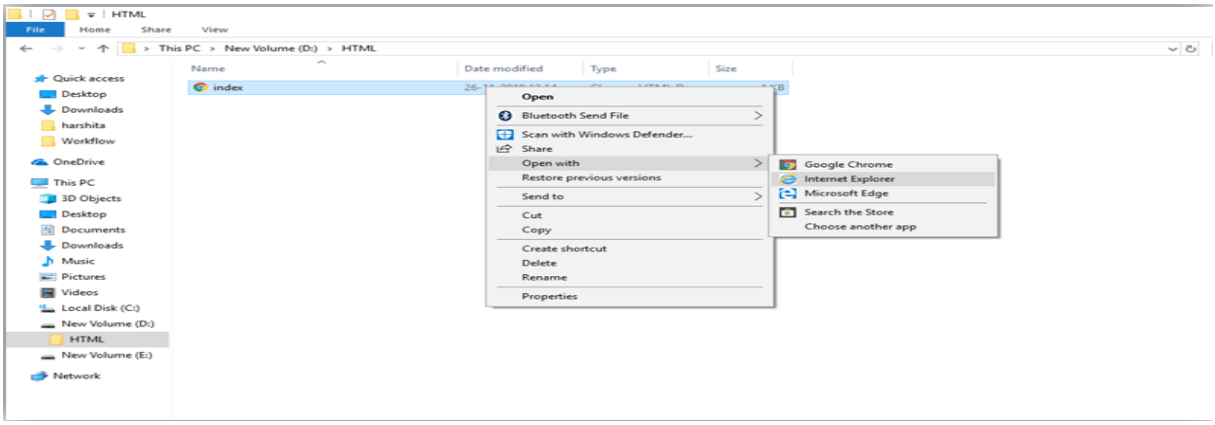
Step2:Writecodein HTML

Step3:Save theHTMLfilewith.htmor.htmlextension.



Step4:OpentheHTMLpagein yourwebbrowser.

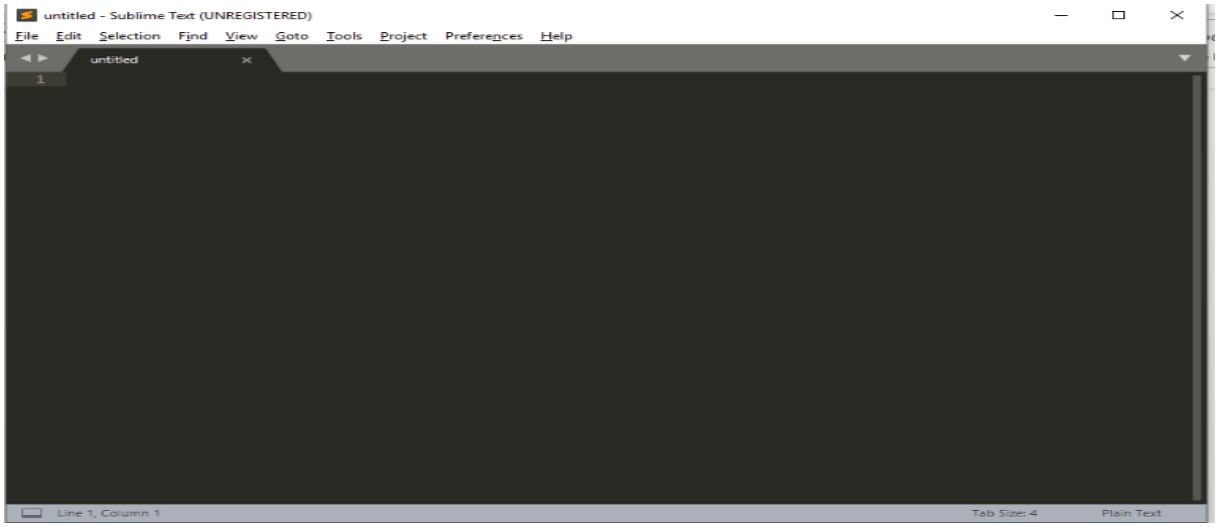
To run the HTML page, you need to open the file location, where you have saved the file andtheneither double-clickon file orclick onopenwith option



B. HTML code with Sublime Text-editor.(Recommendedafterlearning basics ofHTML)

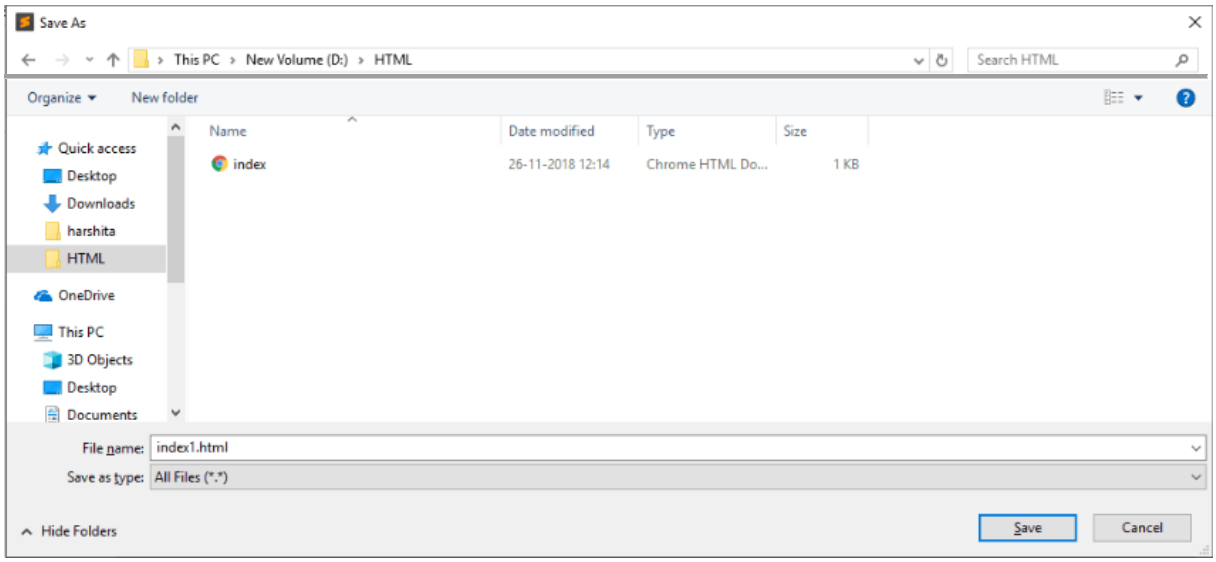
When you will learn the basics of HTML, then you can use some professional text editors,which will help you to write an efficient and fast code. So to use Sublime Text editors, first itneeds to download and install from internet. You can easily download it from thishttps://www.sublimetext.com/downloadlink and can install in your PC. When installation ofSublimetext editor donethen you can follow the simple steps touseit:

Step1:OpenSublimeTexteditor(Windows8):

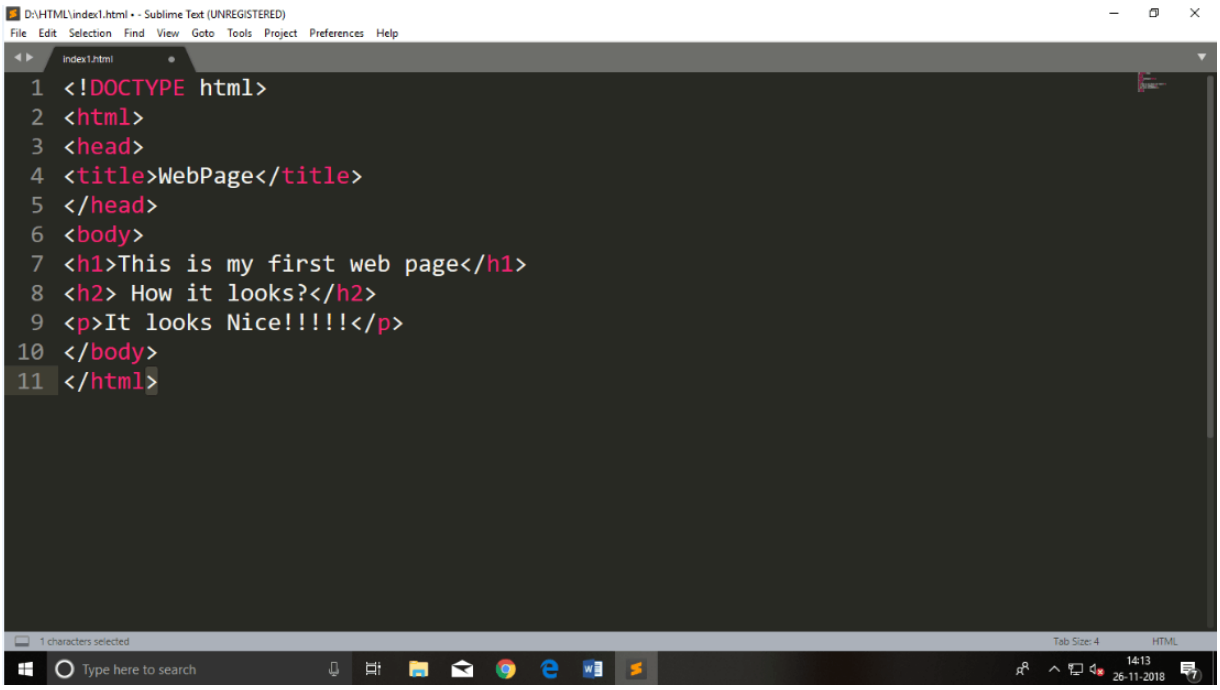


Step2:Savethepagebefore writinganycode.

To save your page in Sublime Text press Ctrl+S or go to File option ⇢ save, to save a file useextension .htm or .html. We recommend to save the file first then write the code because aftersavingthepagesublimetext editorwill give you suggestions to writecode.

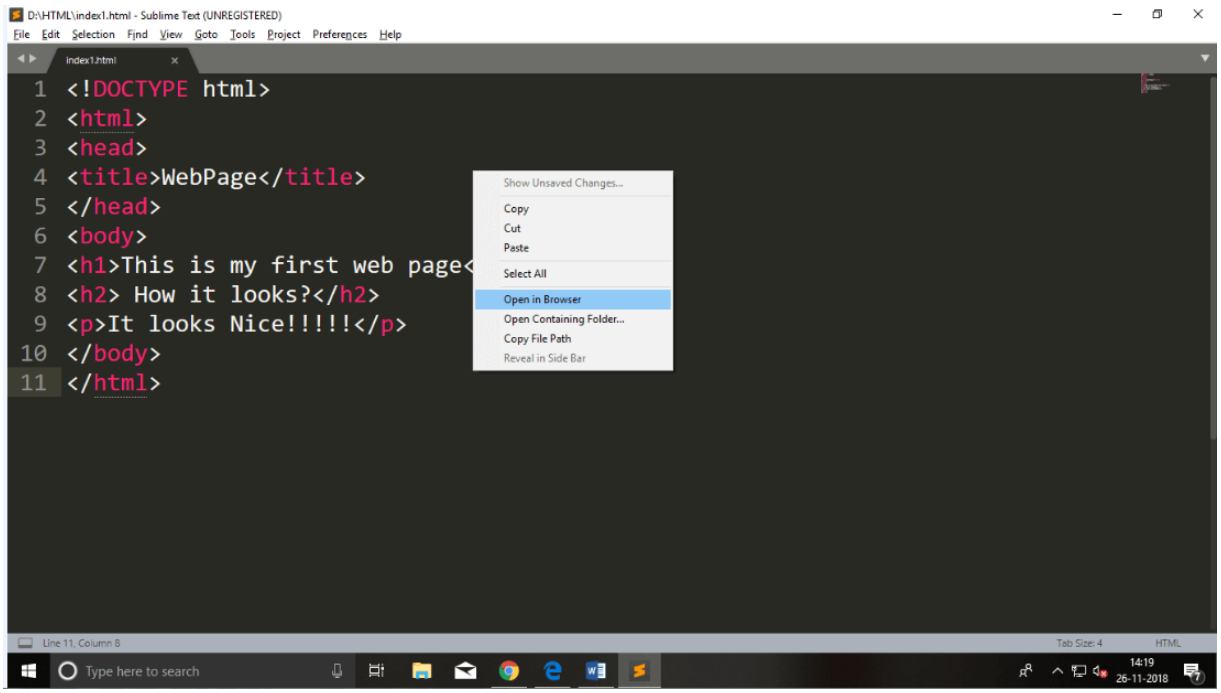


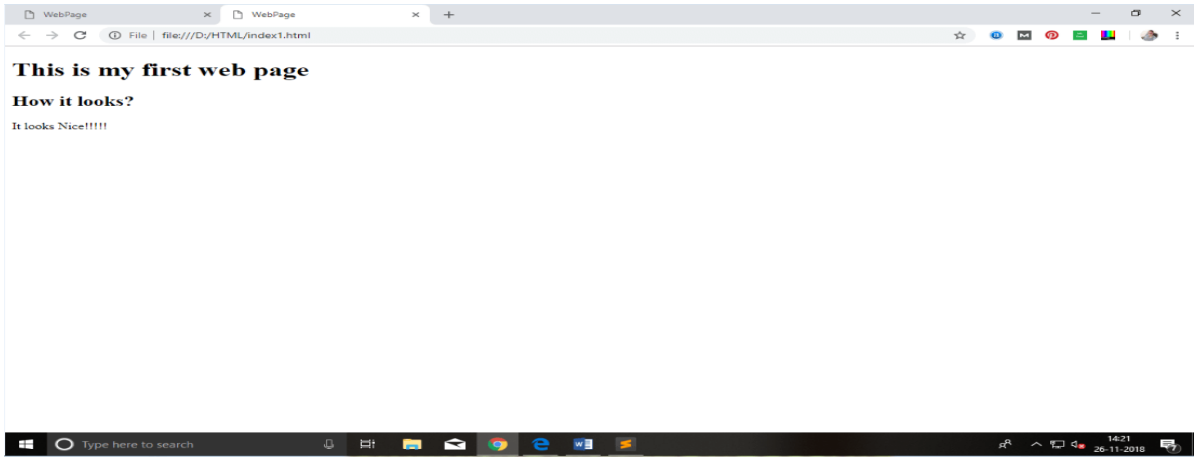
Step3:Writethe codeinSublimeTexteditor



Step4:Openthe HTMLpageinyourBrowser

To execute or open this page in Web browser just **right click** by mouse on sublime text pageandclick on **Open inBrowser**.





Buildingblocksof HTML

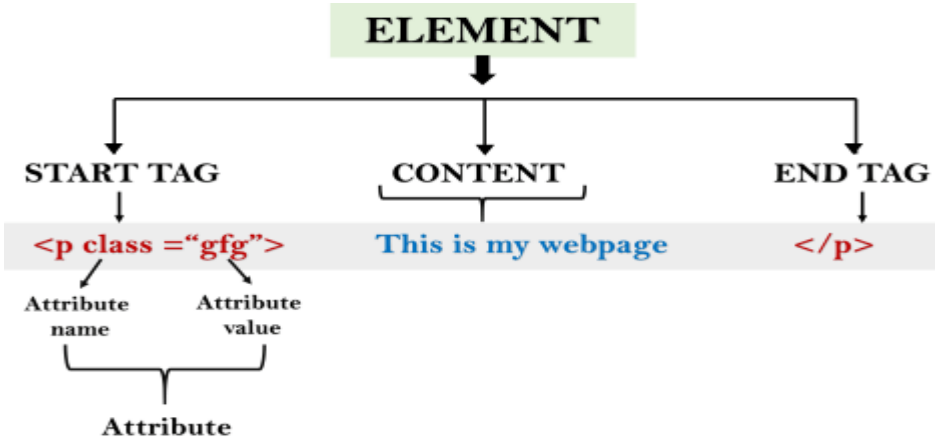
AnHTMLdocument consistof itsbasic buildingblockswhich are:

- **Tags:** An HTML tag surrounds the content and apply meaning to it. It is writtenbetween<and >brackets.
- **Attribute:** An attribute in HTML provides extra information about the element, and itisappliedwithinthe starttag.AnHTML attribute containstwofields: name&value.

Syntax

1. <tagnameattribute_name="attr_value">content </tagname>

- **Elements:**AnHTMLelementisanindividualcomponentofanHTMLfile.InanHTMLfile, everythingwritten withintags aretermed asHTML elements.
-



Example:

```
1. <!DOCTYPEhtml>
2. <html>
3.   <head>
4.     <title>Thebasicbuilding blocksofHTML</title>
5.  </head>
6.   <body>
7.       <h2>Thebuildingblocks</h2>
8.       <p>Thisisaparagraphtag</p>
9.       <pstyle="color: red">Thestyleisattributeof paragraphtag</p>
10.      <span>Theelementcontainstag,attributeandcontent</span>
11.  </body>
12. </html>
```

Output:

Thebuildingblocks

Thisisaparagraphtag

HTMLTags

HTML tags are like keywords which defines that how web browser will format and displaythe content. With the help of tags, a web browser can distinguish between an HTML contentand a simple content. HTML tags contain three main parts: opening tag, content and closingtag.But someHTML tags areunclosedtags.

When a web browser reads an HTML document, browser reads it from top to bottom and leftto right. HTML tags are used to create HTML documents and render their properties. EachHTMLtags havedifferent properties.

An HTML file must have some essential tags so that web browser can differentiate between asimple text and HTML text. You can use as many tags you want as per your coderequirement.

- AllHTMLtagsmustenclosedwithin<>thesebrackets.
- Everytagin HTMLperformdifferenttasks.
- Ifyou have usedan opentag <tag>,then youmustusea closetag</tag>(exceptsometags)

Syntax

<tag>content </tag>

HTML TagExamples

Note:HTMLTags arealwayswritteninlowercaseletters.ThebasicHTMLtagsaregivenbelow:

ParagraphTag

<h2> HeadingTag</h2>

BoldTag

ItalicTag

<u>UnderlineTag</u>

UnclosedHTMLTags

SomeHTMLtags arenotclosed,for examplebr and hr.

**
Tag**:br standsfor breakline, itbreaksthelineof thecode.

<hr>Tag:hrstandsfor HorizontalRule.Thistagis usedtoputalineacrossthewebpage.

HTMLMetaTags

DOCTYPE,title,link,metaandstyle

HTMLText Tags

,<h1>,<h2>,<h3>,<h4>,<h5>,<h6>,,,<abbr>,<acronym>, <address>,<bdo>,<blockquote>,<cite>,<q>,<code>,<ins>,<del>,<dfn>,<kbd>, <pre>, <samp>,<var>and

---

HTMLLinkTags

<a>and<base>

HTMLImageandObjectTags

<img>,<area>,<map>,<param>and<object>

HTML ListTags

,<ol>, <li>,<dl>, <dt>and<dd>

HTMLTableTags

table,tr,td, th,tbody, thead,tfoot, col,colgroup andcaption

HTMLForm Tags

form,input,textarea,select,option,optgroup,button,label,fieldset andlegend

HTMLScriptingTags

scriptandnoscript

Note:We willsee examplesusingthesetagsinlatercharters.

HTMLTags List

FollowingisthecompletelistofHTMLtagswiththedescriptionwhicharearrangedalphabetically.

HTMLAttribute

- HTML attributes are special words which provide additional information about the elementsorattributes are themodifier ofthe HTML element.
- Eachelement ortagcanhaveattributes,whichdefinesthebehaviourofthat element.
- Attributesshouldalwaysbeappliedwithstart tag.
- TheAttributeshouldalwaysbeappliedwithitsnameandvaluepair.
- The Attributes name and values are case sensitive, and it is recommended by W3C that itshouldbe writtenin Lowercaseonly.
- You can add multiple attributes in one HTML element, but need to give space between twoattributes.

Syntax

1.<elementattribute_name="value">content</element>

Example

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.  </head>
```

```
5.  <body>
6.      <h1>ThisisStyle attribute</h1>
7.     <pstyle="height: 50px;color:blue">Itwill addstylepropertyin element</p>
8.      <pstyle="color:red">Itwillchangethecolor ofcontent</p>
9.  </body>
10. </html>
```

Output:

Explanationof aboveexample:

1.<pstyle="height: 50px;color: blue">Itwill add stylepropertyinelement</p>

In the above statement, we have used paragraph tags in which we have applied style attribute.This attribute is used for applying CSS property on any HTML element. It provides height toparagraphelement of 50px and turns it colour to blue.

1.<pstyle="color: red">Itwill changethecolorofcontent</p>

In the above statement we have again used style attribute in paragraph tag, which turns itscolourred.

Note: There are some commonly used attributes are given below, and the complete list andexplanationofallattributesaregivenin HTML attributes List.

Thetitleattribute inHTML

Description: The title attribute is used as text tooltip in most of the browsers. It display itstext when user move the cursor over a link or any text. You can use it with any text or link toshowthedescriptionaboutthatlink ortext.Inour example, wearetakingthiswithparagraphtagand heading tag.

Example

With<h1> tag:

1.<h1title="This isheadingtag">Exampleoftitleattribute</h1>

With tag:

1. Move the cursor over the heading and paragraph, andyouwillseeadescriptionas atooltip

---

Code:

```
1.  <!DOCTYPEhtml>
2.  <html>
3.    <head>
4.   </head>
5.  <body>
6.
7.    <h1title="This isheadingtag">Exampleoftitle attribute</h1>
8.    <p title="This is paragraph tag">Move the cursor over the heading and paragraph, and
      youwillseea descriptionasa tooltip</p>
9.
10. </body>
11. </html>
```

Output:

ThehrefattributeinHTML

Description: The href attribute is the main attribute of <a> anchor tag. This attribute givesthe link address which is specified in that link. **The href attribute provides the hyperlink,andif it is blank, then itwill remainin samepage**.

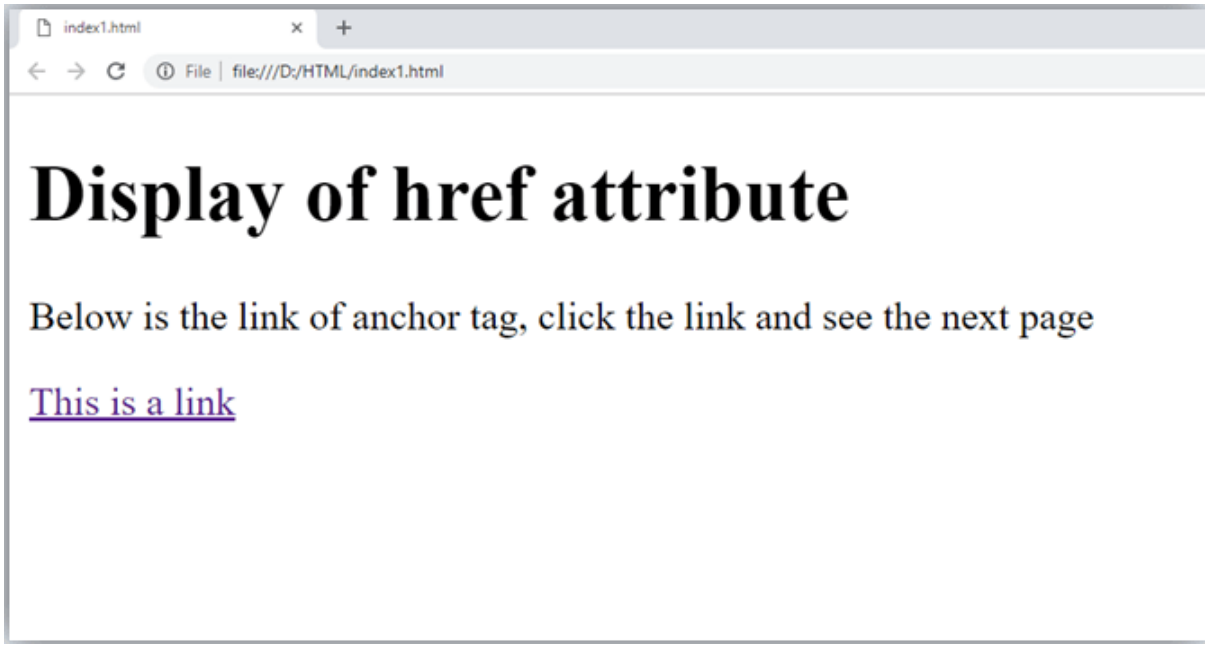
Example

Withlinkaddress:

1.<ahref="https://www.javatpoint.com/html-anchor">Thisisalink

Withoutlinkaddress:

1.<ahref="">Thisisalink



ThesrcAttribute

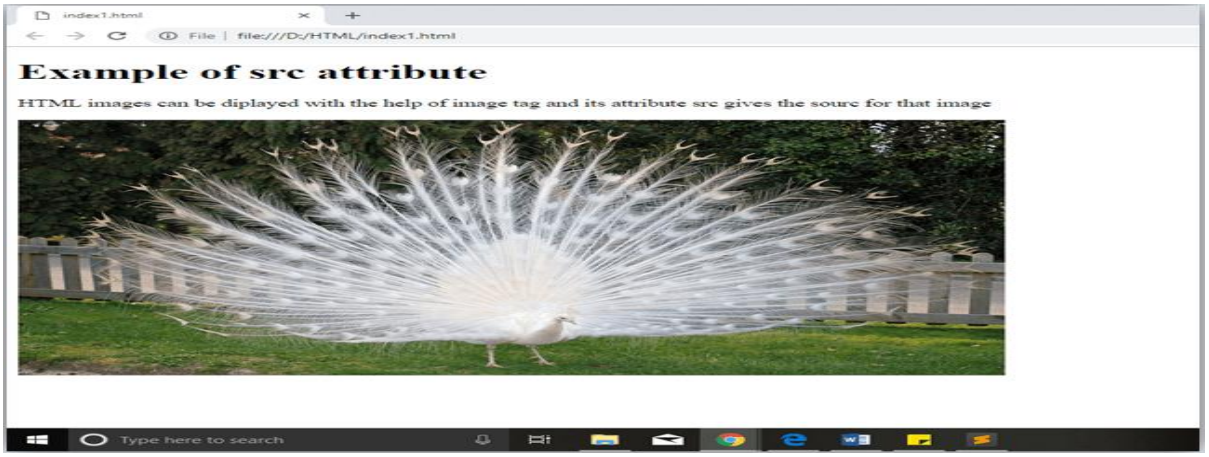
The **src** attribute is one of the important and required attribute of **<img>**element. It is sourcefor the image which is required to display on browser. This attribute can contain image insame directory or another directory. The image name or source should be correct elsebrowserwill not display the image.

Example

1.<imgsrc="whitepeacock.jpg" height="400" width="600">

Note: The above example also have height and width attribute, which define the height and width ofimage onweb page.

Output:



Quotes:singlequotesor double quotes?

In this chapter you have seen that, we have used attribute with double quotes, but somepeople might use single quotes in HTML. So use of single quotes with HTML attribute, isalsoallowed. Thefollowing both statements areabsolutely fine.

```
1. <ahref="https://www.javatpoint.com">AlinktoHTML.</a>
2. <ahref='https://www.javatpoint.com'>AlinktoHTML.</a>
```

INHTML5, youcan alsoomit use ofquotes aroundattributevalues.

```
1.<ahref=https://www.javatpoint.com>AlinktoHTML.</a>
```

HTMLElements

An HTML file is made of elements. These elements are responsible for creating web pagesand define content in that webpage. An element in HTML usually consist of a start tag <tagname>, close tag </tag name> and content inserted between them. **Technically, an elementisa collection of starttag,attributes, end tag,content betweenthem**.

Note: Some elements does not have end tag and content, these elements are termed as empty elementsorself-closing elementor void elements.

Suchas:

```
1.<p>Helloworld!!!</p>
```

Example

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4.     <title>WebPage</title>
5. </head>
6. <body>
7.    <h1>Thisismyfirstwebpage</h1>
8.     <h2>Howitlooks?</h2>
9.      <p>ItlooksNice!!!!!</p>
10. </body>
11. </html>
```

- Allthecontentwrittenbetweenbodyelementsarevisibleonwebpage.

Void element: All the elements in HTML do not require to have start tag and end tag, someelements does not have content and end tag such elements are known as Void elements oremptyelements. **Theseelements arealso calledas unpaired tag**.

**SomeVoidelementsare
(representsalinebreak),<hr>(representsahorizontalline),etc.**

Nested HTML Elements: HTML can be nested, which means an element can containanotherelement.

Block-level andInlineHTMLelements

For the default display and styling purpose in HTML, all the elements are divided into twocategories:

- Block-levelelement
- Inlineelement

Block-levelelement:

- These are the elements, which structure main part of web page, by dividing a page intocoherentblocks.
- A block-level element always start with new line and takes the full width of web page, fromleft to right.
- Theseelementscancontainblock-levelaswellasinlineelements.

Followingarethe block-levelelements inHTML.

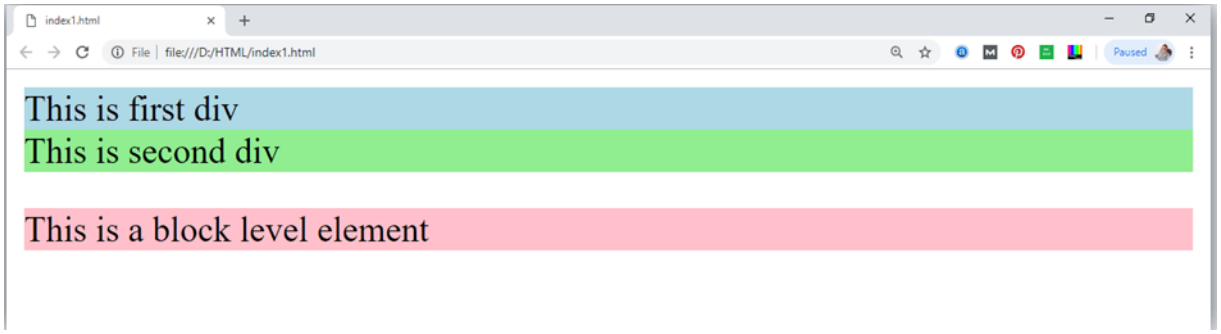
<address>,<article>, <aside>,<blockquote>,<canvas>,<dd>, ,<dl>,<dt>,<fieldset>, <figcaption>,<figure>, <footer>,<form>,<h1>-<h6>,<header>,<hr>, <li>,<main>, <nav>, <noscript>, <ol>,<output>,<p>, <pre>,<section>,<table>,<tfoot>,<ul>and <video>.

Note:Alltheseelementsaredescribedinlaterchapters.

Example:

```
1. <!DOCTYPEhtml>
2. <html>
3.          <head>
4.    </head>
5. <body>
6.    <divstyle="background-color:lightblue">Thisisfirstdiv</div>
7.    <divstyle="background-color:lightgreen">This isseconddiv</div>
8.    <pstyle="background-color:pink">Thisisablocklevelelement</p>
9. </body>
10. </html>
```

Output:



Inthe above examplewe haveused

tag,whichdefinesasectioninaweb page,andtakesfull widthofpage.

We have used style attribute which is used to styling the HTML content, and the backgroundcolorareshowing that it's a block level element.

Inlineelements:

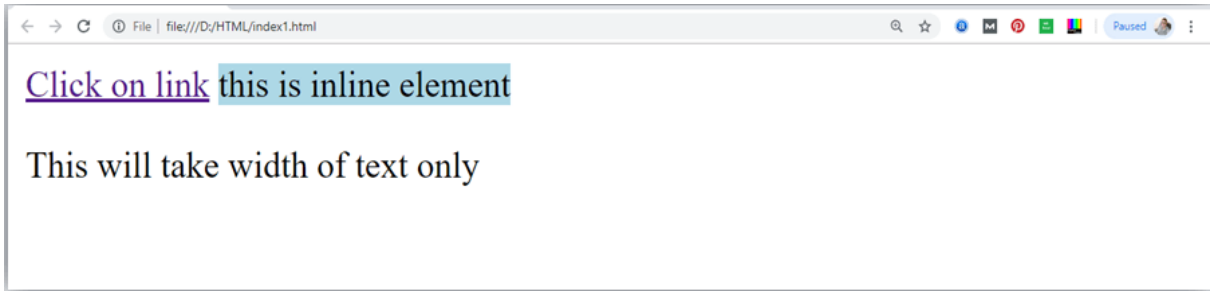
- Inline elements are those elements, which differentiate the part of a given text and provide it aparticularfunction.
- Theseelementsdoesnotstartwithnewlineandtakewidthasperrequirement.
- TheInlineelementsaremostlyusedwithotherelements.

<a>, <abbr>,<acronym>,<b>,<bdo>,<big>, <br>,<button>,<cite>,<code>,<dfn>,, <i>,<img>,<input>, <kbd>,<label>,<map>,<object>,<q>,<samp>, <script>,<select>, <small>,,,<sub>, <sup>,<textarea>,<time>,<tt>,<var>.

Example:

```
1.  <!DOCTYPEhtml>
2.  <html>
3.      <head>
4.      </head>
5.  <body>
6.      <ahref="https://www.javatpoint.com/html-tutorial">Clickonlink</a>
7.      <spanstyle="background-color:lightblue">thisisinlineelement</span>
8.      <p>Thiswilltakewidthof textonly</p>
9.   </body>
10. </html>
```

Output:



Followingis thelist ofthesomemainelements usedin HTML:

HTMLFormatting

HTML Formatting is a process of formatting text for better look and feel. HTML providesus ability to format text without using CSS. There are many formatting tags in HTML. Thesetags are used to make text bold, italicized, or underlined. There are almost 14 optionsavailablethat how text appears in HTMLand XHTML.

In HTMLtheformattingtagsaredividedintotwo categories:

- Physicaltag: Thesetags areusedto providethevisualappearancetothetext.
- Logicaltag:These tagsareusedto addsomelogicalorsemantic value to the text.

NOTE: There are some physical and logical tags which may give same visual appearance, but theywillbe differentinsemantics.

Here, we are going to learn 14 HTML formatting tags. Following is the list of HTMLformattingtext.

Element name	Description
<b>	Thisisaphysicaltag,whichis usedtoboldthetext written betweenit.
	Thisisalogicaltag, whichtellsthebrowserthatthetext isimportant.
<i>	Thisis aphysicaltag whichis usedtomaketextitalic.
	Thisisalogicaltag whichis usedto displaycontentinitalic.

<mark>	Thistagisusedto highlighttext.
<u>	Thistagis usedto underlinetextwrittenbetweenit.
<tt>	Thistagis usedto appearatextinteletype.(notsupportedin HTML5)
<strike>	This tag is used to draw a strikethrough on a section of text. (Not supported inHTML5)
<sup>	Itdisplaysthecontentslightlyabovethenormalline.
<sub>	Itdisplaysthecontent slightlybelowthenormal line.
<del>	Thistagis usedto displaythe deletedcontent.
<ins>	Thistagdisplaysthecontentwhichisadded
<big>	Thistagis usedto increasethefontsize byoneconventionalunit.
<small>	Thistagis usedto decreasethefontsizebyone unitfrombasefontsize.

1) Bold Text

HTMLand formattingelements

The HTML element is a physical tag which display text in bold font, without any logicalimportance. Ifyouwrite anything within ... element, isshown in boldletters.

Seethisexample:

1. WriteYourFirstParagraphinbold text.

Output:

WriteYourFirstParagraphin bold text.

The HTML tag is a logical tag, which displays the content in bold font and informsthebrowserabout itslogical importance.Ifyouwriteanything between ???????., is shown important

text.Seethis example:

1. This isanimportantcontent,and thisisnormal content

Output:

Thisisanimportantcontent,andthisisnormalcontent

Example

1. <!DOCTYPEhtml>
2. <html>

```
3. <head>
4.     <title>formattingelements</title>
5. </head>
6. <body>
7. <h1>Explanationofformattingelement</h1>
8. <p><strong>Thisisanimportantcontent</strong>,andthisisnormalcontent</p>
9. </body>
10. </html>
```

---

2) Italic Text

HTMLandformattingelements

The HTML element is physical element, which display the enclosed content in italic font,withoutanyadded importance.Ifyouwriteanythingwithin ..... element, is showninitalicletters.

Seethisexample:

```
1. <p><i>WriteYourFirstParagraphinitalictext.</i></p>
```

Output:

WriteYourFirstParagraphinitalictext.

The HTML tag is a logical element, which will display the enclosed content in italicfont,with added semantics importance.

Seethis example:

```
1.<p><em>Thisisanimportantcontent</em>,whichdisplayedinitalicfont.</p>
```

Output:

Thisisanimportant content,whichdisplayed initalicfont.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4.     <title>formattingelements</title>
5. </head>
6. <body>
7. <h1>Explanationofitalicformatting element</h1>
8. <p><em>Thisisanimportant content</em>,whichdisplayedinitalicfont.</p>
9. </body>
10. </html>
```

3) HTMLMarked formatting

Ifyou wantto markor highlighta text,you shouldwritethecontent within <mark> .....</mark>.

Seethisexample:

```
<h2>Iwant to puta<mark>Mark</mark>on yourface</h2>
```

Output:

Iwant to putaMarkon your face

4) UnderlinedText

Ifyou writeanythingwithin <u>.....</u>element,isshown inunderlined text.

Seethisexample:

```
1. <p><u>WriteYourFirstParagraphinunderlinedtext.</u></p>
```

Output:

WriteYourFirstParagraph inunderlinedtext.

5) StrikeText

Anythingwrittenwithin <strike> .....</strike>elementis displayed with strikethrough. It is a thin line which cross the

statement.Seethis example:

```
1. <p><strike>WriteYourFirstParagraphwithstrikethrough</strike>.</p>
```

Output:

~~WriteYourFirst Paragraphwithstrikethrough.~~

6) MonospacedFont

Ifyou want thateach letter hasthe samewidth thenyou should writethe content within <tt>.....</tt>element.

Note: We know that most of the fonts are known as variable-width fonts because differentletters have different width. (for example: 'w' is wider than 'i'). Monospaced Font providessimilarspaceamong every letter.

Seethisexample:

```
1. <p>Hello<tt>WriteYourFirstParagraphinmonospacedfont.</tt></p>
```

Output:

HelloWriteYourFirstParagraph inmonospacedfont.

7) SuperscriptText

Ifyou put thecontent within ^{.....}element,is shownin superscript;means it is displayed half a character's height above the other

characters.Seethis example:

1. Hello^{WriteYourFirstParagraphinsuperscript.}

Output:

Hello$^{\text{WriteYourFirstParagraphinsuperscript.}}$

8) SubscriptText

Ifyou put thecontent within _{.....}element, isshown insubscript ;means it is displayed half a character's height below the other

characters.Seethis example:

1. Hello_{WriteYourFirstParagraphinsubscript.}

Output:

Hello$_{\text{WriteYourFirstParagraphinsubscript.}}$

HTMLHeading

A HTML heading or HTML h tag can be defined as a title or a subtitle which you want todisplayonthewebpage.Whenyouplacethe textwithinthe headingtags<h1>.....</h1>,it is displayed on the browser in the bold format and size of the text depends on the number ofheading.

Therearesixdifferent HTMLheadings whichare definedwith the<h1>to<h6>tags,fromhighestlevel h1 (mainheading) to theleastlevel h6 (leastimportant heading).

h1 is the largest heading tag and h6 is the smallest one. So h1 is used for most importantheadingand h6 is used for least important.

HeadingsinHTMLhelpsthesearchengineto understandandindexthestructureofwebpage.

Note: The mainkeyword ofthewhole contentof a webpage shouldbe display byh1 headingtag.

Seethisexample:

1. <h1>Headingno.1</h1>
2. <h2>Headingno. 2</h2>
3. <h3>Headingno.3</h3>
4. <h4>Headingno. 4</h4>
5. <h5>Headingno.5</h5>
6. <h6>Headingno. 6</h6>

Output:

Heading no. 1

Headingno.2

Headingno.3

Headingno.4

Headingno.5

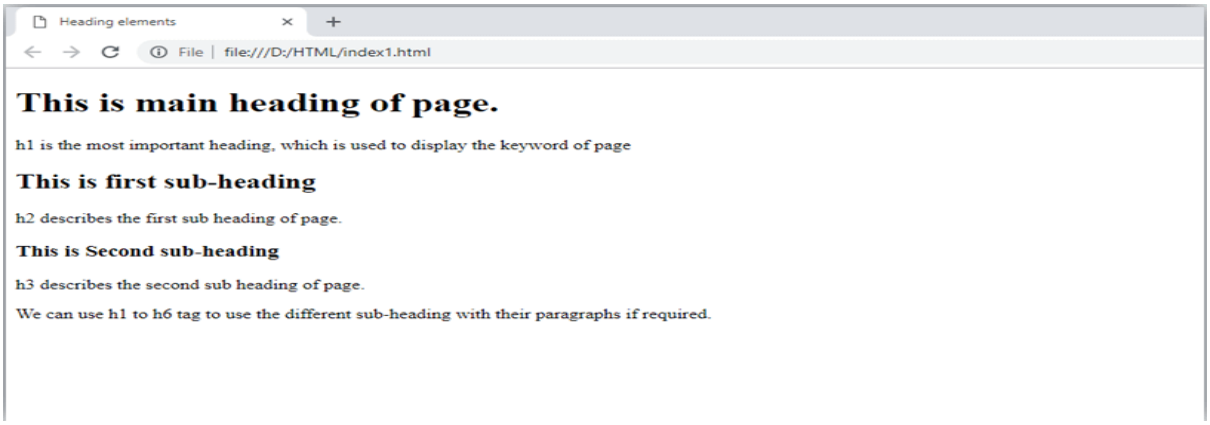
Headingno.6

Headingelements (h1….h6)shouldbe usedforheadings only.They shouldnot beusedjusttomake text bold orbig.

- **HTML headings can also be used with nested elements. Following are different codes todisplaythe way to use heading elements.**

Example:

1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <title>Headingelements</title>
5. </head>
6. <body>
7. <h1>Thisismainheading ofpage.</h1>
8. h1isthemostimportant heading,whichisusedtodisplaythekeywordofpage
9. <h2>Thisisfirst sub-heading</h2>
10. h2describes thefirst subheadingof page.
11. <h3>ThisisSecondsub-heading</h3>
12. h3describesthesecondsubheadingofpage.
13. We can use h1 to h6 tag to use the different sub-
    headingwith theirparagraphs if
14. required.
15.



16. </body>

17. </html>

Output:

HTMLParagraph

HTML paragraph or HTML p tag is used to define a paragraph in a webpage. Let's take asimple example to see how it work. It is a notable point that a browser itself add an emptylinebefore andafteraparagraph.AnHTML tagindicatesstartingofnewparagraph.

Note: If we are using various tags in one HTML file then browser automatically adds a singleblankline between the twoparagraphs.

Seethisexample:

1. Thisisfirstparagraph.
2. Thisissecondparagraph.
3. This is third

paragraph. Output:

This is first

paragraph.This is second

paragraph.Thisisthirdpara

graph.

SpaceinsideHTMLParagraph

If you put a lot of spaces inside the HTML p tag, browser removes extra spaces and extra linewhiledisplayingthe page.Thebrowsercounts numberof spacesand linesas asingleone.

1.
2. Iam
3. going to provide
4. youatutorial onHTML
5. andhopethat itwill
6. beverybeneficial for you.
7.
8.
9. Look,Iput herealot
10. ofspaces but Iknow, Browserwillignoreit.

```
11.</p>
12.<p>
13. Youcannot determinethedisplayofHTML</p>
14. <p>becauseresizedwindowsmaycreatedifferentresult.
15.</p>
```

Output:

I am going to provide you a tutorial on HTML and hope that it will be very beneficial foryou.

Look,Iput herealot of spacesbutIknow, Browserwill ignoreit.

Youcannotdeterminethe displayofHTML

because resizedwindows maycreatedifferentresult.

Asyoucan see,allthe extralinesand unnecessaryspaces areremovedby thebrowser.

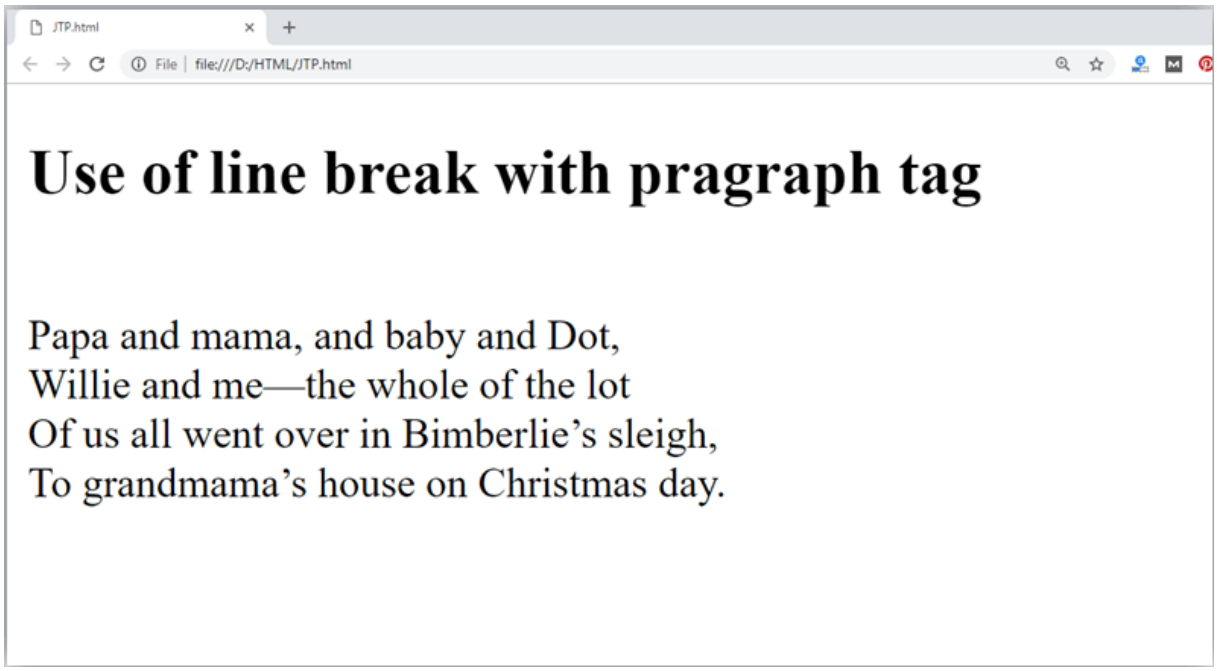
Howto Use
 and<hr> tagwithparagraph?

AnHTML
tagisusedforlinebreakanditcanbeusedwithparagraphelements.Followingis the exampletoshowhow to use
with <p>element.

Example:

```
1. <!DOCTYPEhtml>
2. <html>
3.     <head>
4.    </head>
5.   <body>
6.      <h2>Use of linebreakwithpragraphtag</h2>
7.         <p><br>Papaandmama,andbabyandDot,
8.     <br>Willieandme?thewholeofthelot
9.            <br>Ofusall went overinBimberlie's sleigh,

10.            <br>Tograndmama's house onChristmas day.
11.        </p>
12.  </body>
13. </html>
```

Output:

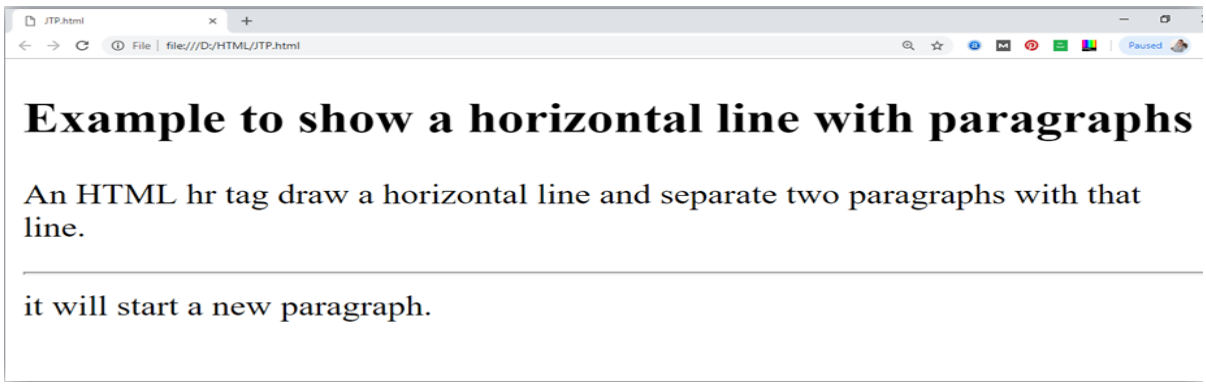


An HTML <hr> tag is used to apply a horizontal line between two statements or twoparagraphs.Followingisthe examplewhichis showinguseof <hr>tagwithparagraph.

Example:

```
1. <!DOCTYPEhtml>
2. <html>
3.  <head>
4.    </head>
5.  <body>
6.    <h2>Exampletoshowahorizontalline withparagraphs</h2>
7.      <p> An HTML hr tag draw a horizontal line and separate two paragraphs with
      thatline.<hr>it willstart anewparagraph.
8.      </p>
9.   </body>
10. </html>
```

Output:



HTMLAnchor

The **HTML anchor tag** defines *a hyperlink that links one page to another page*. It can createhyperlink to other web page as well as files, location, or any URL. The "href" attribute is themostimportant attributeof theHTML atag.andwhich linksto destination pageor URL.

href attribute of HTMLanchortag

The href attribute is used to define the address of the file to be linked. In other words, itpointsout the destinationpage.

ThesyntaxofHTML anchor tagisgivenbelow.

<ahref=".....">LinkText

Let'sseeanexampleof HTMLanchortag.

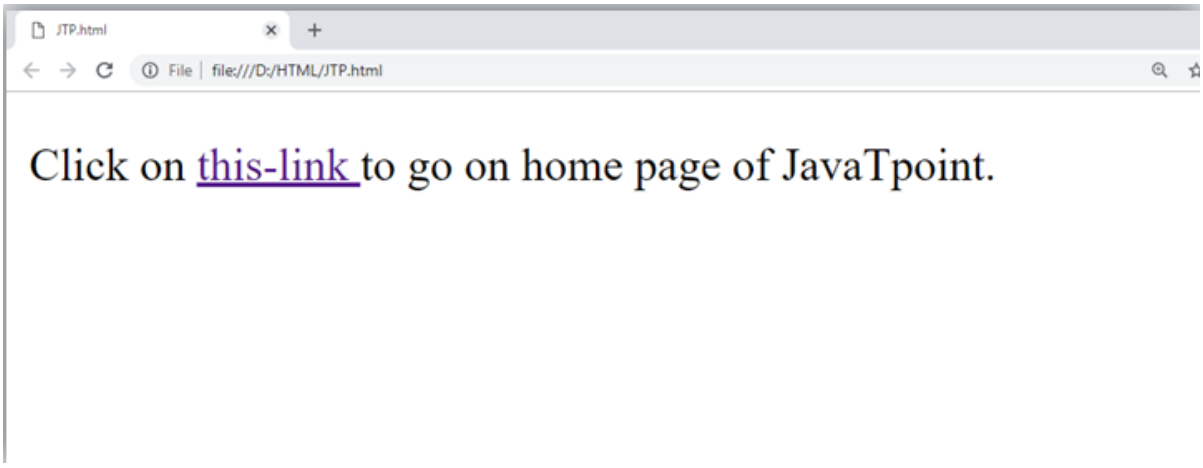
```
1.<ahref="second.html">ClickforSecondPage</a>
```

Specifyalocationfor Linkusingtargetattribute

Ifwewantto open thatlink to anotherpagethenwecan usetarget attributeof<a>tag.Withthehelp of this link willbeopen in next page.

Example:

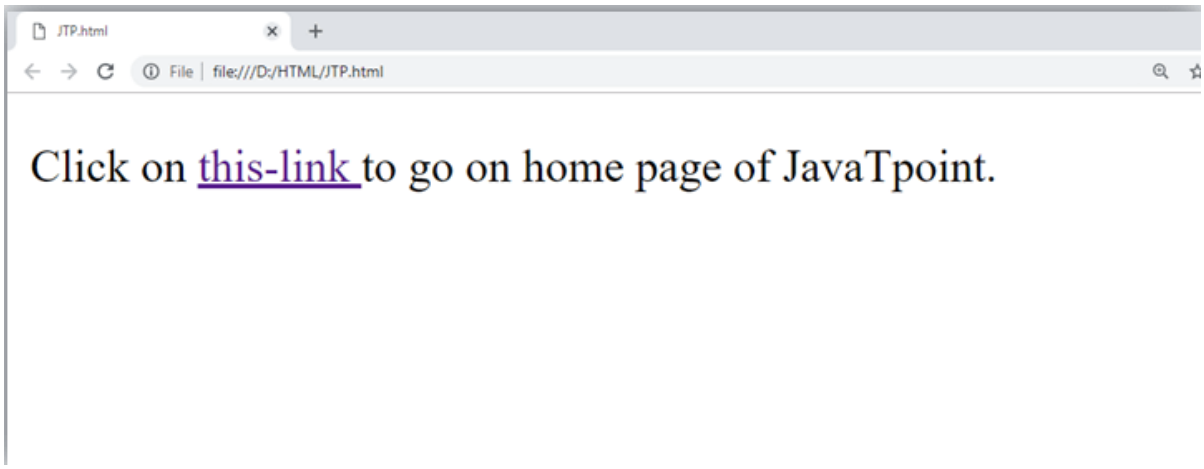
```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4.     <title></title>
1. </head>
2. <body>
3. <p>Click on <a href="https://www.javatpoint.com/" target="_blank"> this-
   link</a>to go on homepageofJavaTpoint.</p>
```




```
4. </body>
```

5. </head>
6. <body>
7. Click on this-linkto go on homepageofJavaTpoint.
8. </body>
9. </html>

Output:



Note:

- The**target**attributecanonlyusewithhref attributeinanchortag.
- Ifwewill notusetarget attributethen link will openin same page.

Appearanceof HTML anchortag

An **unvisited link** is displayed underlined and

blue.A**visitedlink**displayed underlinedandpurple.

An**activelink** isunderlinedandred.

HTMLImage

HTML img tag is used to display image on the web page. HTML img tag is an empty tagthatcontains attributes only,closing tags arenotused in HTMLimageelement.

Let'sseeanexampleofHTML image.

1. <h2>HTMLImageExample</h2>
2. <imgsrc="good_morning.jpg"alt="GoodMorningFriends"/>

Output:

Attributes of HTML imgtag

The src and alt are important attributes of HTML img tag. All attributes of HTML image tagaregiven below.

1) src

It is a necessary attribute that describes the source or path of the image. It instructs thebrowserwhereto look for theimageon the server.

Thelocation ofimagemaybeon the samedirectory oranotherserver.

2) alt

The alt attribute defines an alternate text for the image, if it can't be displayed. The value ofthe alt attribute describe the image in words. The alt attribute is considered good for SEOprospective.

3) width

It is an optional attribute which is used to specify the width to display the image. It is notrecommendednow. Youshouldapply CSS inplaceof widthattribute.

4) height

Ith3theheightoftheimage.TheHTMLheightattributealsosupports iframe,imageandobject elements. It is not recommended now. You should apply CSS in place of heightattribute.

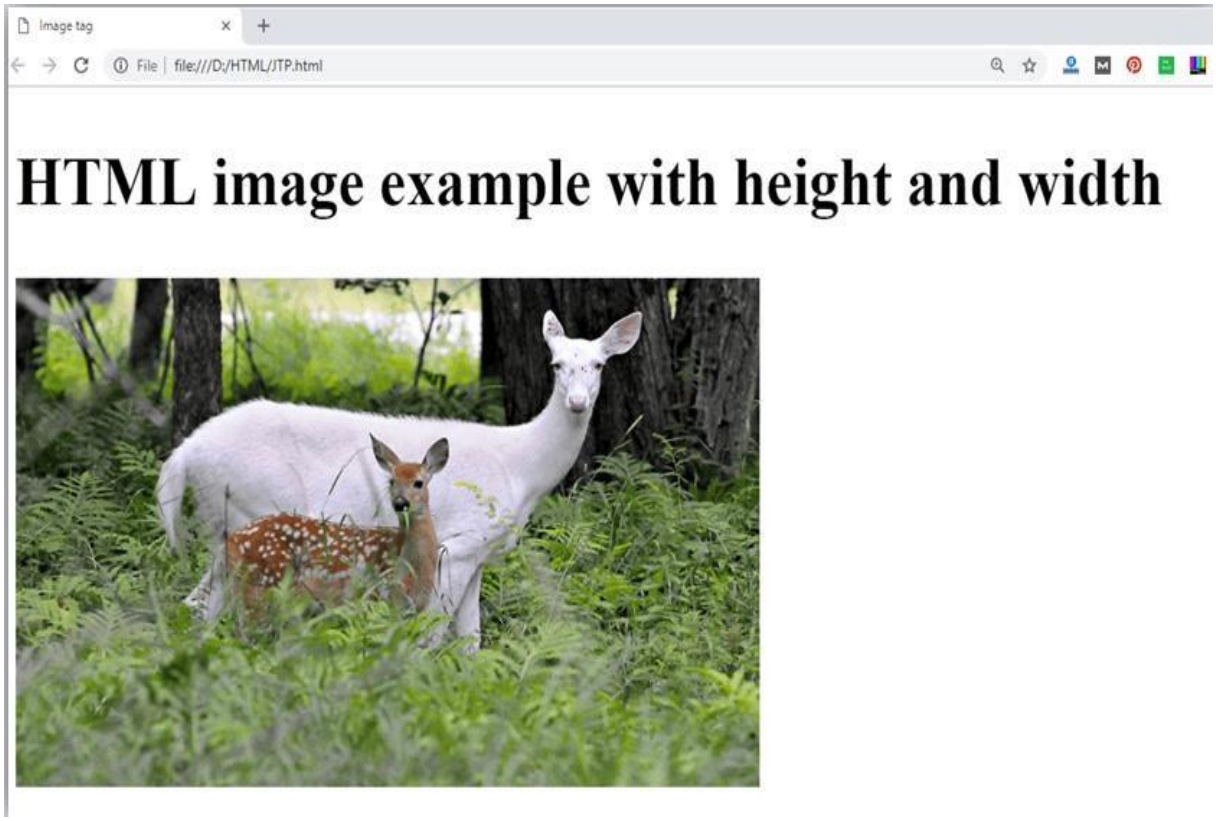
Useof heightandwidthattribute withimgtag

You have learnt about how to insert an image in your web page, now if we want to give someheight and widthto displayimageaccordingto ourrequirement, then wecan setit withheightand width attributes of image.

Example:

1. <imgsrc="animal.jpg" height="180"width="300"alt="animalimage">

Output:



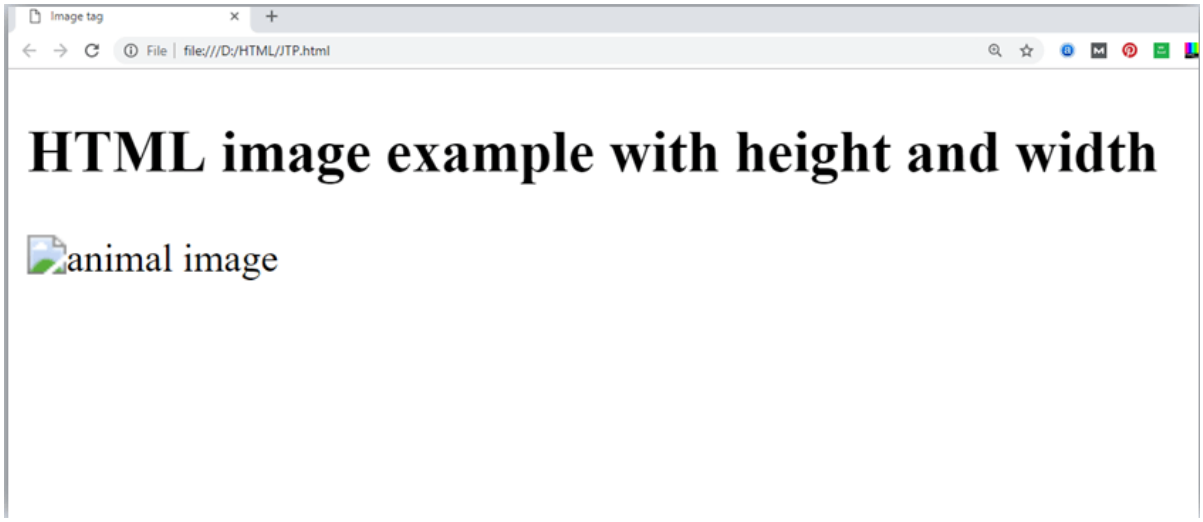
Note: Always try to insert the image with height and width, else it may flicker while displaying onwebpage.

Useof altattribute

Wecan usealt attribute with tag. It will display an alternative text in case if imagecannotbe displayedon browser. Following is theexampleforalt attribute:

1.<imgsrc="animal.png" height="180"width="300" alt="animalimage">

Output:



Howto getimagefromanotherdirectory/folder?

To insert an image in your web, that image must be present in your same folder where youhave put the HTML file. But if in some case image is available in some other directory thenyoucan access theimagelikethis:

1.<img src="E:/images/animal.png" height="180" width="300" alt="animal

image">Inabovestatementwehaveputimageinlocal diskE------>imagesfolder-- >animal.png.

Note: If src URL will be incorrect or misspell then it will not display your image on web page, so trytoputcorrectURL.

Use <img>tagas alink

Wecan also link animagewith other pageor wecan usean imageas alink.To do this, put <img>tag insidethe<a>tag.

Example:

1.<ahref="https://www.javatpoint.com/what-is-robotics"><imgsrc="robot.jpg"height="100"width="100">

Output:

HTMLTable

HTML table tag is used to display data in tabular form (row * column). There can be manycolumnsin arow.

Wecan create atabletodisplaydata in tabularform, using<table>element,with thehelp of <tr>,<td>, and<th>elements.

In Each table, table row is defined by <tr> tag, table header is defined by <th>, and table dataisdefined by <td> tags.

HTML tables are used to manage the layout of the page e.g. header section, navigation bar,body content, footer section etc. But it is recommended to use div tag over table to managethelayout of thepage.

HTMLTableTags

Tag	Description
<table>	Itdefinesatable.
<tr>	Itdefinesa rowinatable.
<th>	Itdefinesaheader cellinatable.
<td>	Itdefinesa cellinatable.
<caption>	Itdefinesthetable caption.
<colgroup>	Itspecifies agroupof oneor morecolumnsin atableforformatting.
<col>	Itisusedwith<colgroup>elementtospecifycolumnpropertiesfor eachcolumn.
<tbody>	Itis usedto groupthebodycontent ina table.
<thead>	Itisused togroupthe headercontent inatable.
<tfooter>	Itisused togroup the footercontentin atable.

HTMLTableExample

Let'sseetheexampleof HTMLtabletag. Itoutput isshownabove.

```
1. <table>
2. <tr><th>First_Name</th><th>Last_Name</th><th>Marks</th></tr>
3. <tr><td>Sonoo</td><td>Jaiswal</td><td>60</td></tr>
4. <tr><td>James</td><td>William</td><td>80</td></tr>
5. <tr><td>Swati</td><td>Sironi</td><td>82</td></tr>
6. <tr><td>Chetna</td><td>Singh</td><td>72</td></tr>
7. </table>
```

Output:

First_Name	Last_Name	Marks
Sonoo	Jaiswal	60

HTMLLists

HTML Lists are used to specify lists of information. All lists may contain one or more listelements.Therearethreedifferent types of HTMLlists:

1. OrderedListorNumberedList(ol)
2. UnorderedListorBulletedList(ul)
3. DescriptionListorDefinitionList(dl)

Note:Wecan createalistinsideanotherlist,whichwill betermedas nestedList.

HTMLOrderedList orNumberedList

IntheorderedHTMLlists,allthelistitemsaremarkedwithnumbersbydefault.Itisknownas numbered list also. The ordered list starts with <ol> tag and the list items start with tag.

```
1. <ol>
2.  <li>Aries</li>
3.  <li>Bingo</li>
4.  <li>Leo</li>
5.  <li>Oracle</li>
6.</ol>
```

Output:

1. Aries
2. Bingo
3. Leo
4. Oracle

Clickhereforfull detailsofHTMLordered list.HTMLOrderedList

HTMLUnorderedList or BulletedList

In HTML Unordered list, all the list items are marked with bullets. It is also known asbulletedlistalso.TheUnordered liststartswith tagandlistitems startwiththe<li>tag.

```
1. <ul>
2.  <li>Aries</li>
3.  <li>Bingo</li>
4.  <li>Leo</li>
5.  <li>Oracle</li>
6.</ul>
```

Output:

- Aries
- Bingo
- Leo
- Oracle

HTMLDescriptionListorDefinitionList

HTML Description list is also a list style which is supported by HTML and XHTML. It isalsoknownas definitionlist whereentriesarelistedlikeadictionary or encyclopedia.

The definition list is very appropriate when you want to present glossary, list of terms orothername-value list.

TheHTMLdefinitionlist containsfollowingthreetags:

1. **<dl>tag**definesthestart ofthelist.
2. **<dt>tag**definesaterm.
3. **<dd>tag**definesthetermdefinition(description).

```
1. <dl>
2.   <dt>Aries</dt>
3.   <dd>-Oneofthe 12 horoscopesign.</dd>
4.   <dt>Bingo</dt>
5.   <dd>-Oneofmyeveningsnacks</dd>
6.  <dt>Leo</dt>
7.  <dd>-Itisalso anoneof the12 horoscopesign.</dd>
8.   <dt>Oracle</dt>
```

```
    <dd>-Itisamultinationaltechnologycorporation.</dd>
</dl>
```

Output:

Aries

-Oneof the 12horoscopesign.

Bingo

-Oneofmyeveningsnacks

Leo

-It isalso anone ofthe 12horoscope sign.

Oracle

-Itisamultinationaltechnologycorporation.

ClickhereforfulldetailsofHTMLdescriptionlist.HTMLDescriptionList

---

HTML NestedList

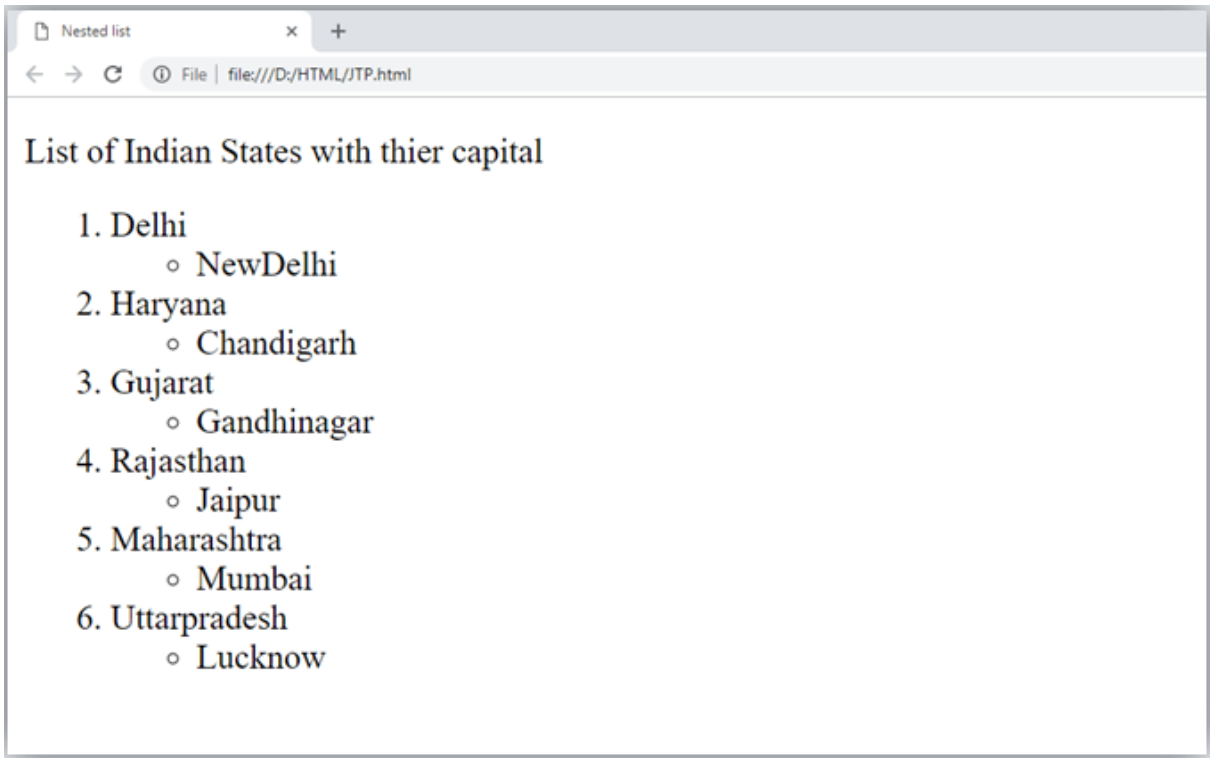
Alistwithinanotherlistis termedasnestedlist.If youwant abulletlistinsideanumberedlistthen such type oflist will called as nested list.

Code:

```
<!DOCTYPEhtml>
<html>
<head>
   <title>Nestedlist</title>
</head>
<body>
   <p>Listof IndianStateswiththiercapital</p>
<ol>
   <li>Delhi
      <ul>
         <li>NewDelhi</li>
      </ul>
   </li>
   <li>Haryana
      <ul>
         <li>Chandigarh</li>
      </ul>
   </li>
   <li>Gujarat
      <ul>
```

```
21.            <li>Gandhinagar</li>
22.         </ul>
23.      </li>
24.      <li>Rajasthan
25.         <ul>
26.            <li>Jaipur</li>
27.         </ul>
28.      </li>
29.      <li>Maharashtra
30.         <ul>
31.            <li>Mumbai</li>
32.         </ul>
33.      </li>
34.      <li>Uttarpradesh
35.         <ul>
36.            <li>Lucknow</li></ul>
37.      </li>
38.</ol>
39. </body>
40. </html>
```

Output:



HTMLOrderedList|HTMLNumberedList

HTML Ordered List or Numbered List displays elements in numbered format. The HTMLol tag is used for ordered list. We can use ordered list to represent items either in numericalorder format or alphabetical order format, or any format where an order is emphasized. Therecanbedifferent types ofnumbered list:

- NumericNumber (1, 2, 3)
- CapitalRomanNumber(IIIIII)
- SmallRomal Number(i iiiii)
- CapitalAlphabet(ABC)
- SmallAlphabet(abc)

Torepresentdifferent orderedlists,thereare5types ofattributesin tag.

Type	Description
Type"1"	Thisis thedefault type. In this type,the listitemsarenumberedwith numbers.
Type"I"	Inthistype,thelistitemsarenumberedwithuppercase roman numbers.
Type"i"	Inthistype,thelistitemsarenumberedwithlowercase romannumbers.
Type"A"	Inthistype, thelistitems arenumberedwith uppercaseletters.
Type"a"	Inthistype,thelistitemsarenumbered withlowercaseletters.

HTMLOrderedList Example

Let's see the example of HTML ordered list that displays 4 topics in numbered list. Here wearenot defining type="1" becauseit is thedefault type.

```
1. <ol>
2.  <li>HTML</li>
3.  <li>Java</li>
4.  <li>JavaScript</li>
5.  <li>SQL</li>
6.</ol>
```

Output:

1. HTML
2. Java
3. JavaScript
4. SQL

---

ol type="I"

Let'sseetheexampleto displaylistinromannumberuppercase.

```
1. <oltype="I">
```

```
2.  <li>HTML</li>
3.  <li>Java</li>
4.  <li>JavaScript</li>
5.  <li>SQL</li>
6.</ol>
```

Output:

I. HTML
II. Java
III. JavaScript
IV. SQL

---

oltype="i"

Let'sseetheexampletodisplaylistinromannumberlowercase.

```
1.  <oltype="i">
2.   <li>HTML</li>
3.   <li>Java</li>
4.   <li>JavaScript</li>
5.   <li>SQL</li>
6.</ol>
```

Output:

i. HTML
ii. Java
iii. JavaScript
iv. SQL

---

ol type="A"

Let'sseetheexampletodisplaylistinalphabetuppercase.

```
1.  <oltype="A">
2.   <li>HTML</li>
3.   <li>Java</li>
4.   <li>JavaScript</li>
5.   <li>SQL</li>
6.</ol>
```

Output:

A. HTML

B. Java
C. JavaScript
D. SQL

---

oltype="a"

Let'sseetheexampleto displaylistinalphabetlowercase.

```
1. <oltype="a">
2.  <li>HTML</li>
3.  <li>Java</li>
4.  <li>JavaScript</li>
5.  <li>SQL</li>
6.</ol>
```

Output:

a. HTML
b. Java
c. JavaScript
d. SQL

---

startattribute

Thestart attributeis usedwithol tag tospecify from whereto startthelist items.

<oltype="1"start="5">:Itwillshownumericvalues startingwith"5".

<oltype="A"start="5">:Itwillshowcapitalalphabetsstartingwith"E".

<oltype="a"start="5">:Itwillshowlower casealphabetsstartingwith "e".

<oltype="I" start="5">:ItwillshowRomanupper casevaluestartingwith"V".

<oltype="i" start="5">:Itwill showRomanlowercasevaluestartingwith"v".

```
1. <oltype="i"start="5">
2.  <li>HTML</li>
3.  <li>Java</li>
4.  <li>JavaScript</li>
5.  <li>SQL</li>
6.</ol>
```

Output:

v. HTML
vi. Java
vii. JavaScript
viii. SQL

HTMLForm

An **HTML form** is *a section of a document* which contains controls such as text fields,passwordfields, checkboxes, radio buttons,submit button, menus etc.

An HTML form facilitates the user to enter data that is to be sent to the server for processingsuchas name,email address, password, phonenumber,etc. .

WhyuseHTMLForm

HTMLforms arerequired ifyou wantto collect somedata fromofthesitevisitor.

For example: If a user want to purchase some items on internet, he/she must fill the form suchasshippingaddressandcredit/debitcarddetails sothatitem canbesent tothegiven address.

HTMLFormSyntax

```
1. <formaction="serverurl"method="get|post">
2.   //inputcontrolse.g.textfield,textarea,radiobutton,button
3. </form>
```

HTMLForm Tags

Let'sseethelist of HTML5 form tags.

Tag	Description
<form>	It definesan HTMLformto enterinputs bytheused side.
<input>	It definesaninput control.
<textarea>	It definesamulti-lineinputcontrol.
<label>	Itdefinesalabel foraninput element.
<fieldset>	Itgroupstherelatedelement inaform.

<legend> It definesacaptionfora<fieldset>element.

<select> It definesadrop-downlist.

<optgroup> It definesa groupof relatedoptionsin adrop-downlist.

<option> It definesanoptionina drop-downlist.

<button> Itdefinesaclickablebutton.

HTML 5FormTags

Let'sseethelist of HTML5 form tags.

Tag	Description
<datalist>	Itspecifiesalist ofpre-definedoptionsforinput control.
<keygen>	It definesakey-pairgeneratorfieldforforms.
<output>	It definestheresult ofacalculation.

HTML<form>element

The HTML <form> element provide a document section to take input from user. It providesvarious interactive controls for submitting information to web server such as text field, textarea,passwordfield, etc.

Note: The <form> element does not itself create a form but it is container to contain all required formelements,suchas <input>,<label>, etc.

Syntax:

```
1. <form>
2. //Formelements
3. </form>
```

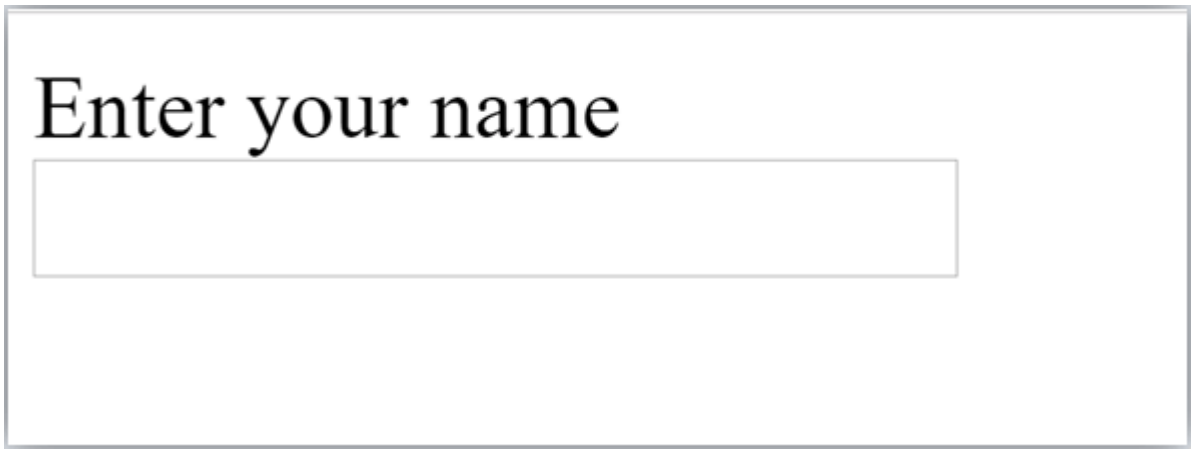
HTML<input>element

The HTML <input> element is fundamental form element. It is used to create form fields, totake input from user. We can apply different input filed to gather different information formuser.Following is the exampleto show thesimple textinput.

Example:

```
1. <body>
2.   <form>
3.      Enteryourname<br>
4.     <inputtype="text"name="username">
5.   </form>
6. </body>
```

Output:

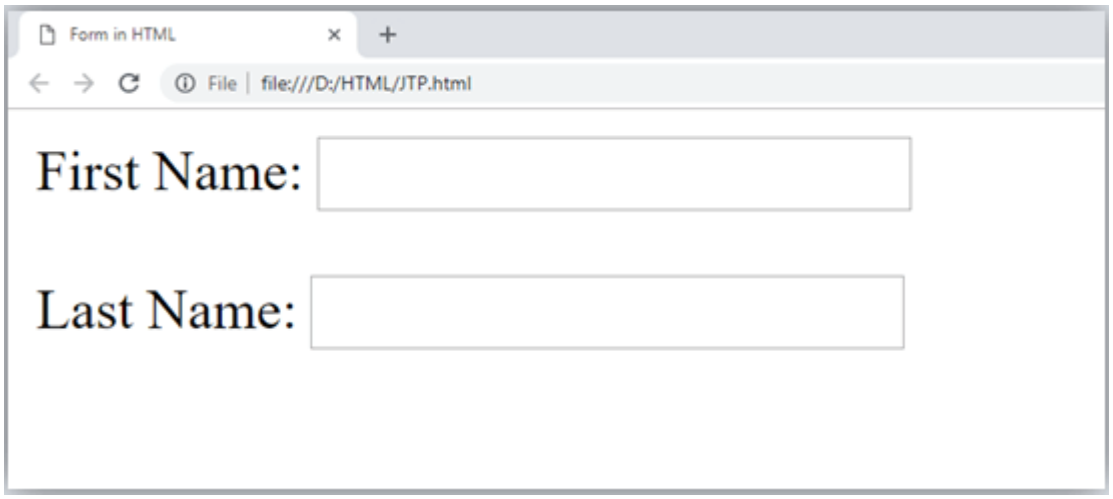


HTMLTextFieldControl

The type="text" attribute of input tag creates textfield control also known as single linetextfield control. The name attribute is optional, but it is required for the server sidecomponentsuch as JSP, ASP, PHP etc.

```
1. <form>
2.    FirstName:<inputtype="text"name="firstname"/><br/>
3.    LastName:<inputtype="text"name="lastname"/><br/>
4. </form>
```

Output:



Note:Ifyouwill omit 'name' attributethenthetextfiledinput willnotbesubmittedtoserver.

HTML<textarea>taginform

The<textarea>tag inHTML is usedto insert multiple-linetext in a form.Thesizeof <textarea> canbespecifyeitherusing "rows"or"cols" attributeor byCSS.

Example:

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4.     <title>ForminHTML</title>
5. </head>
6. <body>
7.   <form>
8.       Enteryouraddress:<br>
9.      <textarearows="2"cols="20"></textarea>
10.  </form>
11. </body>
12. </html>
```

Output:

LabelTaginForm

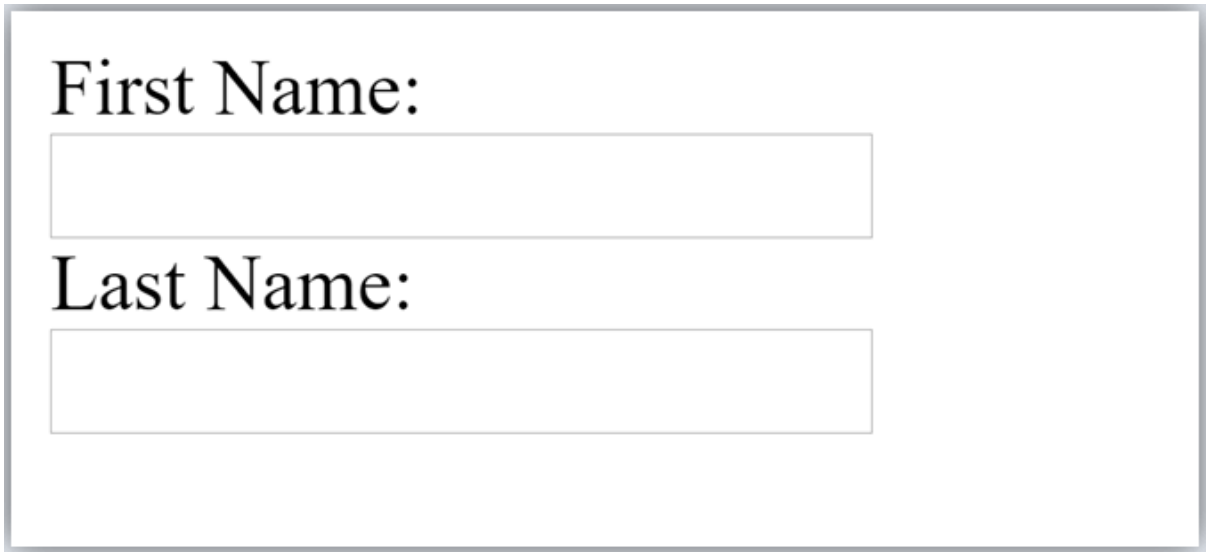
Itisconsideredbettertohavelabelinform.Asitmakesthecodeparser/browser/userfriendly.

If you click on the label tag, it will focus on the text control. To do so, you need to have forattributein label tag thatmust besame as idattribute ofinput tag.

NOTE: It is good to use <label> tag with form, although it is optional but if you will use it, then itwillprovidea focuswhen you tapor click onlabeltag.Itismore worthy withtouchscreens.

```
1. <form>
2.    <labelfor="firstname">FirstName:</label><br/>
3.          <inputtype="text" id="firstname"name="firstname"/><br/>
4.    <labelfor="lastname">LastName:</label>
5.          <inputtype="text"id="lastname"name="lastname"/><br/>
6.  </form>
```

Output:



HTMLPasswordFieldControl

Thepasswordisnotvisibletotheuserin passwordfieldcontrol.

```
1. <form>
2.    <labelfor="password">Password:</label>
3.          <inputtype="password"id="password"name="password"/><br/>
4. </form>
```

Output:

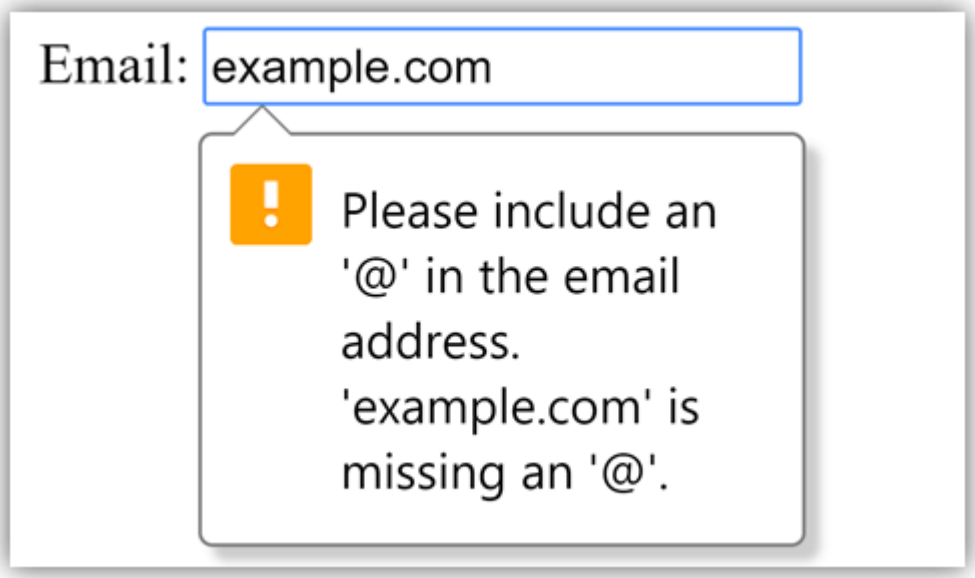
HTML5EmailField Control

The email field in new in HTML 5. It validates the text for correct email address. You mustuse@ and . in this field.

```
1. <form>
2.    <labelfor="email">Email:</label>
3.          <inputtype="email"id="email"name="email"/><br/>
4. </form>
```

Itwilldisplayinbrowser likebelow:

Note:Ifwewillnotenterthecorrect email,it willdisplayerrorlike:



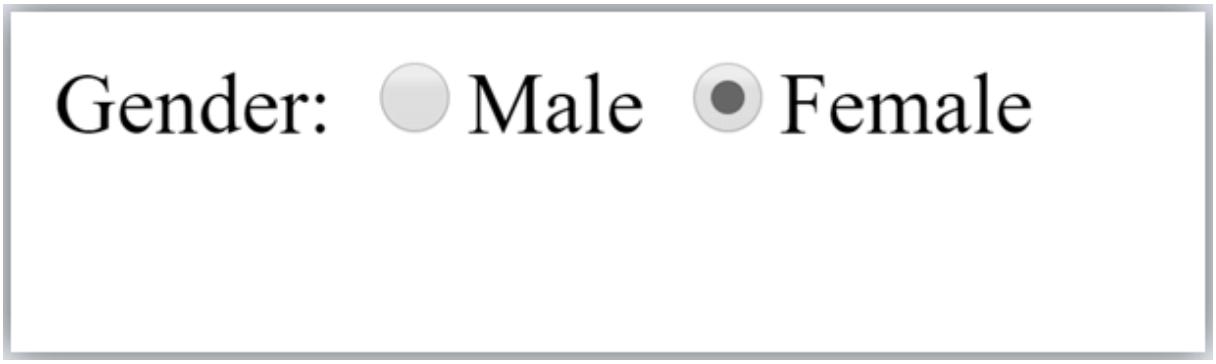
RadioButtonControl

Theradiobuttonisusedtoselectone optionfrommultipleoptions.Itisusedforselection ofgender,quizquestions etc.

If you use one name for all the radio buttons, only one radio button can be selected at a

time.Usingradio buttons for multiple options, you canonly chooseasingleoption at a time.

```
<form>
   <labelfor="gender">Gender:</label>
          <inputtype="radio"id="gender"name="gender"value="male"/>Male
         <inputtype="radio"id="gender"name="gender"value="female"/>Female<br/>
</form>
```



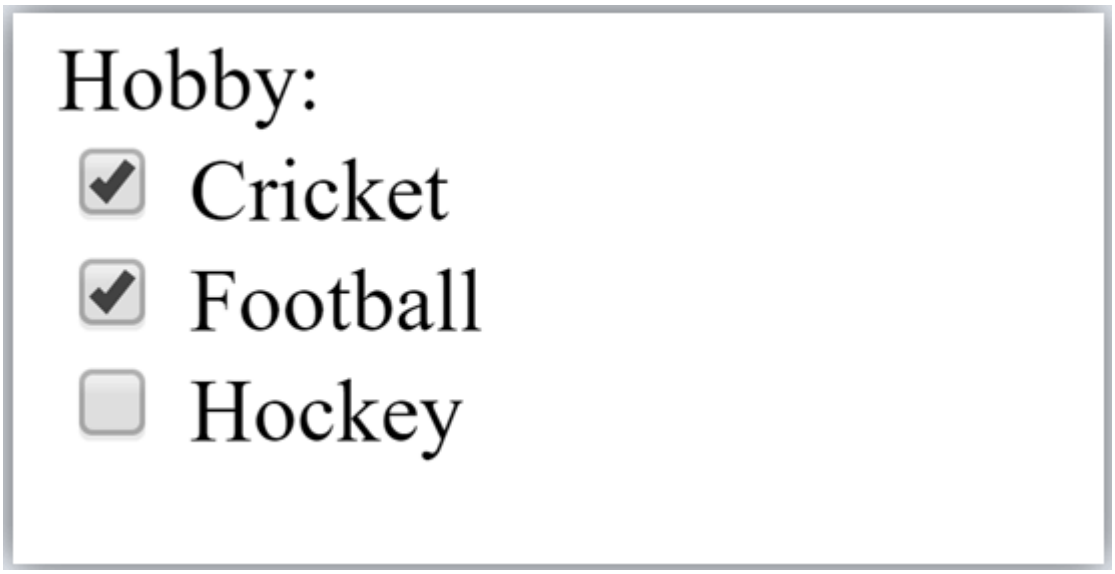
CheckboxControl

Thecheckboxcontrolisusedtocheckmultipleoptionsfromgivencheckboxes.

```
<form>
Hobby:<br>
          <inputtype="checkbox"id="cricket"name="cricket"value="cricket"/>
           <labelfor="cricket">Cricket</label><br>
          <inputtype="checkbox"id="football"name="football"value="football"/>
           <labelfor="football">Football</label><br>
          <inputtype="checkbox"id="hockey"name="hockey"value="hockey"/>
           <labelfor="hockey">Hockey</label>
</form>
```

Note: These are similar to radio button except it can choose multiple options at a time and radiobuttoncanselectone button atatime, andits display.

Output:



Submitbuttoncontrol

HTML **<input type="submit">**are used to add a submit button on web page. When userclickson submit button, then form get submitto theserver.

Syntax:

1.<inputtype="submit"value="submit">

Thetype =submit , specifying thatit is a submit button

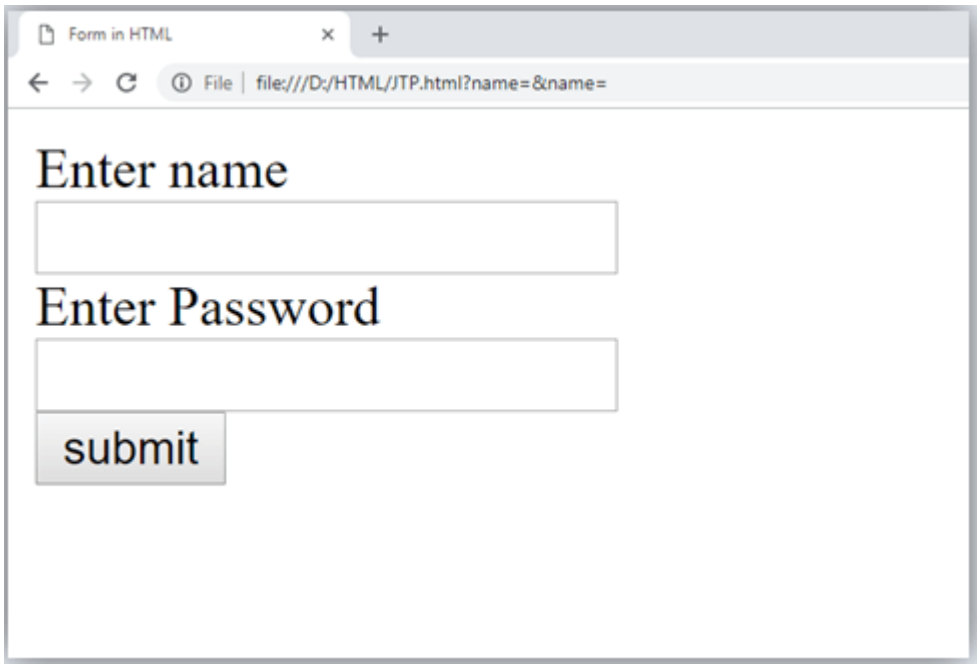
The value attribute can be anything which we write on button on web

page.Thename attributecan beomit here.

Example:

```
<form>
    <labelfor="name">Entername</label><br>
    <inputtype="text"id="name"name="name"><br>
    <labelfor="pass">EnterPassword</label><br>
    <inputtype="Password"id="pass"name="pass"><br>
    <inputtype="submit"value="submit">
</form>
```

Output:



HTML<fieldset> element:

The<fieldset>element inHTML isused togroup therelated informationofaform.Thiselementisused with<legend>elementwhichprovide captionfor thegroupedelements.

Example:

```
1.  <form>
2.     <fieldset>
3.       <legend>UserInformation:</legend>
4.     <labelfor="name">Entername</label><br>
5.  <inputtype="text"id="name"name="name"><br>
6.  <labelfor="pass">EnterPassword</label><br>
7.  <inputtype="Password"id="pass"name="pass"><br>
8.  <inputtype="submit"value="submit">
9.  </fieldset>
10. lt;/form>
```

Output:

HTMLForm Example

Followingistheexample forasimpleformof registration.

```
1. <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.   <title>ForminHTML</title>
5. </head>
6.  <body>
7.     <h2>Registrationform</h2>
8.    <form>
9.     <fieldset>
10.      <legend>Userpersonalinformation</legend>
11.      <label>Enteryourfullname</label><br>
12.      <inputtype="text"name="name"><br>
13.       <label>Enteryouremail</label><br>
14.       <inputtype="email"name="email"><br>
15.       <label>Enteryourpassword</label><br>
16.       <inputtype="password"name="pass"><br>
17.       <label>confirmyourpassword</label><br>
18.       <inputtype="password"name="pass"><br>
19.       <br><label>Enteryourgender</label><br>
20.       <inputtype="radio"id="gender"name="gender"value="male"/>Male<br>
21.       <inputtype="radio"id="gender"name="gender"value="female"/>Female<br/
    >
22.       <inputtype="radio"id="gender"name="gender"value="others"/>others<br/>
23.        <br>EnteryourAddress:<br>
24.       <textarea></textarea><br>
25.       <inputtype="submit"value="sign-up">
26.    </fieldset>
27.  </form>
28. </body>
29. </html>
```

Output:

HTMLFormInputTypes

In HTML <input type=" "> is an important element of HTML form. The "type" attribute ofinput element can be various types, which defines information field. Such as <inputtype="text"name="name"> gives atext box.

Following is a list of all types of <input> element ofHTML.

type=" "	Description
text	Definesaone-linetextinputfield
password	Definesaone-linepasswordinputfield
submit	Definesasubmitbuttontosubmittheformtoserver
reset	Definesaresetbuttontoresetall values intheform.
radio	Definesaradiobuttonwhichallowsselectoneoption.
checkbox	Definescheckboxeswhichallowselectmultipleoptionsform.
button	Definesasimple pushbutton,whichcanbe programmedtoperformataskon anevent.
file	Definestoselectthefilefrom devicestorage.
image	Definesagraphicalsubmitbutton.

HTML5 added new types on <input> element. Following is the list of types of elementsof HTML5

type=" "	Description
color	Definesaninputfieldwithaspecificcolor.
date	Definesaninputfieldforselection ofdate.
datetime-local	Definesaninputfieldforenteringadate withouttimezone.
email	Definesaninputfieldforenteringanemailaddress.
month	Definesacontrolwithmonthandyear,without timezone.
number	Definesaninputfieldto enteranumber.
url	DefinesafieldforenteringURL
week	Definesafieldtoenterthedatewithweek-year,withouttimezone.
search	Definesasinglelinetextfieldforentering asearchstring.
tel	Definesaninputfieldforenteringthetelephone number.

Followingisthedescriptionabouttypesof<input>elementwithexamples.

1. <inputtype="text">:

<input> element of type "text" are used to define a single-line input text

field.Example:

```
1. <form>
2.    <label>Enterfirstname</label><br>
3.    <inputtype="text"name="firstname"><br>
4.    <label>Enterlastname</label><br>
5.    <inputtype="text"name="lastname"><br>
6.    <p><strong>Note:</strong>Thedefaultmaximumcahracterlenghtis20.</p>
7. </form>
```

Output:

Input"text"type:

The**"text"**fielddefines a sinlgelineinputtextfield.

Enterfirstname

Enterlast name

Note: Thedefaultmaximumcahracterlenghtis20.

---

2. <inputtype="password">:

The <input> element of type "password" allow a user to enter the password securely in awebpage. The entered text in password filed converted into "*" or ".", so that it cannot bereadby another user.

Example:

```
1. <form>
2.     <label>EnterUsername</label><br>
3.     <inputtype="text"name="firstname"><br>
4.     <label>EnterPassword</label><br>
5.     <inputtype="Password"name="password"><br>
6.     <br><inputtype="submit"value="submit">
7. </form>
```

Output:

Input"password"type:

The **"password"** field defines a sinlge line input password field to enter the passwordsecurely.

EnterUsername

EnterPassword

---

3. <inputtype="submit">:

The<input>element oftype"submit"definesasubmitbuttonto submittheformtotheserver when the "click" event occurs.

Example:

```
1. <formaction="https://www.javatpoint.com/html-tutorial">
2.     <label>EnterUsername</label><br>
3.     <inputtype="text"name="firstname"><br>
4.     <label>EnterPassword</label><br>
5.     <inputtype="Password"name="password"><br>
6.     <br><inputtype="submit"value="submit">
```

7. </form>

Output:

Input"submit"type:
EnterUsername

EnterPassword

Afterclickingonsubmitbutton,thiswillsubmittheformtoserverandwillredirectthepageto**action** value.Wewill learn about"action" attribute in laterchapters

---

4. <inputtype="reset">:

The <input> type "reset" is also defined as a button but when the user performs a click event,itby default reset theall inputted values.

Example:

```
1. <form>
2.    <label>Userid: </label>
3.     <inputtype="text"name="user-id"value="user">
4.           <label>Password:</label>
5.     <inputtype="password"name="pass"value="pass"><br><br>
6.     <inputtype="submit"value="login">
7.      <inputtype="reset"value="Reset">
8. </form>
```

Output:

Input"reset"type:
Userid: user Password: ****

Try to change the input values of user id and password, then when you click on reset, it willresetinput fields with default values.

---

5. <inputtype="radio">:

The<input>type"radio"defines theradiobuttons,which allowchoosinganoptionbetweenaset ofrelated options. Ata timeonly oneradiobutton optioncan beselectedat atime.

Example:

```
1. <form>
```

```
2.    <p>KindlySelectyourfavoritecolor</p>
3.    <inputtype="radio" name="color"value="red">Red<br>
4.    <inputtype="radio"name="color"value="blue">blue<br>
5.    <inputtype="radio"name="color"value="green">green <br>
6.    <inputtype="radio"name="color"value="pink">pink<br>
7.    <inputtype="submit" value="submit">
8.  </form>
```

Output:

Input"radio"type

KindlySelectyourfavoritecolor

- Redb
- luegr
- eenpi
- nk

---

6. <inputtype="checkbox">:

The<input>type"checkbox"aredisplayed assquareboxes whichcanbecheckedoruncheckedto select thechoices from thegiven options.

Note: The "radio" buttons are similar to checkboxes, but there is an important difference betweenboth types: radio buttons allow the user to select only one option at a time, whereas checkbox allowsausertoselectzero to multiple options atatime.

Example:

```
1.  <form>
2.      <label>EnteryourName:</label>
3.       <inputtype="text"name="name">
4.      <p>KindlySelect yourfavouritesports</p>
5.       <inputtype="checkbox"name="sport1"value="cricket">Cricket<br>
6.      <inputtype="checkbox"name="sport2"value="tennis">Tennis<br>
7.       <inputtype="checkbox" name="sport3"value="football">Football<br>
8.      <inputtype="checkbox"name="sport4"value="baseball">Baseball<br>
9.       <inputtype="checkbox"name="sport5"value="badminton">Badminton<br><br>

10.     <inputtype="submit"value="submit">
11.  </form>
```

Output:

Input"checkbox"type

RegistrationForm

EnteryourName:

KindlySelectyourfavoritesports

- CricketTen
- nisFootball
- BaseballB
- adminton
-

---

7. <inputtype="button">:

The<input>type "button"defines asimple pushbutton,which canbeprogrammedto controlafunctionally on any event such as, click event.

Note:It mainlyworkswithJavaScript.

Example:

```
1. <form>
2.     <inputtype="button" value="Clcikme"onclick="alert('youarelearningHTML')">
3. </form>
```

Output:

Input"button" type.

Clickthebuttonto seetheresult:

Note: In the above example we have used the "alert" of JS, which you will learn in our JS tutorial. Itisusedto showa pop window.

---

8. <inputtype="file">:

The <input> element with type "file" is used to select one or more files from user devicestorage.Onceyouselectthefile,andaftersubmission, thisfilecanbeuploadedtotheserverwiththehelp of JS codeand file API.

Example:

```
1. <form>
2.     <label>Selectfiletoupload:</label>
3.     <inputtype="file"name="newfile">
4.     <inputtype="submit"value="submit">
```

---

5. </form>

Output:

Input"file" type.

We can choose any type of file until we do not specify it! The selected file will appear at nextto"choosefile" option

Selectfiletoupload:

---

9. <inputtype="image">:

The<input>type"image"is usedtorepresentasubmit buttonintheformof

image.Example:

```
1. <!DOCTYPEhtml>
2. <html>
3. <body>
4. <h2>Input"image" type.</h2>
5. <p>Wecancreateanimageassubmitbutton</p>
6.   <form>
7.     <label>Userid:</label><br>
8.      <inputtype="text"name="name"><br><br>
9.      <inputtype="image"alt="Submit"src="login.png"width="100px">
10.  </form>
11. 11.
12.  </body>
13. </html>
```

HTML5newlyadded<input>typeselement

1. <inputtype="color">:

The <input> type "color" is used to define an input field which contains a colour. It allows auserto specify thecolourby thevisual colourinterfaceon abrowser.

Note: The "color" type only supports color value in hexadecimal format, and the default value is#000000(black).

Example:

```
1. <form>
2.     Pickyour Favorite color:<br><br>
3.     <inputtype="color"name="upclick"value="#a52a2a">Upclick<br><br>
4.     <inputtype="color"name="downclick"value="#f5f5dc">Downclick
```

5. </form>

Output:

Input"color"types:
PickyourFavoritecolor:

Up-

clickDown-

click

Note: The default value of "color" type is #000000 (black). It only supports color value inhexadecimalformat.

---

2. <inputtype="date">:

The <input> element of type "date" generates an input field, which allows a user to input thedatein agiven format.Ausercanenterthe dateby textfield orby datepicker interface.

Example:

```
1. <form>
2.     SelectStartand EndDate: <br><br>
3.       <inputtype="date"name="Startdate">Startdate:<br><br>
4.       <inputtype="date"name="Enddate">Enddate:<br><br>
5.       <inputtype="submit">
6. </form>
```

Output:

Input"date"type
Select Start and End

Date:Start date:

End date:

---

3. <inputtype="datetime-local">:

The<input>element oftype"datetime-local" createsinputfiled whichallowausertoselectthedate as wellas local timeinthehourandminute without timezoneinformation.

Example:

```
1. <form>
2.     <label>
```

3. Selectthemeetingschedule:

4. Selectdate&time:<inputtype="datetime-local"name="meetingdate">


```
    </label>
     <inputtype="submit">
</form>
```

Output:

Input"datetime-local"type
Select the meeting

schedule:Select date&time:

---

4. <inputtype="email">:

The <input> type "email" creates an input filed which allow a user to enter the e-mail addresswith pattern validation. The multiple attributes allow a user to enter more than one emailaddress.

Example:

```
<form>
      <label><b>EnteryourEmail-address</b></label>
      <inputtype="email"name="email"required>
      <inputtype="submit">
       <p><strong>Note:</strong>User can also enter multiple email addresses separatingby commaorwhitespaceas following:</p>
      <label><b>EntermultipleEmail-addresses</b></label>
       <inputtype="email"name="email"multiple>
      <inputtype="submit">
</form>
```

Output:

Input"email"type
EnteryourEmail-address

Note: User can also enter multiple email addresses separating by comma or whitespace asfollowing:

EntermultipleEmail-addresses

---

5. <inputtype="month">:

The <input> type "month" creates an input field which allows a user to easily enter monthand year in the format of "MM, YYYY" where MM defines month value, and YYYY definestheyear value. New

Example:

```
<form>
    <label>EnteryourBirthMonth-year:</label>
    <inputtype="month"name="newMonth">
    <inputtype="submit">
</form>
```

Output:

Input"month"type:
Enteryour BirthMonth-year:

HTMLformAttribute

HTML<form>elementattributes

In HTMLtherearevariousattributesavailablefor<form> elementwhich aregivenbelow:

HTMLactionattribute

Theactionattributeof <form>elementdefinesthe processtobeperformedon formwhenform is submitted,orit isaURIto process theform information.

Theactionattributevaluedefinesthewebpagewhereinformationproceed.It canbe.php, .jsp,.asp,etc. oranyURLwhereyouwant toprocess yourform.

Note:Ifactionattributevalueisblank thenformwillbeprocessedto thesamepage.

Example:

```
<formaction="action.html"method="post">
<label>UserName:</label><br>
<inputtype="text"name="name"><br><br>
<label>UserPassword</label><br>
<inputtype="password" name="pass"><br><br>
 <inputtype="submit">
   </form>
```

Output:

Demo of actionattribute offform element

UserName:

UserPassword

Itwillredirect toanewpage"action.html"whenyouclickonsubmitbutton

---

HTMLmethodattribute

The method attribute defines the HTTP method which browser used to submit the form. Thepossiblevalues ofmethod attributecan be:

- **post:** We can use the post value of method attribute when we want to process the sensitivedataasitdoes notdisplaythe submitted datain URL.

Example:

```
1.<formaction="action.html"method="post">
```

- **get:** The get value of method attribute is default value while submitting the form. But this isnot secure as itdisplaysdata in URL after submitting the form.

Example:

```
1.<formaction="action.html"method="get">
```

Whensubmittingthe data,it willdisplay theentereddata inthe formof:

```
1.file:///D:/HTML/action.html?name=JavaTPoint&pass=123
```

HTMLtargetattribute

The target attribute defines where to open the response after submitting the form. Thefollowingarethe keywords used with the target attribute.

- **_self:**Ifweuse_selfasanattributevalue,thentheresponsewill displayincurrent pageonly.

Example:

```
1.<formaction="action.html"method="get"target="_self">
```

- **_blank:** Ifwe use_blankas anattributeitwillloadthe responseinanewpage.

Example:

```
1.<formaction="action.html"method="get"target="_blank">
```

HTMLautocomplete attribute

The HTML autocomplete attribute is a newly added attribute of HTML5 which enables aninput field to complete automatically. It can have two values "on" and "off" which enablesautocompleteeitherON or OFF.Thedefaultvalueofautocompleteattributeis "on".

Example:

```
1.<form action="action.html" method="get"
```

autocomplete="on">Example:

```
1.<formaction="action.html"method="get"autocomplete="off">
```

Note:itcanbe usedwith<form>elementand<input>element both.

HTMLenctypeattribute

The HTML enctype attribute defines the encoding type of form-content while submitting theformto the server. Thepossible values ofenctype can be:

- **application/x-www-form-urlencoded:** It is default encoding type if the enctype attribute isnot includedintheform.Allcharactersareencodedbefore submittingthe form.

Example:

```
1.<form action="action.html" method="post" enctype="application/x-www-form-
   urlencoded">
```

- **multipart/form-data:** It does not encode any character. It is used when our form containsfile-uploadcontrols.

Example:

```
1.<formaction="action.html" method="post" enctype="multipart/form-data">
```

- **text/plain (HTML5):** In this encoding type only space are encoded into + symbol and no anyotherspecialcharacterencoded.

Example:

```
1.<formaction="action.html"method="post" enctype="text/plain" >
```

HTMLnovalidateattributeHTML5

The novalidate attribute is newly added Boolean attribute of HTML5. If we apply thisattributeinformthenitdoes notperform anytype ofvalidation andsubmittheform.

Example:

```
1.<formaction="action.html"method ="get" novalidate>
```

Output:

Fillthe form

Entername:

Enterage:

Enteremail:

Try to change the form detials with novalidateatttribute and without novalidateattributeand seethe difference.

HTML <input> element

attributeHTMLnameattribute

The HTML name attribute defines the name of an input element. The name and valueattributeareincluded in HTTP request whenwesubmittheform.

Note: One should not omit the name attribute as when we submit the form the HTTP request includesbothname-valuepairandif nameis not available it willnotprocessthatinputfield.

Example:

```
1.  <formaction ="action.html"method="get">
2.          Entername:<br><inputtype="name"name="uname"><br>
3.          Enterage:<br><inputtype="number"name="age"><br>
4.          Enteremail:<br><inputtype="email"><br>
5.          <inputtype="submit" value="Submit">
6.       </form>
```

Output:

Fillthe form

Enter

name:Enter

age:Entere

mail:

Note: If you will not use name attribute in any input field, then that input field will notbesubmitted, when submit theform.

Click on submit and see the URL where email is not included in HTTP request as we havenotused name attributein the email input field

---

HTMLvalueattribute

The HTML value attribute defines the initial value or default value of an input

field.Example:

```
1. <form>
2.         <label>EnteryourName</label><br>
3.          <inputtype="text" name="uname"value="EnterName"><br><br>
4.         <label>EnteryourEmail-address</label><br>
5.          <inputtype="text" name="uname"value="Enteremail"><br><br>
6.           <label>Enteryourpassword</label><br>
7.          <inputtype="password"name="pass"value=""><br><br>
8.         <inputtype="submit"value="login">
9.     </form>
```

Output:

Fillthe form

EnteryourName
EnterName

EnteryourEmail-address
Enteremail

Enteryour password

Note:Inpasswordinputfiledthevalueattributewillalwaysunclear

HTMLrequiredattributeHTML5

HTMLrequiredisaBooleanattributewhichspecifies thatusermustfillthatfiled beforesubmittingthe form.

Example:

```
<form>
      <label>EnteryourEmail-address</label><br>
       <inputtype="text"name="uname"required><br><br>
       <label>Enteryourpassword</label><br>
       <inputtype="password"name="pass"><br><br>
      <inputtype="submit"value="login">
 </form>
```

Output:

Fillthe form

EnteryourEmail-address

Enteryour password

If you will try to submit the form without completing email field then it will give anerrorpopup.

HTMLautofocusattributeHTML5

The autofocus is a Boolean attribute which enables a field automatically focused when awebpageloads.

Example:

```
<form>
      <label>EnteryourEmail-address</label><br>
       <inputtype="text"name="uname"autofocus><br><br>
       <label>Enteryourpassword</label><br>
       <inputtype="password"name="pass"><br><br>
      <inputtype="submit"value="login">
 </form>
```

HTMLplaceholder attribute HTML5

Theplaceholderattribute specifiesatextwithinaninputfieldwhichinformstheuserabouttheexpected input of that filed.

Theplaceholderattribute canbeusedwith text,password,email,andURL values.

When the user enters the value, the placeholder will be automatically

removed.Example:

```
1.  <form>
2.        <label>Enteryourname</label><br>
3.         <inputtype="text" name="uname"placeholder="Yourname"><br><br>
4.           <label>EnteryourEmailaddress</label><br>
5.         <input type="email" name="email"
    placeholder="example@gmail.com"><br><br>
6.           <label>Enteryourpassword</label><br>
7.         <inputtype="password"name="pass"placeholder="yourpassword"><br><br>
8.        <inputtype="submit"value="login">
9.     </form>
```

Output:

Registrationform
Enteryour name

EnteryourEmail address

Enteryour password

HTMLdisabledattribute

The HTML disabled attribute when applied then it disable that input field. The disabled fielddoesnot allow theuser to interact with that field.

The disabled input filed does not receive click events, and these input value will not be senttotheserverwhen submitting the form.

Example:

```
1.<inputtype="text" name="uname"disabled><br><br>
```

Output:

Registrationform
EnterUsername
USER

EnteryourEmail address

Enteryour password

HTMLsizeattribute

Thesizeattributecontrolsthesizeoftheinputfield intyped

characters.Example:

```
1. <label>Accountholdername</label><br>
2.         <inputtype="text"name="uname"size="40"required><br><br>
3.          <label>Accountnumber</label><br>
4.         <inputtype="text"name="an"size="30"required><br><br>
5.          <label>CVV</label><br>
6.         <inputtype="text"name="cvv"size="1"required><br><br>
```

Output:

Registrationformwithdisbaledattribute
Accountholdername

Accountnumber

CVV

HTMLformattribute

HTML form attribute allows a user to specify an input filed outside the form but remains thepartofthe parent form.

Example:

```
1. Useremail: <br><inputtype="email"name="email"form="fcontrol"required><br>

2.         <inputtype="submit"form="fcontrol">
```

Output:

UserName:

Userpassword:

Theemailfieldis outsidetheformbut stillitwillremain partofthe form

Useremail:

HTMLstyleusingCSS

Let's suppose we have created our web page using a simple HTML code, and we wantsomething which can present our page in a correct format, and visibly attractive. So to dothis,wecan style ourweb pagewith CSS (Cascading Stylesheet) properties.

CSS is used to apply the style in the web page which is made up of HTML elements. Itdescribesthe look of thewebpage.

CSS provides various style properties such as background color, padding, margin, border-color,and many more, to style awebpage.

Each property in CSS has a name-value pair, and each property is separated by a semicolon(;).

Note: In this chapter, we have given a small overview of CSS. You will learn everything in depthaboutCSSin our CSStutorial.

Example:

```
1. <bodystyle="text-align:center;">
2.     <h2style="color:red;">WelcometojavaTpoint</h2>
3.     <pstyle="color: blue;font-size:25px;font-style:italic;">This isagreatwebsitetolearntechnologies inverysimpleway.</p>
4. </body>
```

In the above example, we have used a style attribute to provide some styling format to ourcode.

Output:

Welcome tojavaTpoint

Thisisa great websiteto learntechnologiesinverysimpleway.

ThreewaystoapplyCSS

TouseCSS withHTMLdocument, there arethree ways:

- **InlineCSS:** DefineCSSpropertiesusingstyleattributeintheHTMLelements.
- **InternalorEmbeddedCSS:**DefineCSSusing<style>tagin<head>section.
- **External CSS:** Define all CSS property in a separate .css file, and then include the file withHTMLfile using taginsection.

InlineCSS:

InlineCSSisusedtoapplyCSSina singleelement.Itcanapplystyleuniquelyin eachelement.

To apply inline CSS, you need to use style attribute within HTML element. We can use asmanyproperties aswewant,but each property shouldbe separated byasemicolon(;).

Example:

```
1. <h3style="color:red;
2.          font-style:italic;
3.           text-align:center;
4.          font-size:50px;
5.           padding-top:25px;">LearningHTMLusingInlineCSS</h3>
```

Output:

LearningHTMLusingInlineCSS

InternalCSS:

An Internal stylesheets contains the CSS properties for a webpage in <head> section ofHTMLdocument. To use Internal CSS, wecan useclassand id attributes.

We can use internal CSS to apply a style for a single HTML

page.Example:

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4.              <style>
5.       /*InternalCSS usingelementname*/
6.          body{background-color:lavender;
7.            text-align:center;}
8.           h2{font-style:italic;
9.             font-size:30px;
10.           color:#f08080;}
11.          p{font-size: 20px;}
12.       /*InternalCSSusingclassname*/
```

```
13.            .blue{color: blue;}
14.           .red{color:red;}
15.            .green{color:green;}
16.      </style>
17.    </head>
18.   <body>
19.    <h2>LearningHTMLwithinternalCSS</h2>
20.     <pclass="blue">Thisisabluecolorparagraph</p>
21.     <pclass="red">Thisis ared colorparagraph</p>
22.     <pclass="green">Thisisagreencolorparagraph</p>
23.   </body>
24. </html>
```

Note:Intheaboveexample, wehaveuseda classattribute whichyou will learninthe next chapter.

ExternalCSS:

An external CSS contains a separate CSS file which only contains style code using the classname, id name, tag name, etc. We can use this CSS file in any HTML file by including it inHTMLfileusing <link>tag.

If we have multiple HTML pages for an application and which use similar CSS, then we canuseexternal CSS.

Therearetwofiles needtocreateto applyexternalCSS

- First,createtheHTMLfile
- Create a CSS file and save it using the .css extension (This file only will only contain thestylingcode.)
- LinktheCSSfile in yourHTMLfileusingtaginheader sectionofHTMLdocument.

Example:

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.     <linkrel="stylesheet"type="text/css"href="style.css">
5.     </head>
6.    <body>
7.     <h2>LearningHTMLwithExternalCSS</h2>
8.     <pclass="blue">Thisisabluecolorparagraph</p>
9.     <pclass="red">Thisis ared colorparagraph</p>
10.    <pclass="green">Thisisagreencolorparagraph</p>
11.  </body>
12. </html>
```

CSS file:

```
body{
background-color:lavender;
```

```
text-align:center;
}
h2{
font-style:
italic;size:
30px;color:#f08
080;
}
p{
font-size:20px;
}

.blue{color
:blue;
}
.red{color
:red;
}
.green{color
:green;
}
```

CommonlyusedCSSproperties:

Properties-name	Syntax	Description
background-color	background-color:red;	It definesthebackground colorofthat element.
color	color:lightgreen;	It definesthecoloroftextofanelement
padding	padding: 20px;	It definesthespacebetween contentandthe border.
margin	margin:30px;margin-left:	Itcreatesspacearoundanelement.
font-family	font-family:cursive;	Font-familydefinesafontforaparticularelement.
Font-size	font-size:50px;	Font-sizedefinesafont sizeforaparticularelement.
text-align	text-align:left;	It isusedto align thetextinaselectedposition.

HTMLClasses

ClassAttributein HTML

The HTML class attribute is used to specify a single or multiple class names for an HTMLelement. The class name can be used by CSS and JavaScript to do some tasks for HTMLelements. You can use this class in CSS with a specific class, write a period (.) character,followedby the name ofthe class forselecting elements.

Aclassattributecanbedefinedwithin<style>tag orinseparatefileusingthe(.)

character.InanHTMLdocument,wecanusethesame class

attributenamewithdifferentelements.

DefininganHTMLclass

TocreateanHTMLclass, firstlydefinestyleforHTMLclassusing <style> tagwithin <head>sectionasfollowingexample:

Example:

```
1. <head>
2.    <style>
3.        .headings{
4.           color:lightgreen;
5.            font-family:cursive;
6.           background-color:black;}
7.    </style>
8. </head>
```

We have define style for a class name "headings", and we can use this class name with any ofHTML element in which we want to provide such styling. We just need to follow thefollowing syntaxto useit.

1.<tag class="ghf"> content

</tag>Example1:

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4.    <style>
5.        .headings{
6.           color:lightgreen;
7.            font-family:cursive;
8.           background-color:black;}
9.    </style>
10. </head>
11. <body>
12. <h1class="headings">Thisisfirstheading</h1>
13. <h2class="headings">This isSecondheading</h2>
14. <h3class="headings">Thisisthirdheading</h3>
15. <h4class="headings">This isfourthheading</h4>
16. </body>
17. </html>
```

Another Example withdifferent classname

Example:

Let'suseaclass name"Fruit"with CSStostyleallelements.

```
<style>
.fruit {
    background-color:orange;
    color:white;
    padding: 10px;
}
</style>

<h2class="fruit">Mango</h2>
<p>Mangoiskingof allfruits.</p>
11.
<h2class="fruit">Orange</h2>
<p>Orangesarefull of VitaminC.</p>
14.
<h2class="fruit">Apple</h2>
<p>Anappleaday,keepsthe Doctor away.</p>
```

Hereyoucan seethat we haveused the class name"fruit"with (.)touseall itselements.

Note: Youcanuseclass attributeonany HTMLelement.Theclassnameiscase-sensitive.

ClassAttributein JavaScript

You can use JavaScript access elements with a specified class name by using thegetElementsByClassName()method.

Example:

Let'shideall theelements with classname"fruit"whenthe user clickon thebutton.

```
<!DOCTYPEhtml>
<html>
<body>

<h2>ClassAttributewithJavaScript</h2>
<p>Clickthebutton,tohideallelements withtheclassname"fruit",withJavaScript:</p>

<buttononclick="myFunction()">Hideelements</button>


<h2class="fruit">Mango</h2>
<p>Mangoiskingof allfruits.</p>
13.
<h2class="fruit">Orange</h2>
<p>Orangesarefull of VitaminC.</p>
16.
```

```
17. <h2class="fruit">Apple</h2>
18. <p>Anappleaday,keepsthe Doctor away.</p>
19. 19.
20. <script>
21. functionmyFunction(){
22.   varx=document.getElementsByClassName("fruit");
23.   for(vari =0; i<x.length; i++){
24.     x[i].style.display="none";
25.}
26.}
27.</script>
28.
29. </body>
30. </html>
```

Note: YouwilllearnmoreaboutJavaScriptinourJavaScripttutorial.

MultipleClasses

You can use multiple class names (more than one) with HTML elements. These class namesmustbeseparated byaspace.

Example:

Let'sstyleelements withclass name"fruit"andalsowith aclassname "center".

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <style>
4.  .fruit {
5.      background-color:orange;
6.      color:white;
7.      padding: 10px;
8.}
9.
10. .center{
11.     text-align:center;
12.}
13. </style>
14. <body>
15. 15.
16. <h2>MultipleClasses</h2>
17. <p>Allthree elements
    havetheclassname"fruit".Inaddition,Mangoalsohavetheclassname"center",
    whichcenter-aligns thetext.</p>
18. 18.
19. <h2class="fruit center">Mango</h2>
20. <h2class="fruit">Orange</h2>
21. <h2class="fruit">Apple</h2>
22. 22.
23. </body>
```

```
24. </html>
```

You can see that the first element <h2> belongs to both the "fruit" class and the "center"class.

Same classwithDifferent Tag

You can use the same class name with different tags like <h2> and <p> etc. to share the samestyle.

Example:

```
1. <!DOCTYPEhtml>
2. <html>
3. <style>
4. .fruit {
5.   background-color:orange;
6.   color:white;
7.   padding: 10px;
8.}
9. </style>
10. <body>
11. <h2>SameClasswithDifferent Tag</h2>
12. <h2class="fruit">Mango</h2>
13. <pclass="fruit">Mangoisthekingofall fruits.</p>
14. </body>
15. </html>
```

Test itNow**HTMLIdAttribute**

The **id attribute** is used to specify the unique ID for an element of the HTML document. Itallocates the unique identifier which is used by the **CSS** and the **JavaScript** for performingcertaintasks.

Note: In the Cascading Style sheet (CSS), we can easily select an element with the specific id by usingthe#symbolfollowed byid.

Note:JavaScriptcanaccess anelement withthegivenIDby usingthegetElementById() method.

Syntax

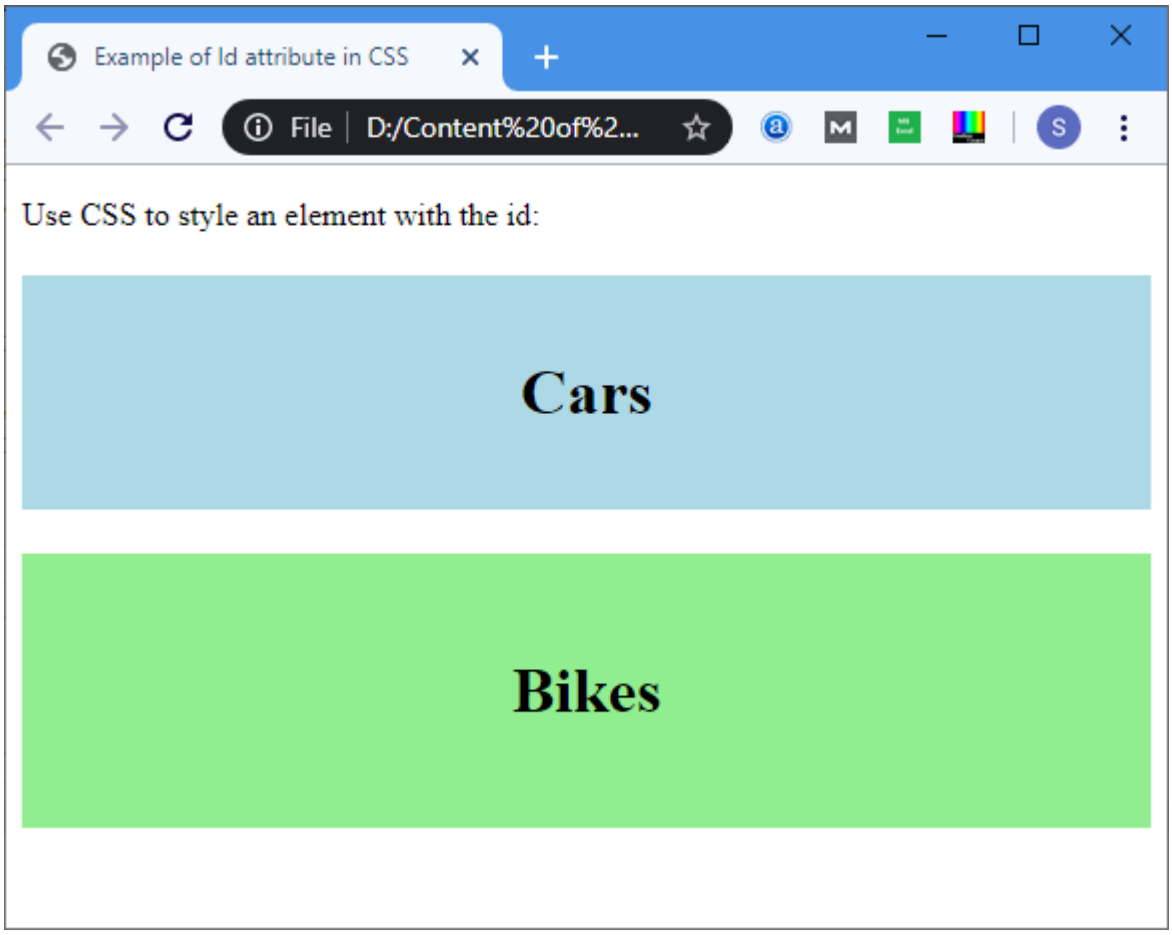
```
1.<tagid="value">
```

Example1: Thefollowing exampledescribes how to usetheid attributein CSS document:

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <title>
```

```
5. Exampleof Idattributein CSS
6. </title>
7. <style>
8. #Cars {
9. padding: 40px;
10. background-color:lightblue;
11. color:black;
12. text-align:center;
13.}
14.
15.#Bikes
16.{
17. padding: 50px;
18. background-color:lightGreen;
19. text-align:center;
20.}
21. </style>
22. </head>
23. <body>
24. <p>UseCSSto styleanelementwiththeid:</p>
25. <h1id="Cars">Cars </h1>
26. <h1id="Bikes">Bikes</h1>
27. </body>
28. </html>
```

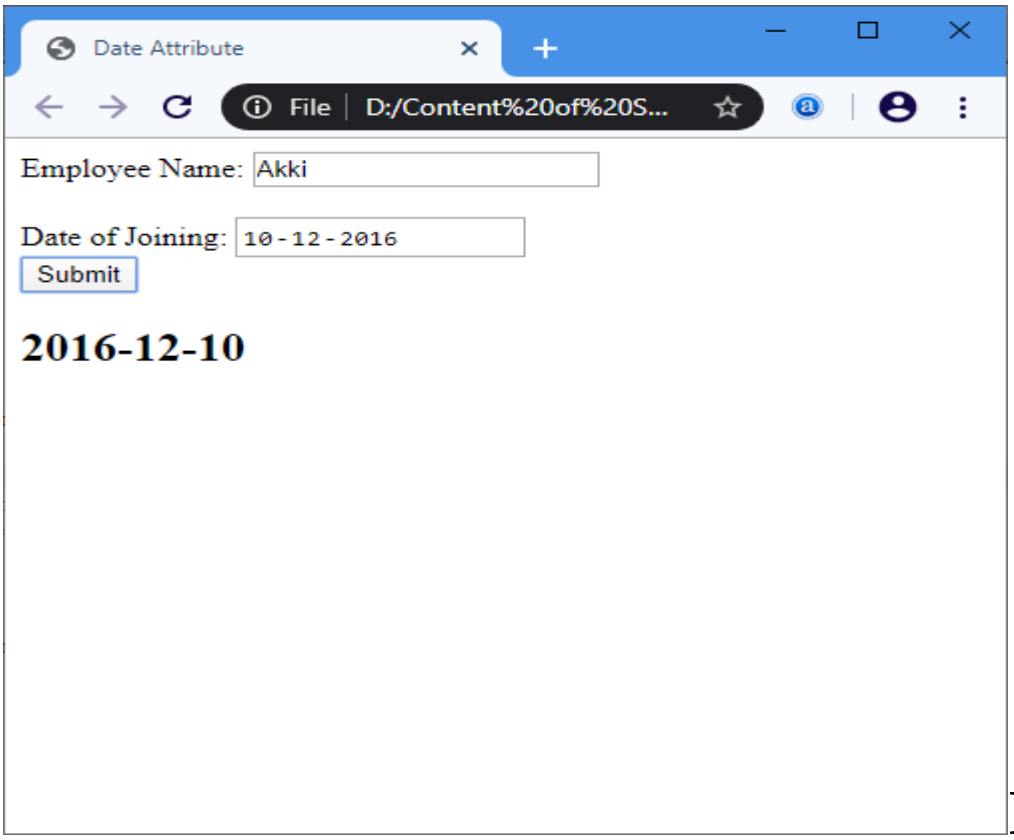
Output:



Example2: Thefollowing exampledescribeshowto usethe ID attributeinJavaScript.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <title>DateAttribute</title>
5. <script>
6. functionviewdate(){
7. varx=document.getElementById("dob").value;
8. document.getElementById("demo").innerHTML=x;
9. </script>
10. </head>
11. <body>
12. EmployeeName: <inputtype="text"placeholder="YourGoodname"/>
13. <br>
14. <br>
15. DateofJoining:
16. <inputtype="date"id="dob">
17. <br>
18. <buttononclick="viewdate()">Submit
19. </button>
20. <br>
21.<h2id="demo"></h2>
22. </body>
23. </html>
```

Output:



HTML ListBox

The **list box** is a graphical control element in the HTML document that allows a user to selectoneor moreoptions fromthe list of options.

Syntax

To create a list box, use the HTML element**<select>**which contains two attributes **Name** and**Size**. The **Name** attribute is used to define the name for calling the list box, and **size** attributeisused to specify thenumerical valuethat shows thehow many options it contains.

```
<selectName="Name_of_list_box"Size="Number_of_options">
  <option>Listitem1</option>
  <option>List item2</option>
  <option>Listitem3</option>
  <option>List itemN</option>
</select>
```

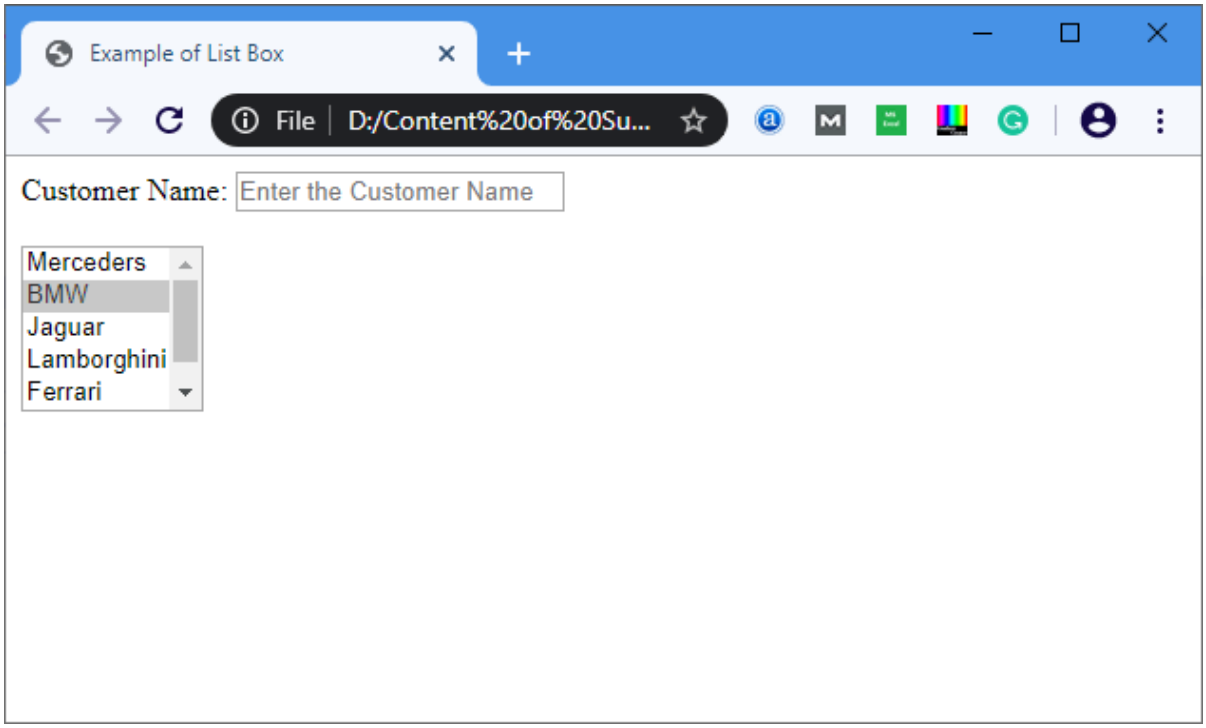
Examples:

Example1: Considerthebelowexamplethatcreatesasimplelist box.

```
<!DOCTYPEhtml>
<html>
```

```
3. <title>
4. ExampleofList Box
5. </title>
6. <body>
7. CustomerName:<inputtype="text" Placeholder="EntertheCustomerName"/>
8. <br>
9. <br>
10. <selectname="Cars"size="5">
11.     <optionvalue="Merceders">Merceders</option>
12.     <optionvalue="BMW">BMW </option>
13.     <optionvalue="Jaguar">Jaguar </option>
14.     <optionvalue="Lamborghini">Lamborghini</option>
15.     <optionvalue="Ferrari">Ferrari</option>
16.     <optionvalue="Ford">Ford</option>
17. </select>
18. </body>
19. </html>
```

Output:

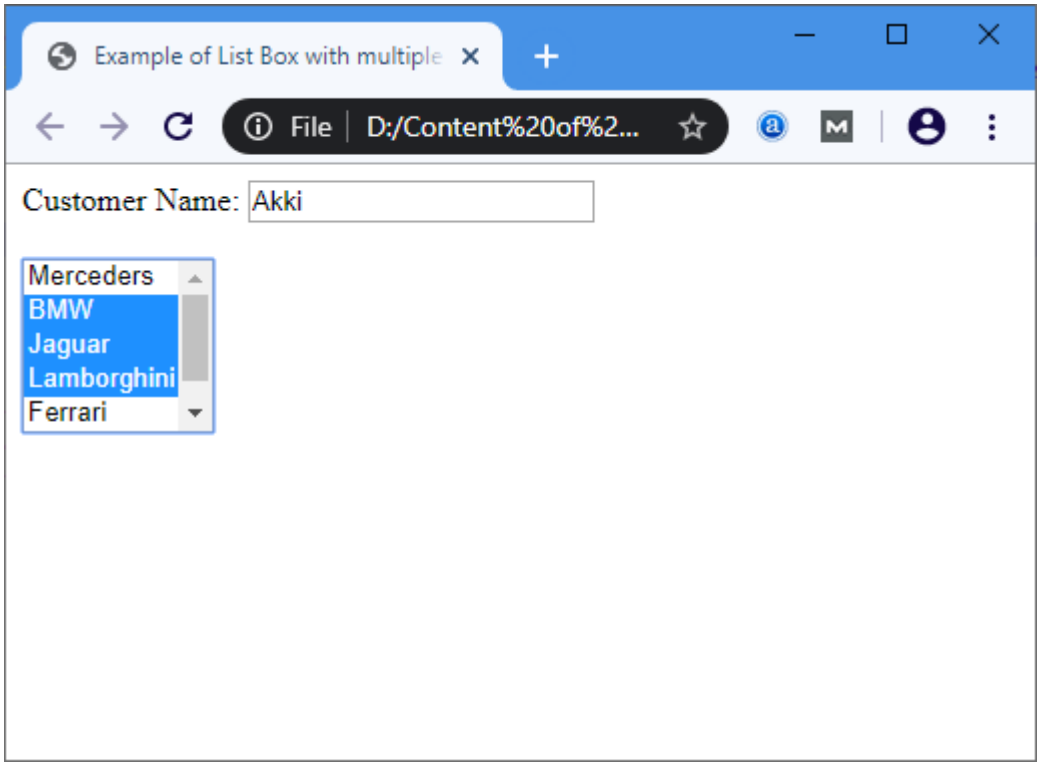


Example 2: Below example uses the **multiple**attribute for selecting the multiple options in alist.Wecan select multipleoptions from list boxby holding the ctrlkey.

```
1. <!DOCTYPEhtml>
2. <html>
3. <title>
4. ExampleofListBoxwithmultipleattribute
5. </title>
6. <body>
7. CustomerName:<inputtype="text" Placeholder="EntertheCustomerName"/>
```

```
8.  <br>
9.  <br>
10. <selectname="Cars"size="5"multiple="multiple">
11.     <optionvalue="Merceders">Merceders</option>
12.     <optionvalue="BMW">BMW </option>
13.     <optionvalue="Jaguar">Jaguar </option>
14.     <optionvalue="Lamborghini">Lamborghini</option>
15.     <optionvalue="Ferrari">Ferrari</option>
16.     <optionvalue="Ford">Ford</option>
17. </select>
18. </body>
19. </html>
```

Output:



Unixcommandslist

This guide has been prepared by me to help myself with the list of frequently used ***basiccommands in UNIX/LINUX*** to be on my finger tip. Thought of sharing it with the others, incase, it might turn out helpful to other readers as well. This is ***Unix/Linux basic commands -1***,for2nd part follow thelink given at theend ofthis article.

Web serversShell

Unix/Linuxfilecommandsguide

This article will serve as a 5 minute guide or tutorial to learn/revisit basic unix or linuxcommands frequently used while working with files. Unix/Linux command is given alongwith their *usageor description*.

- **ls ►** use this *command in unix/linux* to see all the directory listing. However, anyhiddenfiles will not be listed.
- **ls -al ►** use this *command in unix/linux* to see formatted directory listing along withthehidden files.
- **ls -lt ►** use this *command in unix/linux* to sort the directory listing by their time ofmodification.
- **pwd►** usethis*commandin unix/linux*to showyourcurrentworking directory.
- **touch fileName ►** use this *command in unix/linux* to create new file with its name asfilename.
- **cd►** usethis *command inunix/linux*to moveto homedirectory.
- **cd dirName ►** use this *command in unix/linux* to change current directory todirNamedirectory.
- **mkdirdirName ►** use this *command in unix/linux* to make or create directory havingnameas dirName.
- **rm fileName ►** use this *command in unix/linux* to remove or delete file having nameasfileName.
- **rm -r dirName ►** use this *command in unix/linux* to remove or delete directorydirName.
- **rm -ffilename►** usethis*commandin unix/linux*toforceremove the filefilename.
- **more fileName ►** use this *command in unix/linux* to get the content of file havingnameas filename
- **head fileName ►** use this *command in unix/linux* to get output of first 10 lines of thefilefileName.
- **tail fileName ►** use this *command in unix/linux* to get output of last 10 lines of thefilefilename.
- **cpfileAfileB ►** usethis *commandinunix/linux* tocopy thecontent of fileAto fileB.
- **cp -r dirAdirB ►** use this *command in unix/linux* to copy directory dirA to directorydirBand create dirB if not already created.
- **mvfileAfileB►**usethis*command inunix/linux* torename ormovefileAto fileB.
- **cat>file►**usethis*commandin unix/linux* toplacestandard inputinto thefile.

UnixorLinuxprocessmanagementcommandsguide

This section will serve as a 5 minute guide or tutorial to learn/revisit basic unix or linuxcommands frequently used while working with process management. Unix/Linux commandisgiven along with their *usageor description*.

- **ps►**usethiscommandinunix/linuxtoseecurrentlyworkingprocesses.
- **top►**usethis commandinunix/linux todisplayallthe runningprocesses.

- **killpid ►**usethiscommand inunix/linuxtokilltheprocesswithgivenpid.
- **killallprocessA ►** use this command in unix/linux to kill all the process named asprocessA
- **pkill pattern ►** use this command in unix/linux to kill all processes matching thegivenpattern.
- **bg►**usethiscommandin unix/linuxtolist allthebackgroundjobs.
- **fg►** usethis command inunix/linux to bringthemost recentjob to foreground.
- **fgn1 ►**usethiscommand in unix/linuxto bringjob n1 tothe foreground.

Unix/Linuxsysteminfocommandsguide

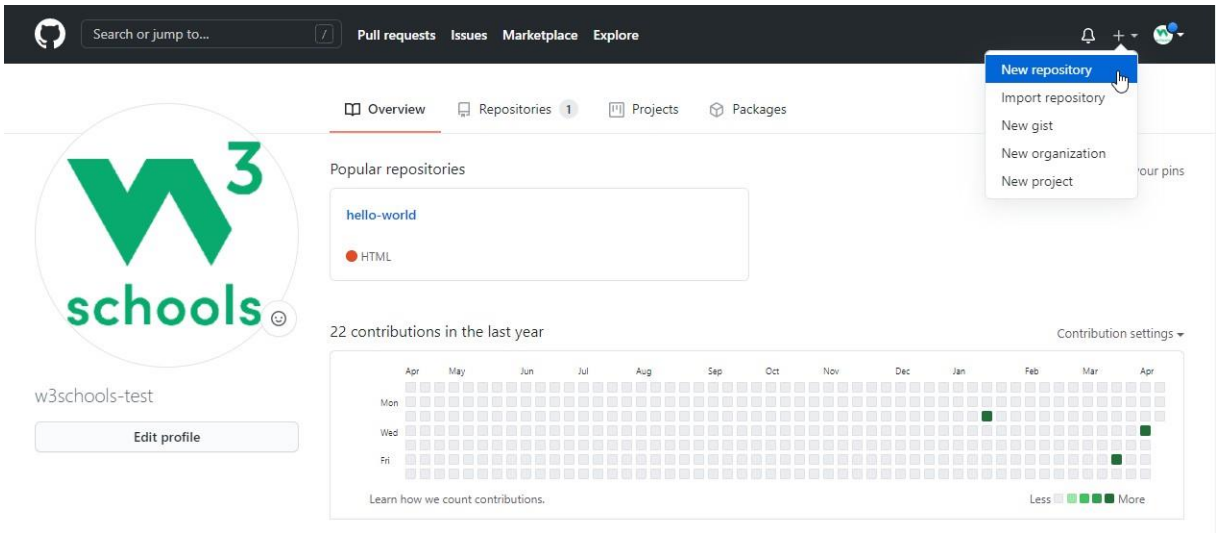
This section will serve as a 5 minute guide or tutorial to learn/revisit basic unix or linuxcommands frequently used while working with system. Unix/Linux command is given alongwith their *usageor description*.

- **cal►**usethiscommandinunix/linux toshowcurrent monthscalendar.
- **date►**usethis commandinunix/linux toshowcurrentdateandtime.
- **w ►** use this command in unix/linux to see who all are currently logged in to thesystem.
- **whoami ►** use this command in unix/linux to see who you are currently logged in asin thesystem.
- **uname-a►**usethiscommandinunix/linuxtoseekernelinformation.
- **fingeruser►** usethis command inunix/linux todisplayinformation about user.
- **mancommand►**usethiscommandinunix/linux toshowthemanual for command.
- **free►** usethis commandin unix/linuxto showmemory andswap usage.
- **df►** usethis command inunix/linux to seethe disk usage.
- **du►**usethiscommandin unix/linuxtoseethedirectory spaceusage.
- **whereisapp ►** usethiscommandinunix/linux toshowpossiblelocationofapp.
- **which app ►** use this command in unix/linux to show which application will be runbydefault.

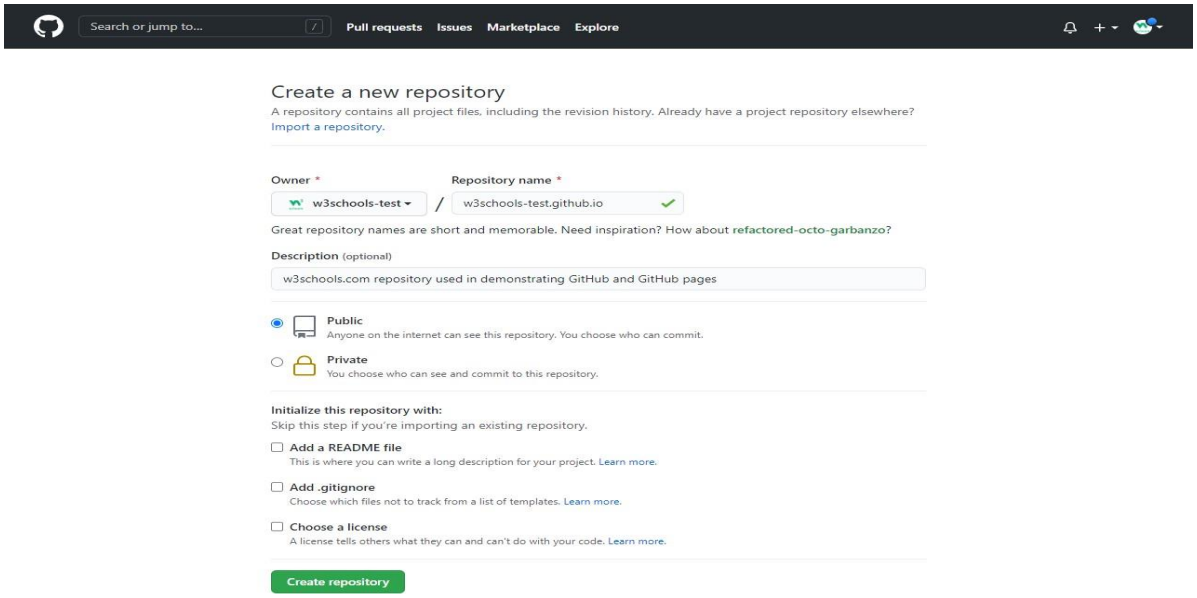
Git GitHubPages

Create aNewRepository

Start by signing in to GitHub. GitHub pages need a special name and setup to work, so westartby creating anewrepository:



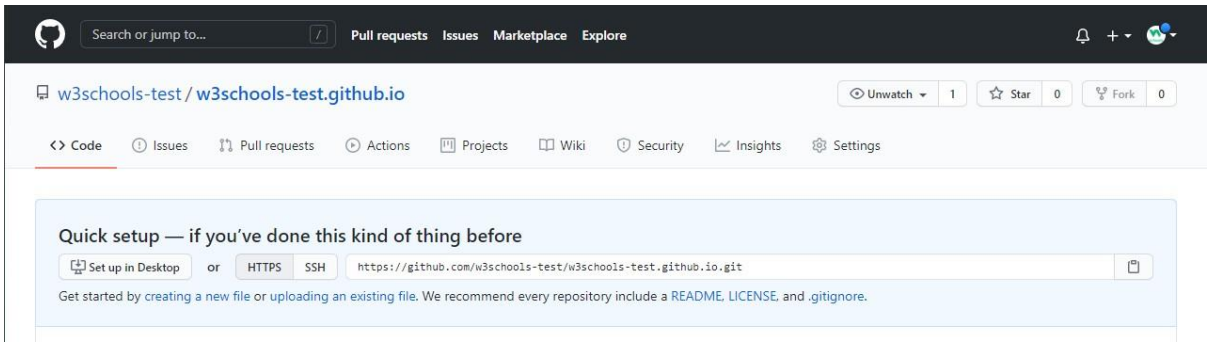
This repository needs a special name to function as a GitHub page. It needs to be yourGitHubusername, followed by .github.io:



PushLocalRepositoryto GitHubPages

We add this new repository as a remote for our local repository, we are calling it gh-page (forGitHubPages).

CopytheURLfromhere:



Andadd it as anewremote:

Example

gitremoteaddgh-pagehttps://github.com/w3schools-test/w3schools-test.github.io.git

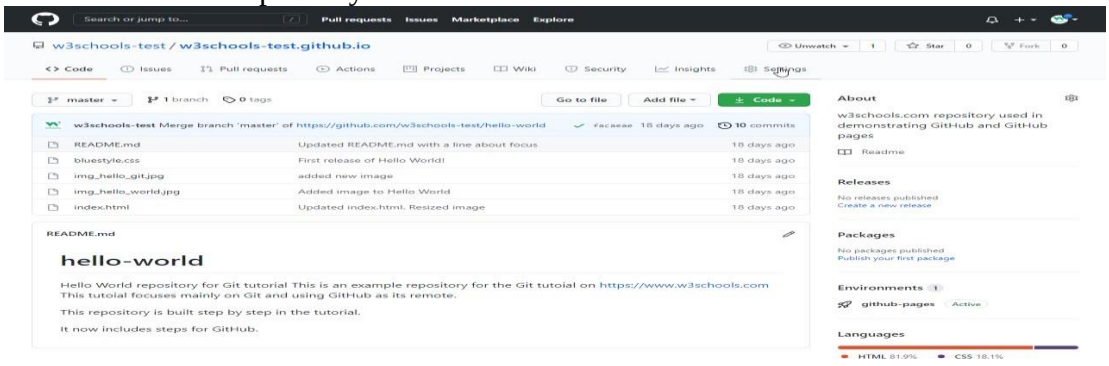
Makesureyouareon themasterbranch, thenpush themasterbranchto thenewremote:

Example

```
git push gh-page
masterEnumeratingobjects:33,
done.
Counting objects: 100% (33/33),
done.Delta compression using up to 16
threadsCompressingobjects:100%(33/33),
done.
Writingobjects:100%(33/33),94.79KiB|15.80MiB/s,done.
Total 33 (delta 18), reused 0 (delta 0), pack-reused
0remote:Resolving deltas:100%(18/18),done.
Tohttps://github.com/w3schools-test/w3schools-test.github.io.git
 *[newbranch]      master->master
```

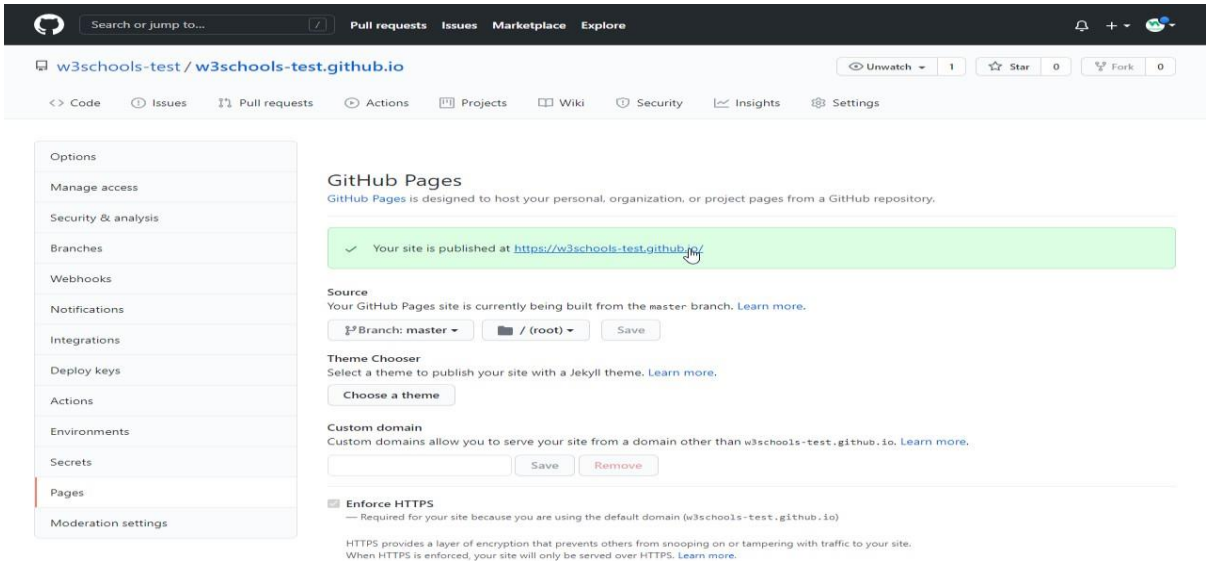
Note: If this is the first time you are connecting to GitHub, you will get some kind ofnotificationto authenticate this connection.

Checkthatthenew repositoryhasreceivedallthe files:



Check OutYourOwn GitHubPage

Thatlooksgood, nowclickthe Settingsmenuand navigateto thePagestab:



TheGitHubpageiscreated, andyou canclick the URL toview theresult!

GitTutorial

LearningbyExamples

Inthistutorial, wewillshow youGitcommands likethis:

Example

```
git--version
gitversion2.30.2.windows.1
```

For new users, using the terminal view can seem a bit complicated. Don't worry! We willkeepitreally simple,andlearning thisway gives youagoodgrasp ofhow Git works.

In the code above, you can see commands (input) and

output.Lineslikethis arecommands weinput:

Example

```
git--version
```

Lineslikethis arethe output/response to ourcommands:

Example

```
gitversion2.30.2.windows.1
```

In general, lines with $ in front of it is input. These are the commands you can copy and runinyour terminal.

GitandRemote Repositories

GitandGitHub aredifferentthings.

In this tutorial you will understand what Git is and how to use it on the remote repositoryplatforms,likeGitHub.

Youcanchoose, andchange,which platformtofocus onbyclicking inthemenu ontheright:

GitExercises

Test Yourself With

ExercisesExercise:

Insertthemissing partof the commandtocheckwhichversionofGit(if any) isinstalled.

git 

What is Git?

Git is a popular version control system. It was created by Linus Torvalds in 2005, and hasbeenmaintained by Junio Hamano sincethen.

Itisusedfor:

- Trackingcodechanges
- Trackingwhomade changes
- Codingcollaboration

WhatdoesGitdo?

- Manageprojectswith**Repositories**
- **Clone**aprojecttoworkonalocalcopy
- Controlandtrackchangeswith**Staging**and**Committing**
- **Branch**and**Merge**toallowforworkondifferentpartsandversionsofaproject
- **Pull**thelatest versionoftheproject toalocal copy
- **Push**localupdatestothemain project

WorkingwithGit

- InitializeGit onafolder,makingita**Repository**
- Git nowcreatesahidden foldertokeeptrackof changesinthat folder

- Whenafileischanged,addedor deleted,it is considered**modified**
- Youselectthemodifiedfilesyouwant to **Stage**
- The **Staged** files are **Committed**, which prompts Git to store a **permanent** snapshot of thefiles
- Git allowsyoutoseethefull historyofeverycommit.
- You canrevertbacktoanypreviouscommit.
- Git does not store a separate copy of every file in every commit, but keeps track of changesmadeineachcommit!

WhyGit?

- Over 70%ofdevelopersuseGit!
- Developerscanworktogether from anywhereintheworld.
- Developerscanseethe fullhistoryofthe project.
- Developerscanreverttoearlierversionsofaproject.

WhatisGitHub?

- GitisnotthesameasGitHub.
- GitHubmakestools thatuse Git.
- GitHub is the largest host of source code in the world, and has been owned by Microsoft since2018.
- Inthistutorial,wewillfocusonusingGit withGitHub.

Git Install

YoucandownloadGitforfreefromthe followingwebsite:https://www.git-scm.com/

UsingGit withCommandLine

Tostart usingGit, weare firstgoing to openup ourCommand shell.

For Windows, you can use Git bash, which comes included in Git for Windows. For Mac andLinuxyou can usethe built-in terminal.

Thefirstthing weneed todo, isto checkif Gitis properlyinstalled:

Example

```
git--version
gitversion2.30.2.windows.1
```

IfGit isinstalled, itshould show somethinglike gitversion X.Y

ConfigureGit

NowletGitknowwhoyouare.Thisisimportantforversioncontrolsystems,aseachGitcommituses this information:

Example
gitconfig--globaluser.name"w3schools-test"
gitconfig--globaluser.email"test@w3schools.com"

Change the user name and e-mail address to your own. You will probably also want to usethiswhen registering toGitHub later on.

Note: Use global to set the username and e-mail for **every repository** on your

computer.Ifyou wantto settheusername/e-mailforjustthe currentrepo, youcan

removeglobal

CreatingGit Folder

Now,let's createanewfolderforour project:

Examplemkdi
rmyprojectcdm
yproject

mkdir**make**sa**newdirectory**.

cd**changes**the**currentworkingdirectory**.

Nowthat wearein thecorrect directory.Wecanstart byinitializing Git!

Note: Ifyoualready haveafolder/directory youwouldliketo useforGit:

Navigate to it in command line, or open it in your file explorer, right-click and select "GitBashhere"

InitializeGit

OnceyouhavenavigatedtothecorrectfolderyoucaninitializeGitonthatfolder:

Example
gitinit
InitializedemptyGitrepositoryin/Users/user/myproject/.git/

Youjustcreated yourfirst GitRepository!

Note: Git now knows that it should watch the folder you initiated it

on.Gitcreatesahiddenfolder to keep trackofchanges.

Git AddingNew Files

Youjustcreated yourfirstlocal Gitrepo.But itisempty.

So let's add some files, or create a new file using your favourite text editor. Then save ormoveit to the folderyoujust created.

If you want to learn how to create a new file using a text editor, you can visit our HTMLtutorial:
HTMLEditors

Forthis example,Iamgoing touseasimpleHTML filelikethis:

Example
```
<!DOCTYPEhtml>
<html>
<head>
<title>HelloWorld!</title>
</head>
<body>

<h1>Helloworld!</h1>
<p>Thisis thefirstfileinmy newGitRepo.</p>

</body>
</html>
```

Andsaveitto our new folderas index.html.

Let'sgobacktotheterminalandlistthefiles inourcurrentworkingdirectory:

Example
```
lsindex.ht
ml
```

lswill

listthefilesinthedirectory.Wecanseethatindex.htmllisthere.Thenwecheck

theGit statusand seeif itis apart of ourrepo:

Example
```
gitstatus
On branch

masterNo

commitsyet

Untrackedfiles:
  (use "git add ..." to include in what will be
    committed)index.html
```

nothingadded to commitbutuntrackedfilespresent(use "gitadd"totrack)

Now Git is **aware** of the file, but has not **added** it to our

repository!Filesin your Gitrepository foldercan bein one of2states:

- Tracked-filesthat Git knowsabout andareaddedtotherepository
- Untracked-filesthatareinyourworkingdirectory,but notaddedtotherepository

Whenyoufirstadd filestoanemptyrepository,theyarealluntracked.To get Gittotrackthem,you need to stagethem, or add them to thestaging environment.

Git StagingEnvironment

Oneof thecorefunctions ofGit is theconcepts oftheStaging Environment,and theCommit.

As you are working, you may be adding, editing and removing files. But whenever you hit amilestoneor finish apartofthework, youshouldadd thefiles to aStagingEnvironment.

Staged files are files that are ready to be **committed** to the repository you are working on.Youwill learn moreaboutcommitshortly.

Fornow, wearedoneworking with index.html.Sowecanadd itto theStagingEnvironment:

Example

```
gitadd index.html
```

Thefileshouldbe**Staged**.Let's checkthe status::

Example

```
gitstatus
On branch

masterNo

commitsyet

Changesto becommitted:
  (use "git rm --cached ..." to
    unstage)newfile:index.html
```

Nowthe filehas been addedto theStaging Environment.

GitAddMore thanOne File

Youcan alsostagemorethan onefileata time.Let's add2 morefiles toour workingfolder.Usethe text editor again.

AREADME.mdfilethatdescribesthe repository(recommendedforallrepositories):

Example

#hello-world
HelloWorldrepositoryforGit tutorial
This is an example repository for the Git tutoial on

https://www.w3schools.comThisrepositoryisbuiltstepby step in the tutorial.

Abasicexternalstylesheet(bluestyle.css):

Example

```
body {
background-color:lightblue;
}

h1 {
color:
navy;margin-
left:20px;
}
```

Andupdateindex.htmltoincludethestylesheet:

Example

```
<!DOCTYPEhtml>
<html>
<head>
<title>HelloWorld!</title>
<linkrel="stylesheet"href="bluestyle.css">
</head>
<body>

<h1>Helloworld!</h1>
<p>Thisis thefirstfileinmy newGitRepo.</p>

</body>
</html>
```

Nowaddall filesin thecurrentdirectory totheStagingEnvironment:

Example

```
gitadd --all
```

Using--allinsteadofindividualfilenameswillstageallchanges(new,modified,and deleted)files.

Example

```
gitstatus
On branch

masterNo

commitsyet
```

Changesto becommitted:

```
(use "git rm --cached ..." to
    unstage)newfile:README.md
    new
    file:bluestyle.cssnewfile:i
    ndex.html
```

Nowall3 filesareaddedtotheStaging Environment,andweareready todoourfirstcommit.

GitCommit

Sincewehavefinishedour work,we arereadymove fromstagetocommitfor

ourrepo.Addingcommitskeeptrackofourprogressand

changesaswework.Gitconsiderseach
commit change point or "save point". It is a point in the project you can go back to if you findabug, orwant to make achange.

Whenwecommit, weshould**always** includea**message**.

By adding clear messages to each commit, it is easy for yourself (and others) to see what haschangedand when.

Example

```
gitcommit-m"FirstreleaseofHelloWorld!"
[master (root-commit) 221ec6e] First release of Hello
 World!3 fileschanged, 26insertions(+)
 create mode 100644
 README.mdcreate mode 100644
 bluestyle.csscreatemode100644ind
 ex.html
```

Thecommitcommandperformsacommit,andthe-m "*message*"addsamessage.

TheStagingEnvironmenthasbeencommittedtoourrepo,withthemessage:"Firstrele
aseof Hello World!"

Git Commitwithout Stage

Sometimes,whenyoumakesmall changes,usingthestagingenvironmentseemslikeawasteof time. It is possible to commit changes directly, skipping the staging environment. The -aoptionwill automaticallystageeverychanged, already tracked file.

Let's add a small update to

index.html:Example

```
<!DOCTYPEhtml>
<html>
<head>
<title>HelloWorld!</title>
```

```
<linkrel="stylesheet"href="bluestyle.css">
</head>
<body>
```

```
<h1>Helloworld!</h1>
<p>Thisis thefirstfileinmy newGitRepo.</p>
<p>Anewlineinourfile!</p>

</body>
</html>
```

And check the status of our repository. But this time, we will use the --short option to see thechangesin a morecompact way:

Example

```
git status --
 shortMindex.ht
 ml
```

Git Help

Ifyouarehavingtrouble remembering commands oroptions forcommands, youcan useGit help.

Thereareacoupleofdifferent waysyoucan usethehelpcommandin commandline:

- git*command*-help-Seeall theavailableoptionsforthespecificcommand
- githelp--all-Seeall possiblecommands

Let'sgo overthe different commands.

Git-helpSeeOptionsfor aSpecific Command

Anytimeyouneed some help rememberingthe specificoptionforacommand, youcan use git *command*-help:

Example

```
gitcommit-help
usage:gitcommit[][--] ...

   -q,--quiet          suppresssummaryaftersuccessfulcommit
   -v,--verbose        showdiffin commitmessagetemplate

Commitmessageoptions
   -F,--file       readmessagefromfile
   --author      overrideauthorforcommit
   --date        overridedateforcommit
   -m,--message
                     commitmessage
   -c,--reedit-message
                     reuseandeditmessagefromspecifiedcommit
   -C,--reuse-message
                     reusemessagefromspecifiedcommit
   --fixup       useautosquashformattedmessageto fixupspecified commit
```

```
   --squash      useautosquashformattedmessagetosquashspecifiedcommit
   --reset-author        thecommitisauthoredbymenow(usedwith-C/-c/--amend)
   -s,--signoff          addaSigned-off-by trailer
   -t,--template
                         usespecifiedtemplatefile
   -e,--edit             forceeditofcommit
   --cleanup       howtostripspacesand#commentsfrommessage
   --status              includestatusincommitmessagetemplate
   -S,--gpg-sign[=]
                         GPGsigncommit

Commitcontentsoptions
   -a,--all              commitallchangedfiles
   -i,--include          addspecifiedfilestoindexforcommit
   --interactive         interactivelyaddfiles
   -p,--patch            interactivelyaddchanges
   -o,--only             commitonlyspecifiedfiles
   -n,--no-verify        bypasspre-commitandcommit-msghooks
   --dry-run             showwhatwould becommitted
   --short               showstatusconcisely
   --branch              showbranchinformation
   --ahead-behind        computefullahead/behindvalues
   --porcelain           machine-readableoutput
   --long                showstatusinlongformat(default)
   -z, --null            terminateentrieswithNUL
   --amend               amendpreviouscommit
   --no-post-rewrite     bypasspost-rewrite hook
   -u,--untracked-files[=]
                         showuntrackedfiles,optionalmodes:all,normal,no.(Default:all)
   --pathspec-from-file
                         readpathspecfrom file
   --pathspec-file-nulwith--pathspec-from-file,pathspecelementsareseparatedwithNULcharacter
```

Note: You canalsouse--helpinsteadof-helptoopentherelevantGitmanualpage

---

Githelp--allSee AllPossibleCommands

Tolistallpossiblecommands, usethehelp--allcommand:

Warning: This will display a very long list of

commandsExample

```
$githelp --all
See'githelp'toread aboutaspecificsubcommand

MainPorcelainCommands
  add               Addfilecontentsto theindex
  am                Apply a series of patches from a
  mailboxarchive
                    Createanarchiveoffilesfromanamedtree
  bisect
                    Usebinarysearchtofindthecommitthatintroducedabugbranc
  h                  List,create,or delete branches
  bundle             Moveobjectsand refsbyarchive
```

checkout	Switchbranchesorrestoreworkingtreefiles

cherry-pick
Applythechangesintroducedbysomeexistingcommitscitool
Graphicalalternative togit-commit
clean
Removeuntrackedfilesfromtheworkingtreeclo
ne Clone a repository into a new
directorycommit Record changestotherepository
describe Giveanobjectahumanreadablenamebased on an availablerefdiff
Show changes between commits, commit and working tree,
etcfetch Downloadobjectsand refsfromanother repository
format-patch Prepare patches for e-mail
submissiongcCleanupunnecessaryfilesandoptimizethelocalrep
ositorygitk TheGitrepositorybrowser
grep Printlinesmatching apattern
gui Aportablegraphicalinterfaceto Git
init CreateanemptyGitrepositoryorreinitializeanexistingonelog
Showcommitlogs
maintenance Run tasks to optimize Git repository
datamerge Jointwoormoredevelopmenthistoriestogethermv
Move or rename a file, a directory, or a
symlinknotes Add orinspect object notes
pull Fetchfromandintegratewithanotherrepositoryoralocalbranchpush
Updateremote refsalongwithassociated objects
range-diff Compare two commit ranges (e.g. two versions of a
branch)rebase Reapplycommitsontopof anotherbase tip
reset
ResetcurrentHEADtothespecifiedstaterest
ore Restoreworkingtreefiles
revert Revertsomeexistingcommits
rm
Removefilesfromtheworkingtreeandfromtheindexshortl
og Summarize'gitlog'output
show Showvarioustypesofobjects
sparse-checkout Initializeandmodifythesparse-checkout
stash
Stashthechangesinadirtyworkingdirectoryawaystatu
s Showthe workingtreestatus
submodule Initialize, update or inspect
submodulesswitch Switch branches
tag Create, list, delete or verify a tag object signed with
GPGworktree Managemultiple workingtrees

AncillaryCommands/Manipulators
config
Getandsetrepositoryorglobaloptionsfast
-export Gitdata exporter
fast-import Backend for fast Git data
importersfilter-branch Rewritebranches
mergetool Run merge conflict resolution tools to resolve merge
conflictspack-refs Packheadsandtagsfor efficientrepositoryaccess
prune
Pruneallunreachableobjectsfromtheobjectdatabasereflog
Managerefloginformation
remote Manage set of tracked
repositoriesrepack Pack unpacked objects in a
repositoryreplace
Create,list,deleterefstoreplaceobjects

AncillaryCommands/Interrogators
annotate Annotatefilelineswithcommitinformation
blame

Showwhatrevisionandauthorlastmodifiedeachlineofafilebugrep
ort Collectinformationforusertofile abugreport
count-objects Countunpackednumberofobjectsandtheir
diskconsumptiondifftool Showchangesusingcommondifftools
fsck Verifies the connectivity and validity of the objects in the
databasegitweb Gitweb interface (web frontendto Gitrepositories)
help Displayhelpinformation aboutGit
instaweb Instantlybrowseyourworkingrepositoryin gitweb

merge-tree Show three-way merge without touching
indexrerere Reuserecordedresolutionofconflictedmerges
show-branch Show branches and their
commitsverify-commit
CheckGPGsignatureofcommitsverif
y-tag Check GPGsignature of tags
whatchanged Showlogswithdifferenceeach commitintroduces

Interactingwith Others
archimport Import a GNU Arch repository into
Gitcvsexportcommit ExportasinglecommittoCVScheckout
cvsimport Salvageyourdataoutofanother
SCMpeoplelovetohatecvsserver ACVSserveremulatorfor Git
imap-send Sendacollection ofpatchesfromstdin toan IMAPfolderp4
Importfrom and submitto Perforcerepositories
quiltimport Appliesaquiltpatchsetonto
thecurrentbranchrequest-pull Generates a summary
of pending changessend-email Send
acollectionofpatchesasemails
svn BidirectionaloperationbetweenaSubversionrepositoryandGit

Low-levelCommands/Manipulators
apply Apply a patch to files and/or to the
indexcheckout-index Copyfilesfrom
theindextotheworkingtreecommit-graph
Write and verify Git commit-graph filescommit-
tree Createa new commitobject
hash-object Compute object ID and optionally creates a blob from a
fileindex-pack Buildpack indexfile foran existingpacked archive
merge-file Runathree-way file merge
merge-index
Runamergeforfilesneedingmergingmktag
Createsa tagobject
mktree Build a tree-object from ls-tree formatted
textmulti-pack-index Write and verify multi-pack-
indexespack-objects Createapackedarchiveofobjects
prune-packed Remove extra objects that are already in pack
filesread-tree Readstreeinformationinto the index
symbolic-ref Read, modify and delete symbolic
refsunpack-objects Unpackobjectsfromapackedarchive
update-index
Registerfilecontentsintheworkingtreetotheindexupdate
-ref Updatetheobjectname stored in a refsafely
write-tree Createatreeobjectfromthecurrentindex

Low-levelCommands/Interrogators
cat-file Providecontentortypeandsizeinformationforrepository
objectscherry Find commitsyettobe applied toupstream
diff-files Compares files in the working tree and the
indexdiff-index Compareatreetotheworking treeorindex
diff-tree Comparesthecontentand modeofblobsfoundviatwotreeobjectsfor-
each-ref Outputinformationoneachref
for-each-repo RunaGitcommandonalistofrepositories
get-tar-commit-idExtract commit ID from an archive created using git-archivels-
files Showinformation aboutfilesin theindexand theworkingtree
ls-remote List references in a remote
repositoryls-tree Listthe contentsof atree object
merge-base Findasgood
commonancestorsaspossibleforamergename-rev Find symbolic
namesforgivenrevs
pack-redundant Findredundantpack files

rev-list	Lists commit objects in reverse chronological
orderrev-parse	Pickoutandmassage parameters
show-index	Showpackedarchiveindex
show-ref	Listreferencesinalocalrepository
unpack-file	Createsatemporary filewith ablob'scontents

```
  var               ShowaGitlogical variable
  verify-pack       ValidatepackedGitarchivefiles

Low-levelCommands/SyncingRepositories
  daemon            Areallysimpleserver forGitrepositories
  fetch-pack        Receive missing objects from another
  repositoryhttp-backend                Server side implementation
  of Git over HTTPsend-pack   Push objects over Git protocol to
  another repositoryupdate-server-infoUpdateauxiliary info filetohelp
  dumb servers

Low-levelCommands/InternalHelpers
  check-attr        Display gitattributes
  informationcheck-ignore
                    Debuggitignore/excludefiles
  check-mailmap
                      Showcanonicalnamesandemailaddressesofcontactschec
  k-ref-format        Ensuresthat areferencename iswell formed
  column            Displaydataincolumnscredential
                    Retrieveandstoreusercredentials
  credential-cache
                     Helpertotemporarilystorepasswordsinmemorycred
  ential-store      Helper tostore credentialsondisk
fmt-merge-msg       Produceamergecommitmessage
  interpret-trailersAdd or parse structured information in commit
messagesmailinfo      Extracts patch and authorship from a single e-mail
messagemailsplit      SimpleUNIXmboxsplitterprogram
  merge-one-fileThe standard helper program to use with git-merge-
  indexpatch-id   Computeunique ID for a patch
  sh-i18n           Git'si18nsetup codeforshellscriptssh-
setup               Common Git shell script setup
codestripspace   Removeunnecessary whitespace

External
commandsaskyesno
  credential-helper-
  selectorflow
lfs
```

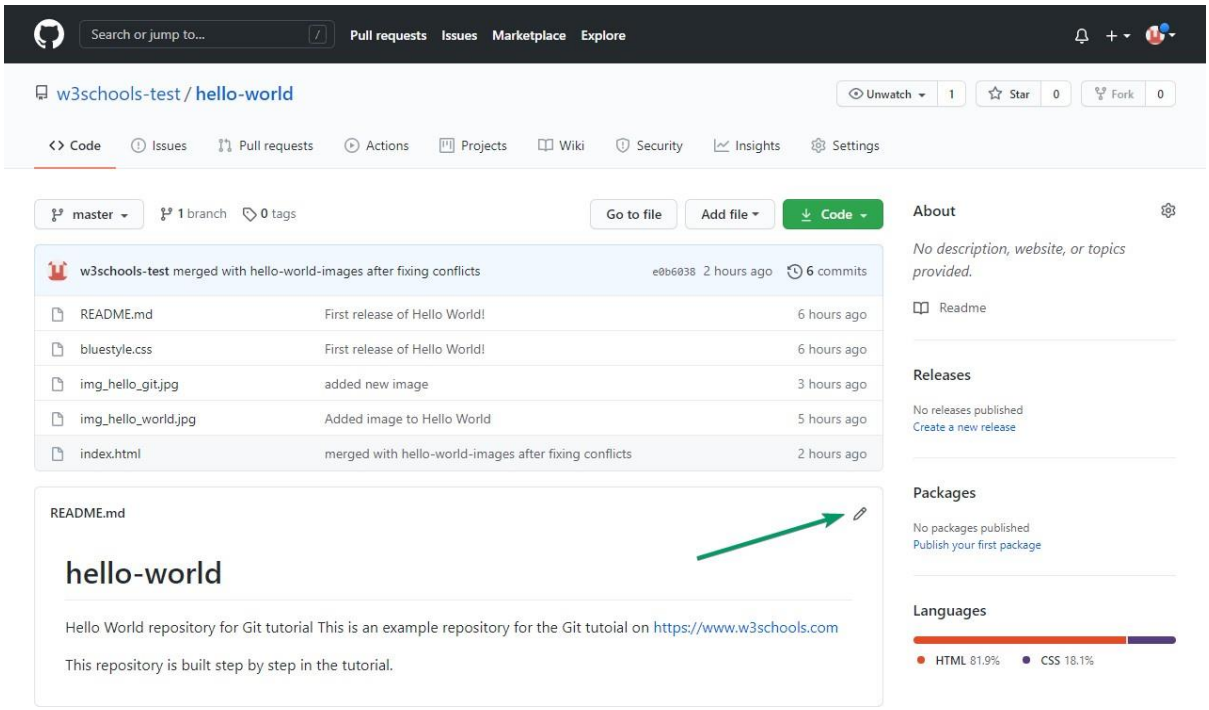
Note: Ifyoufind yourselfstuck inthe listview, SHIFT +Gtojump theend ofthelist, then q toexit theview.

GitGitHub Getting Started

EditCodeinGitHub

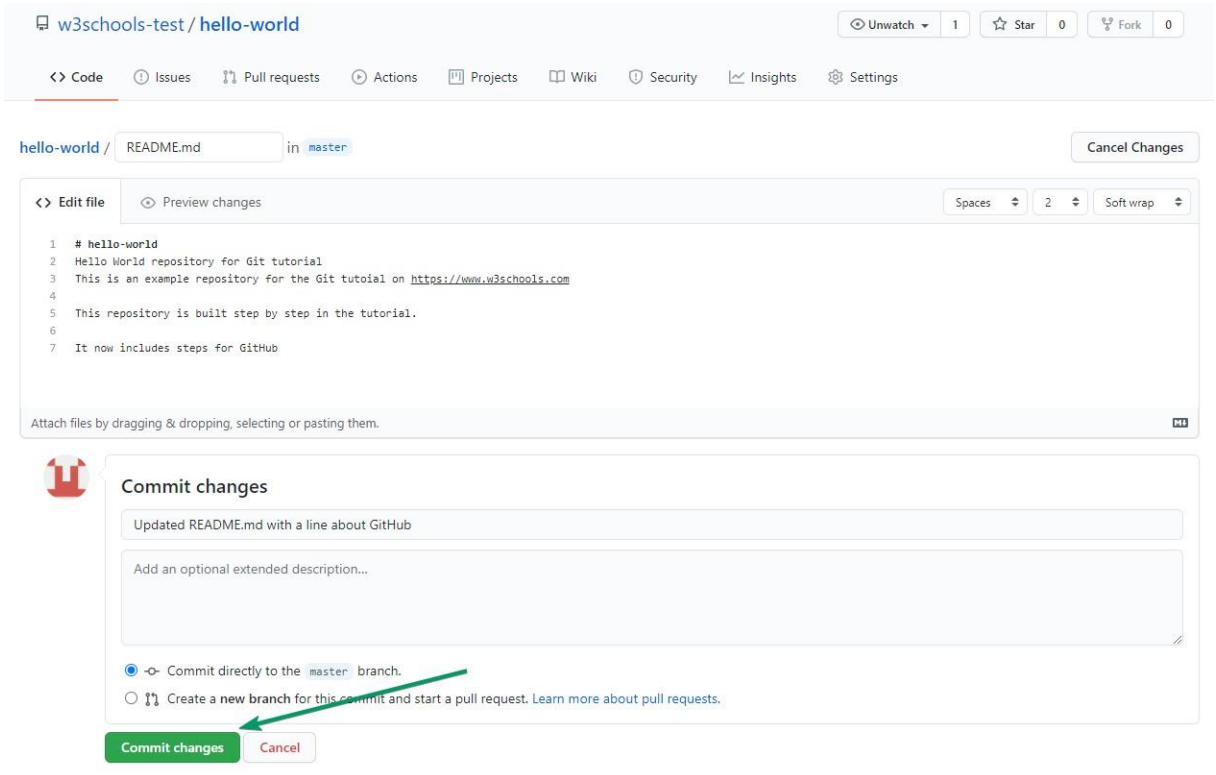
In addition to being a host for Git content, GitHub has a very good code

editor.Let'stry toedit theREADME.mdfilein GitHub.Just clicktheedit button:



Add some changes to the code, and then commit the changes. For now, we will "Commitdirectlyto themaster branch".

Remembertoadd adescriptionforthe commit:



Thatishowyouedit codedirectlyinGitHub!

PullingtoKeep up-to-date with Changes

Whenworkingasateamonaproject,itisimportantthateveryonestaysupto date.

Anytimeyou startworkingon aproject,you shouldgetthe mostrecentchanges toyourlocalcopy.

WithGit, you cando thatwithpull.

pullisacombinationof2differentcommands:

- fetch
- merge

Let'stakea closerlookinto how fetch, merge,and pullworks.

Git Fetch

fetchgetsallthechangehistory ofatracked branch/repo.

So,onyourlocal Git,fetchupdates toseewhat has changedon GitHub:

Example

```
gitfetch origin
remote: Enumerating objects: 5,
done.remote:Countingobjects:100%(5/5),do
ne.
remote:Compressing objects:100%(3/3),done.
remote: Total 3 (delta 2), reused 0 (delta 0), pack-reused
0Unpackingobjects:100%(3/3),733bytes|3.00KiB/s,done.
From https://github.com/w3schools-test/hello-
  worlde0b6038..d29d69fmaster          -
  >origin/master
```

Nowthatwehavetherecentchanges,wecancheckourstatus:

Example

```
gitstatus
Onbranchmaster
Your branch is behind 'origin/master' by 1 commit, and can be fast-
  forwarded.(use"gitpull"toupdate yourlocalbranch)

nothingtocommit,workingtreeclean
```

We are behind the origin/master by 1 commit. That should be the updated README.md, but letsdoublecheck by viewingthe log:

Example

```
gitlogorigin/master
commitd29d69ffe2ee9e6df6fa0d313bb0592b50f3b853(origin/master)
```

```
Author: w3schools-test <77673807+w3schools-
test@users.noreply.github.com>Date:FriMar 2614:59:142021+0100

    UpdatedREADME.mdwithalineaboutGitHub

commit e0b6038b1345e50aca8885d8fd322fc0e5765c3b (HEAD ->
master)Merge:dfa79db1f1584e
Author:w3schools-test
Date:FriMar2612:42:56 2021+0100

    mergedwithhello-world-imagesafterfixingconflicts

...
...
```

Thatlooksasexpected, butwecanalsoverifyby showingthedifferencesbetween ourlocal masterandorigin/master:

Example

```
gitdifforigin/master
diff --git a/README.md
b/README.mdindex 23a0122..a980c39
100644
---a/README.md
+++b/README.md
@@-2,6+2,4 @@
 HelloWorldrepositoryforGittutorial
 Thisisan examplerepositoryfortheGittutoialonhttps://www.w3schools.com

-Thisrepositoryisbuiltstepbystepinthetutorial.
-
-ItnowincludesstepsforGitHub
+Thisrepositoryisbuiltstep bystep inthetutorial.
\Nonewlineat endoffile
```

Thatlookspreciselyasexpected!Nowwecansafelymerge.

GitMerge

mergecombinesthecurrentbranch,withaspecifiedbranch.

Wehaveconfirmed thattheupdates areasexpected, andwecan mergeour current branch(master)with origin/master:

Example

```
git merge
origin/masterUpdating
e0b6038..d29d69fFast-
forward
 README.md|4+++-
 1 filechanged,3 insertions(+),1 deletion(-)
```

Checkourstatusagaintoconfirm we areuptodate:

Example

```
gitstatus
Onbranchmaster
Yourbranchisuptodatewith'origin/master'.not

hingto commit,workingtreeclean
```

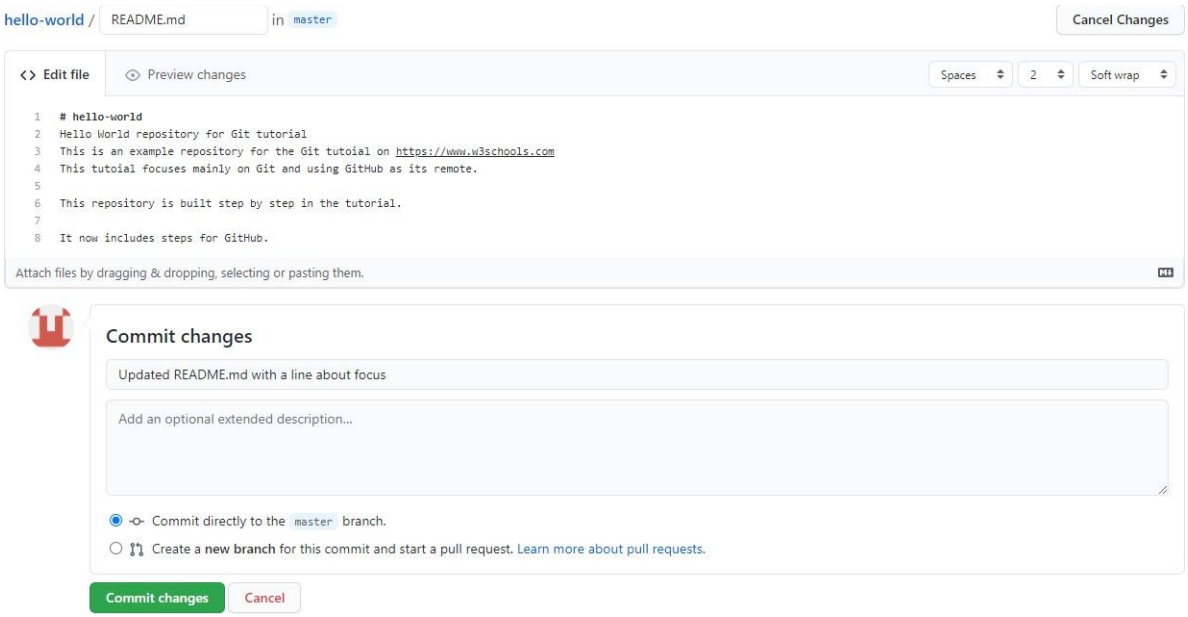
There! Yourlocal gitisup todate!

GitPull

But what if you just want to update your local repository, without going through all thosesteps?

pullisacombinationoffetchandmerge. Itisusedtopullallchangesfrom aremoterepositoryintothe branch you areworking on.

Makeanother changeto theReadme.mdfileon GitHub.



Usepullto updateour local Git:

Example

```
gitpullorigin
remote: Enumerating objects: 5,
done.remote:Countingobjects:100%(5/5),do
ne.
remote:Compressingobjects:100%(3/3),done.
remote: Total 3 (delta 1), reused 0 (delta 0), pack-reused
0Unpackingobjects:100%(3/3),794 bytes|1024 bytes/s,done.
From https://github.com/w3schools-test/hello-
  worlda7cdd4b..ab6b4edmaster          -
  >origin/master
Updating
a7cdd4b..ab6b4edFast-
```

forward

```
README.md|2 ++
1filechanged,2insertions(+)
```

That is how you keep your local Git up to date from a remote repository. In the next chapter,wewill look closer at how pushworks on GitHub.

Git Push toGitHub

PushChanges toGitHub

Let's try making some changes to our local git and pushing them to

GitHub.Example

```
<!DOCTYPEhtml>
<html>
<head>
<title>HelloWorld!</title>
<linkrel="stylesheet"href="bluestyle.css">
</head>
<body>

<h1>Helloworld!</h1>
<div><imgsrc="img_hello_world.jpg" alt="Hello World from Space" style="width:100%;max-
width:640px"></div>
<p>Thisisthefirstfileinmy newGit Repo.</p>
<p>Thislineisheretoshowhowmergingworks.</p>
<div><imgsrc="img_hello_git.jpg"alt="HelloGit"style="width:100%;max-width:640px"></div>

</body>
</html>
```

Committhechanges:

Example

```
git commit -a -m "Updated index.html. Resized
image"[mastere7de78f]Updatedindex.html.Resizedima
ge
 1 filechanged,1 insertion(+),1 deletion(-)
```

Andcheck thestatus:

Example

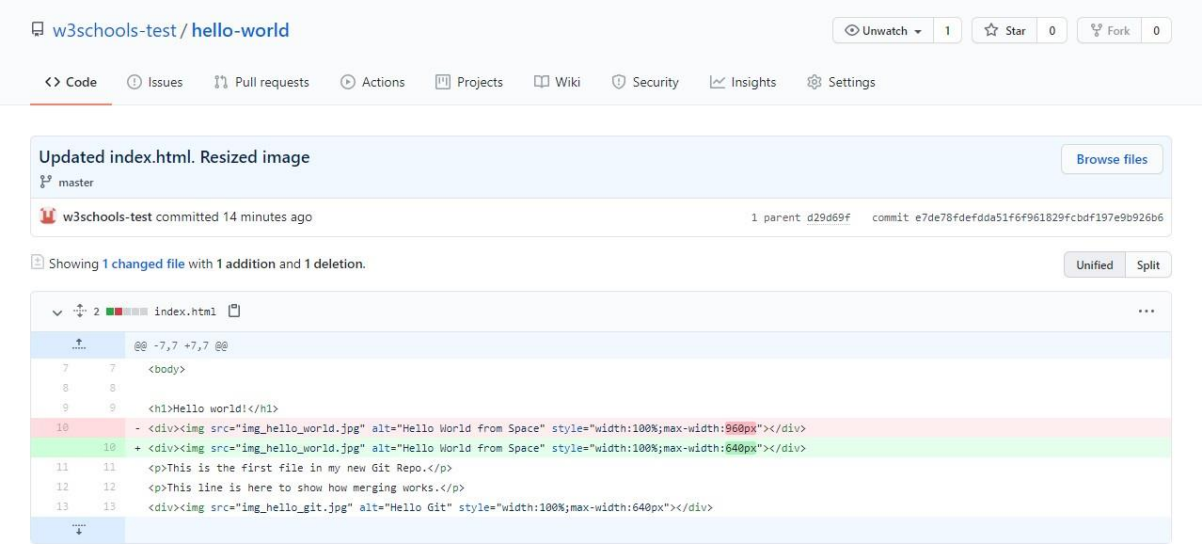
```
gitstatus
Onbranchmaster
Your branch is ahead of 'origin/master' by 1
  commit.(use"gitpush"to publish yourlocalcommits)

nothingtocommit,workingtreeclean
```

Nowpushour changestoour remoteorigin:

Example

```
gitpush origin
Enumerating objects: 9,
done.Countingobjects:100%(8/8),don
e.
Delta compression using up to 16
threadsCompressingobjects:100%(5/5),d
one.
Writingobjects:100%(5/5),578 bytes|578.00KiB/s,done.
Total5 (delta3),reused 0(delta0),pack-reused0
remote:Resolvingdeltas:100%(3/3),completedwith3localobjects.Tohtt
ps://github.com/w3schools-test/hello-
world.git5a04b6f..facaeaemaster-> master
```

GotoGitHub,and confirmthattherepository hasanewcommit:



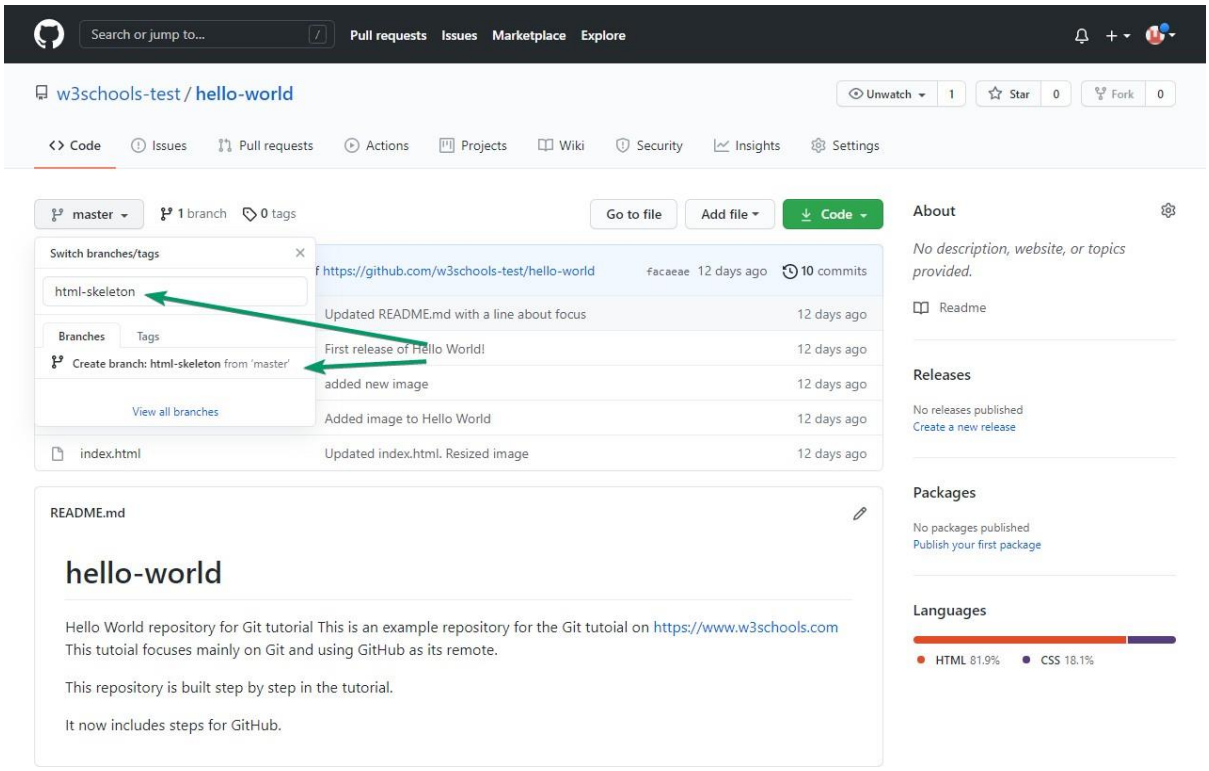
Now,wearegoing to start working on branches on GitHub.

GitGitHubBranch

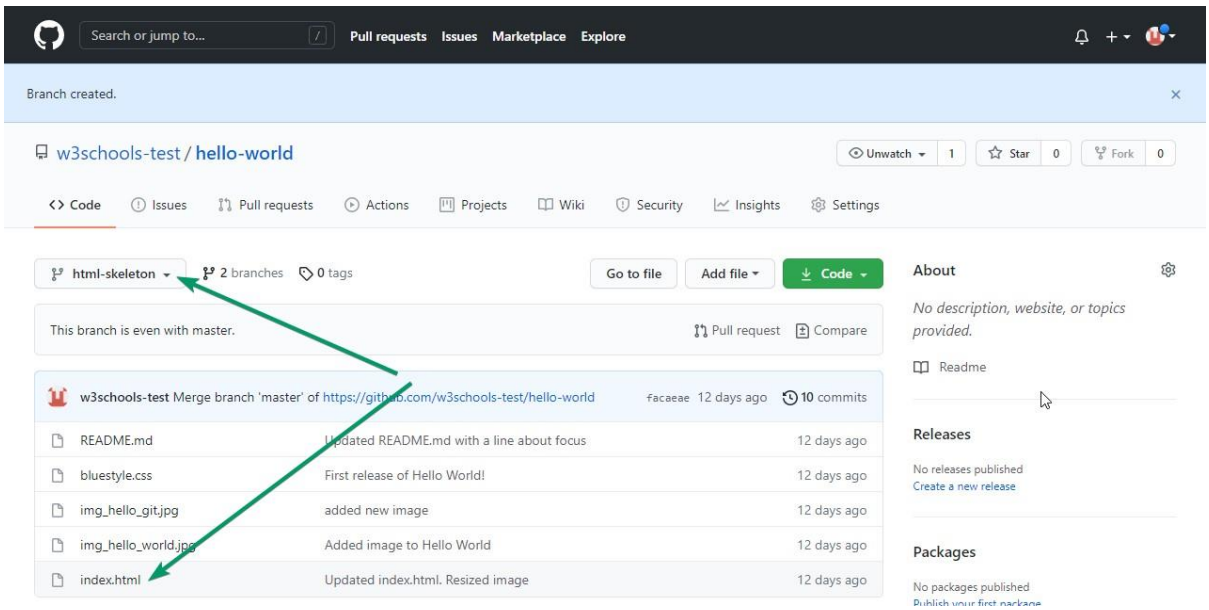
Create aNewBranch onGitHub

OnGitHub,accessyour repositoryandclickthe "master"branchbutton.

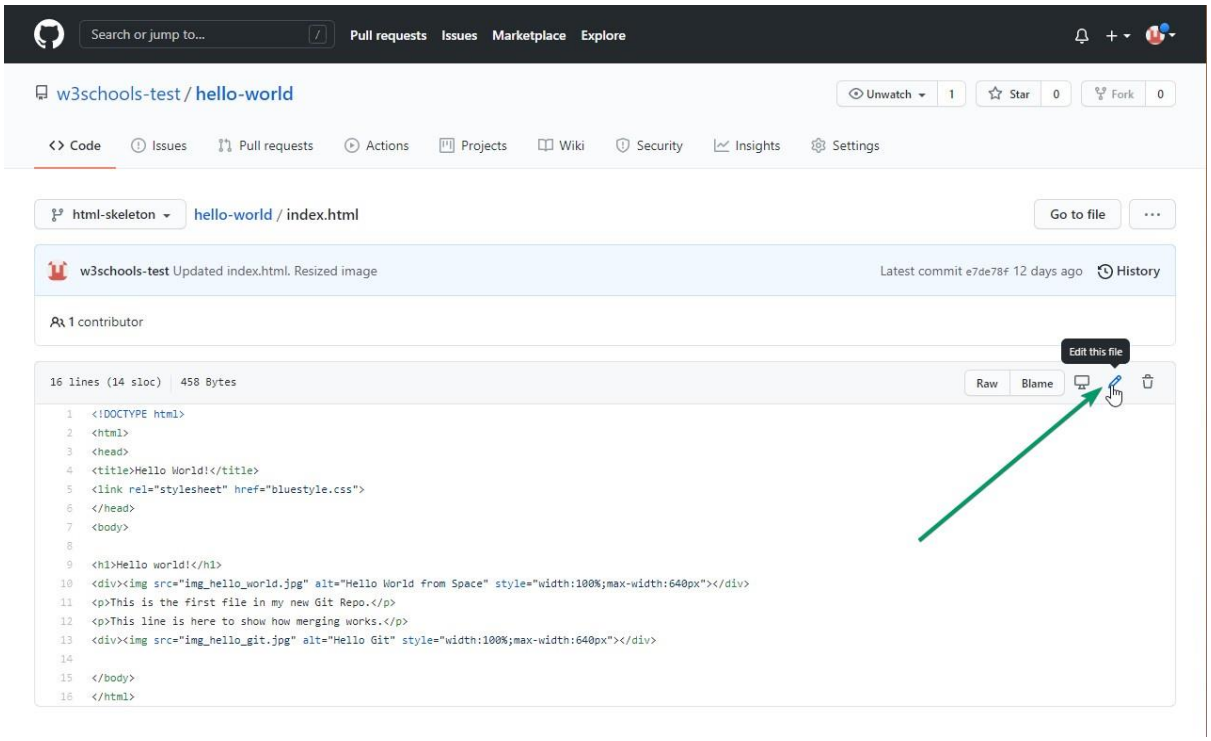
ThereyoucancreateanewBranch.Typeinadescriptivename,andclickCreatebranch:



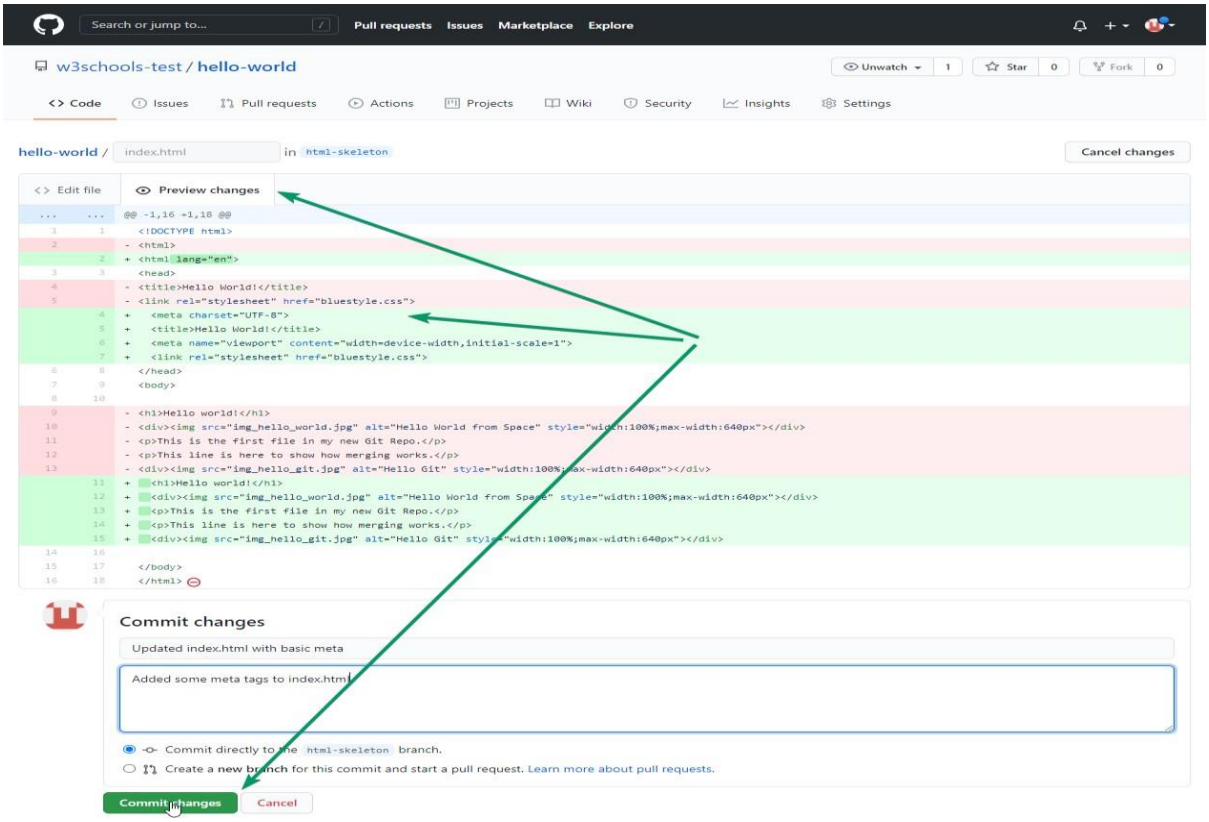
The branch should now be created and active. You can confirm which branch you are workingonby lookingat thebranch button.Seethatit nowsays "html-skeleton"instead of"main"?



Startworkingonanexisting fileinthisbranch.Click the"index.html"fileand startediting:



After you have finished editing the file, you can click the "Preview changes" tab to see thechangesyou madehighlighted:



If you are happy with the change, add a comment that explains what you did, and clickCommitchanges.

GitPullBranchfromGitHub

Pullinga Branchfrom GitHub

Nowcontinueworkingon ournewbranchinour local Git.

LetspullfromourGitHub repository againsothatour codeisup-to-date:

Example

```
gitpull
remote: Enumerating objects: 5,
done.remote:Countingobjects:100%(5/5),do
ne.
remote:Compressingobjects:100%(3/3),done.
remote: Total 3 (delta 2), reused 0 (delta 0), pack-reused
0Unpackingobjects:100%(3/3),851bytes|9.00KiB/s,done.Fro
m https://github.com/w3schools-test/hello-world
 *[newbranch]      html-skeleton -> origin/html-
skeletonAlready uptodate.
```

Nowourmainbranchisuptodate. Andwe can see thatthereisanew branchavailableonGitHub.

Doaquickstatuscheck:

Example

```
gitstatus
Onbranchmaster
Your branch is up to date with

'origin/master'.nothingto

commit,workingtreeclean
```

Andconfirm whichbranches wehave, andwhereweareworking atthe moment:

Example

```
git branch
*master
```

So,wedo not havethenew branchon ourlocal Git.But weknow it is availableon GitHub. Sowecan usethe-aoption toseeall local andremotebranches:

Example

```
gitbranch -a
*master
  remotes/origin/html-
  skeletonremotes/origin/mast
  er
```

Note:branch -risforremotebranchesonly.

We see that the branch html-skeleton is available remotely, but not on our local git. Lets checkit out:

Example

```
gitcheckouthtml-skeleton
Switchedto anewbranch 'html-skeleton'
Branch'html-skeleton'setuptotrackremotebranch'html-skeleton'from'origin'.
```

Andcheck if it isall up to date:

Example

```
gitpull
Already uptodate.
```

Whichbranches dowehavenow,andwhereareweworking from?

Example

```
git branch
* html-
  skeletonmaster
```

Now, open your favourite editor and confirm that the changes from the GitHub branchcarriedover.

Thatis how youpull aGitHub branchto your local Git.

GitPush Branch toGitHub

Pusha BranchtoGitHub

Let's try to create a new local branch, and push that to

GitHub.Startby creating abranch, likewedid earlier:

Example

```
gitcheckout-bupdate-readme
Switchedtoanewbranch'update-readme'
```

AndwemakesomechangestotheREADME.mdfile.Justaddanewline.Sonow

wecheck the statusof thecurrent branch.

Example

```
gitstatus
On branch update-
readmeChangesnotstagedforcom
mit:
  (use"gitadd..."toupdatewhatwillbecommitted)
  (use"gitrestore..."todiscardchangesinworkingdirectory)modifi
       ed:README.md

nochangesadded tocommit(use"gitadd"and/or"gitcommit-a")
```

WeseethatREADME.mdismodified butnotaddedtotheStagingEnvironment:

Example

```
gitaddREADME.md
```

Checkthestatusof thebranch:

Example

```
gitstatus
On branch update-
readmeChangestobecomm
itted:
  (use "git restore --staged ..." to
       unstage)modified:README.md
```

Wearehappy with ourchanges.So wewillcommitthemto thebranch:

Example

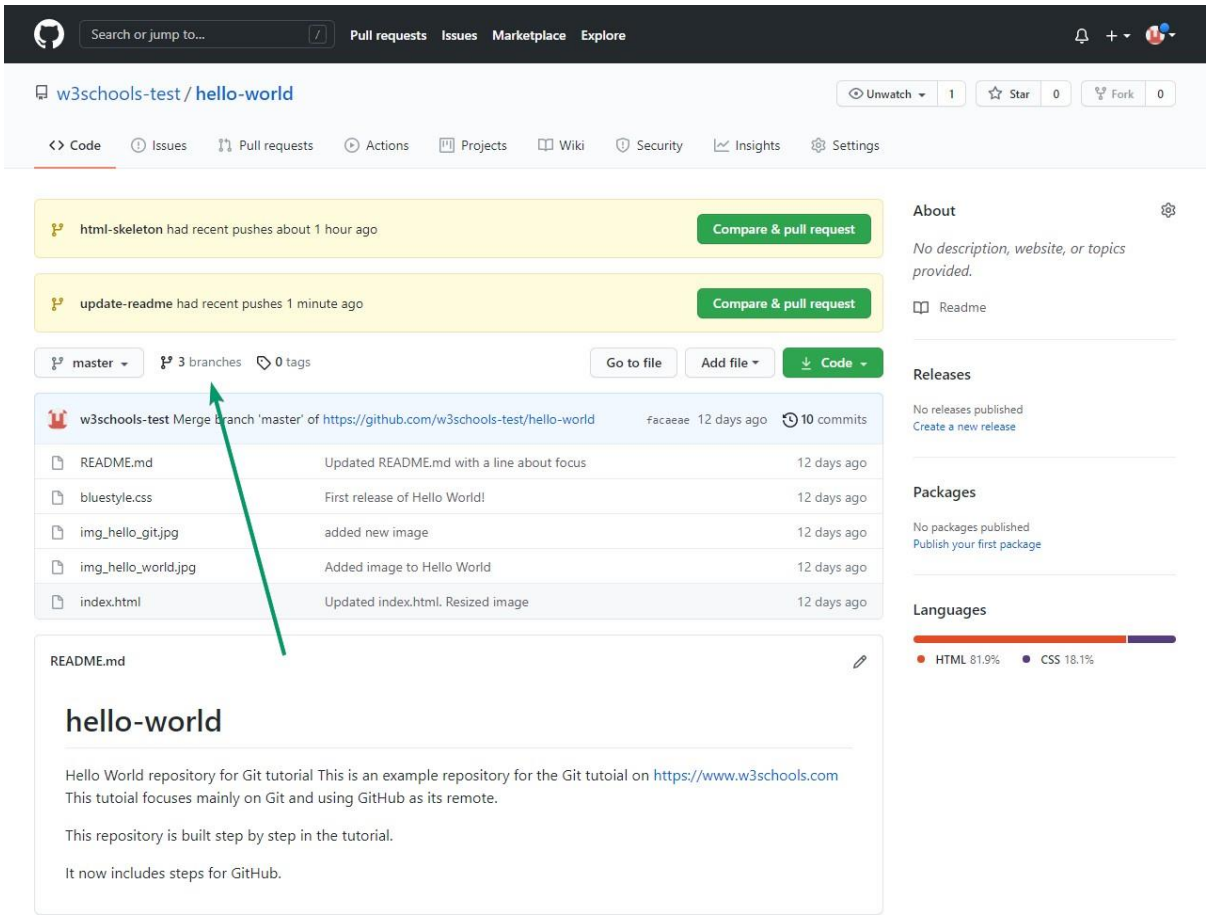
```
gitcommit-m"UpdatedreadmeforGitHubBranches"
[update-readme 836e5bf] Updated readme for GitHub
 Branches1 file changed,1insertion(+)
```

Nowpushthebranchfromourlocal Git repository,to GitHub,whereeveryonecanseethechanges:

Example

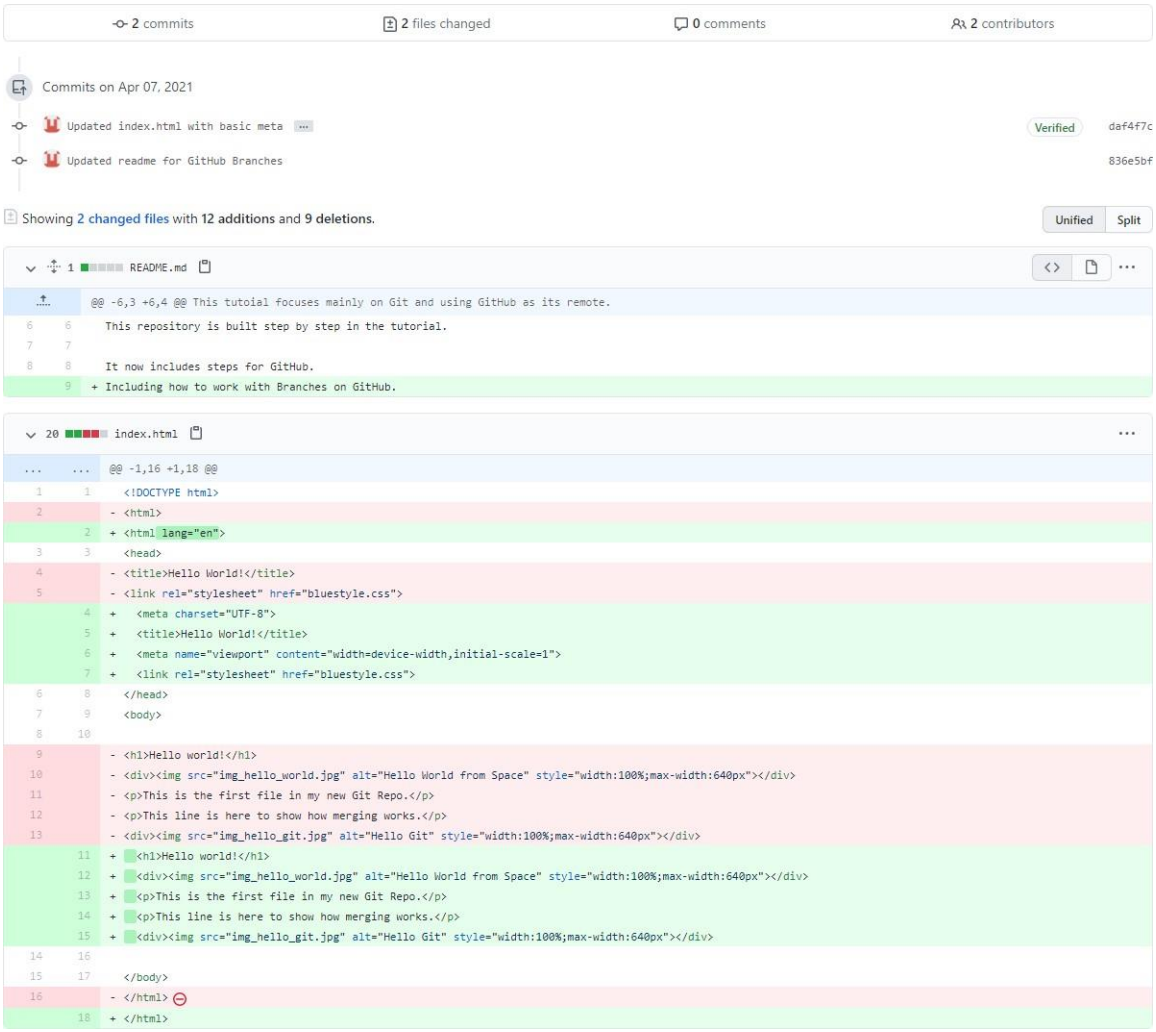
```
gitpush originupdate-
readmeEnumerating objects: 5,
done.Countingobjects:100%(5/5),don
e.
Delta compression using up to 16
threadsCompressingobjects:100%(3/3),d
one.
Writingobjects:100%(3/3),366 bytes|366.00KiB/s,done.
Total3 (delta2),reused 0(delta0),pack-reused0
remote:Resolvingdeltas:100%(2/2),completedwith2localobjects.remo
te:
remote:Createapullrequestfor'update-readme'on GitHubby visiting:
remote:      https://github.com/w3schools-test/hello-world/pull/new/update-
readmeremote:
Tohttps://github.com/w3schools-test/hello-world.git
 *[newbranch]        update-readme->update-readme
```

Goto GitHub,and confirmthat therepository hasanewbranch:



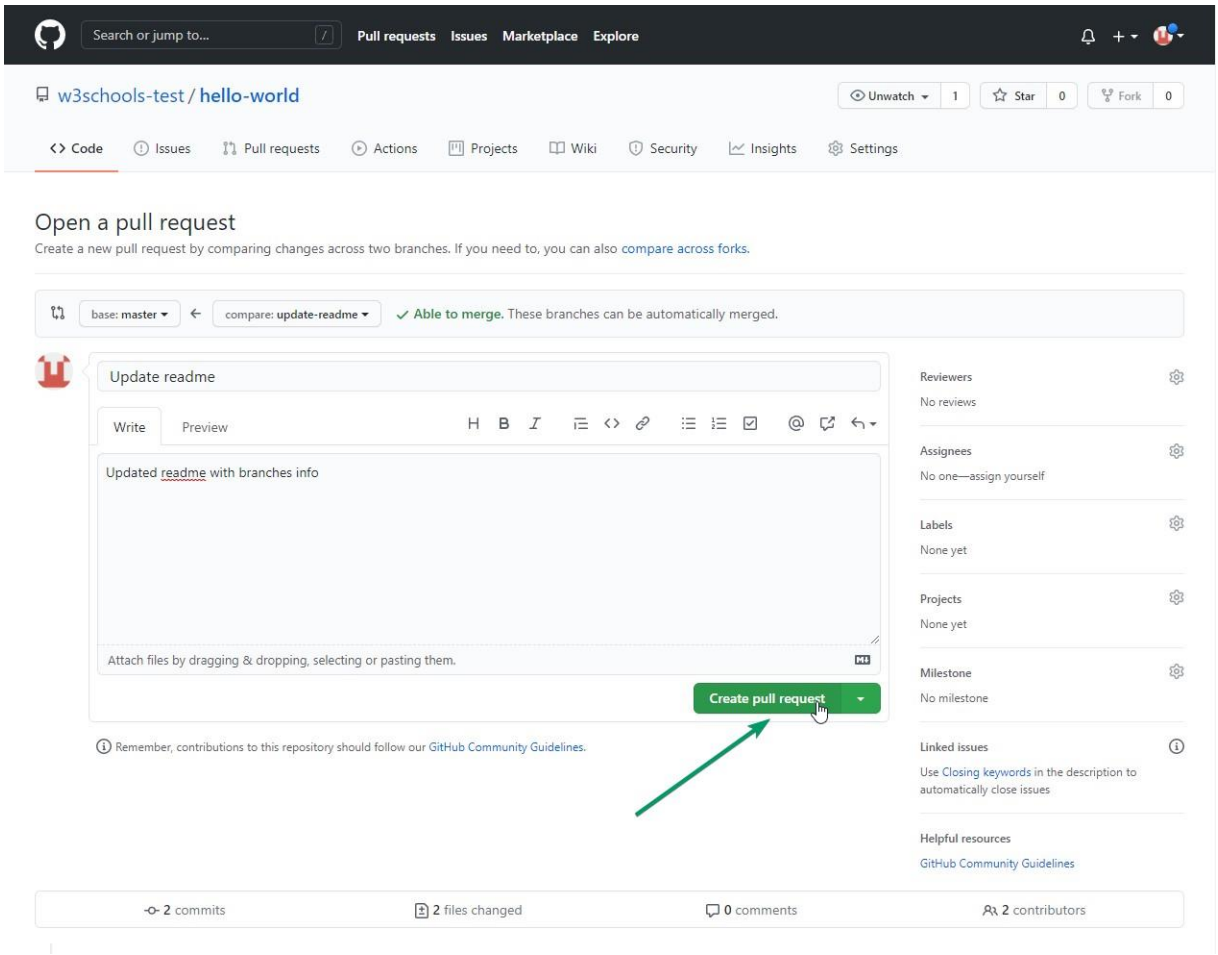
InGitHub,wecannow seethechangesandmergethemintothemasterbranchifweapproveit.

Ifyou clickthe"Compare&pull request",you cango throughthechangesmadeandnewfilesadded:



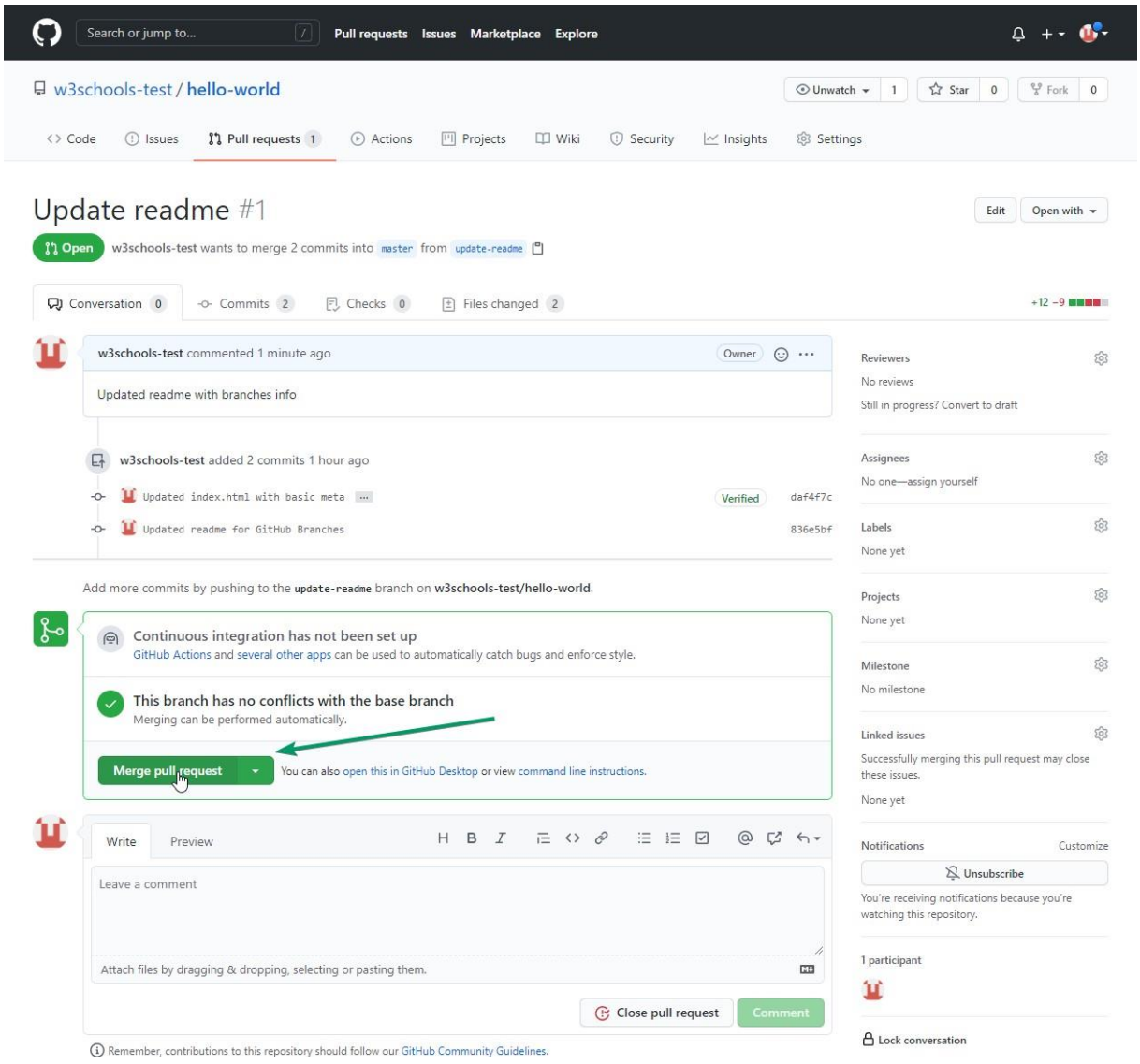
Note: This comparison shows both the changes from update-readme and html-skeleton because we created the new branch FROM html-skeleton.

If the changes look good, you can go forward, creating a pull request:



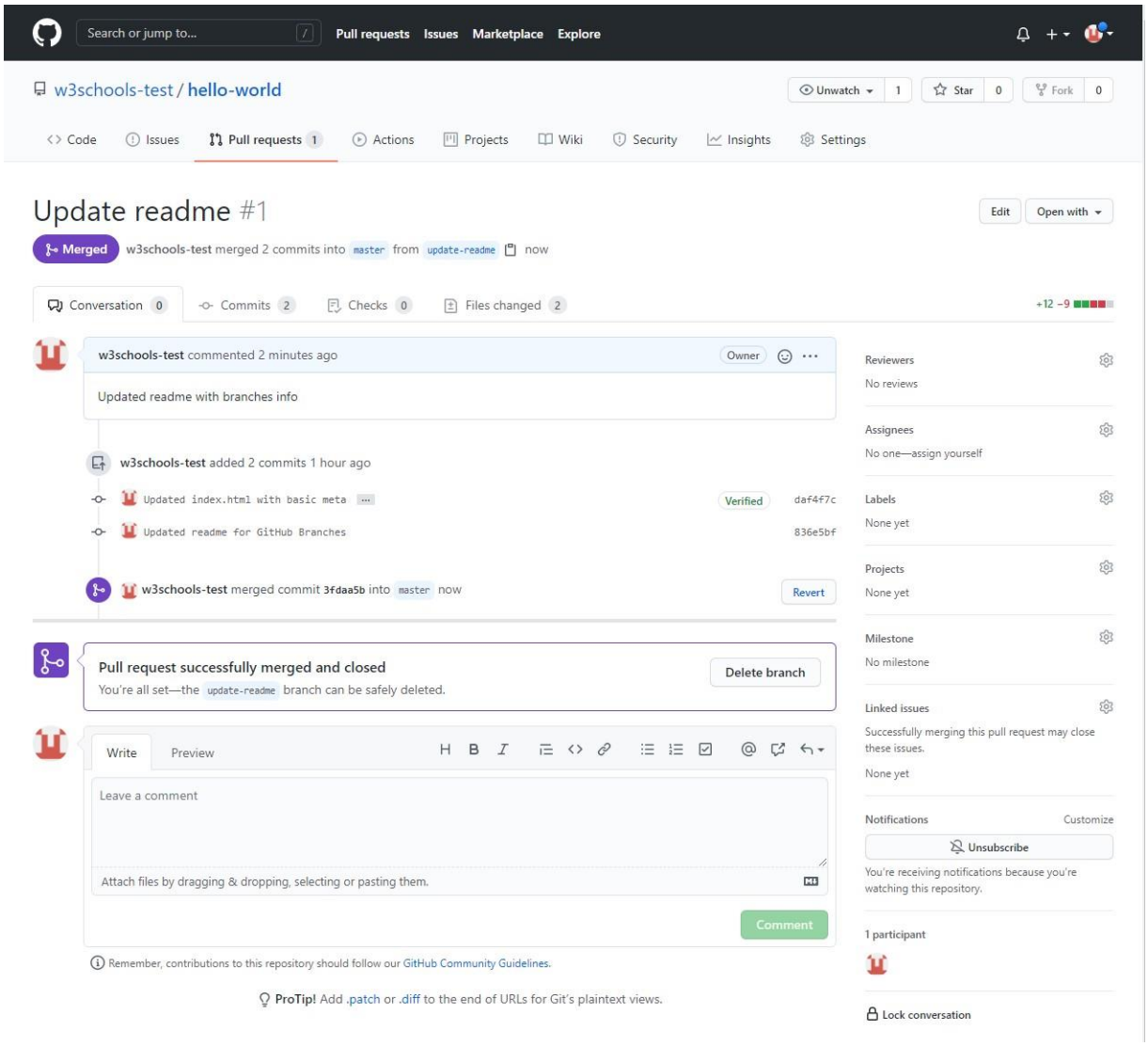
A pull request is how you propose changes. You can ask some to review your changes or pullyourcontribution and mergeit into theirbranch.

Sincethis isyourownrepository, youcanmergeyourpullrequest yourself:

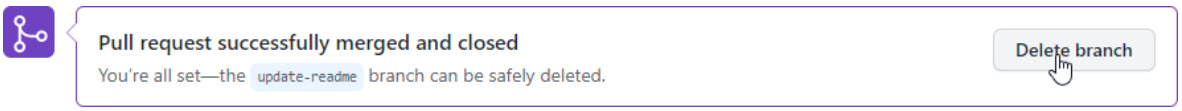


The pull request will record the changes, which means you can go through them later tofigureout thechanges made.

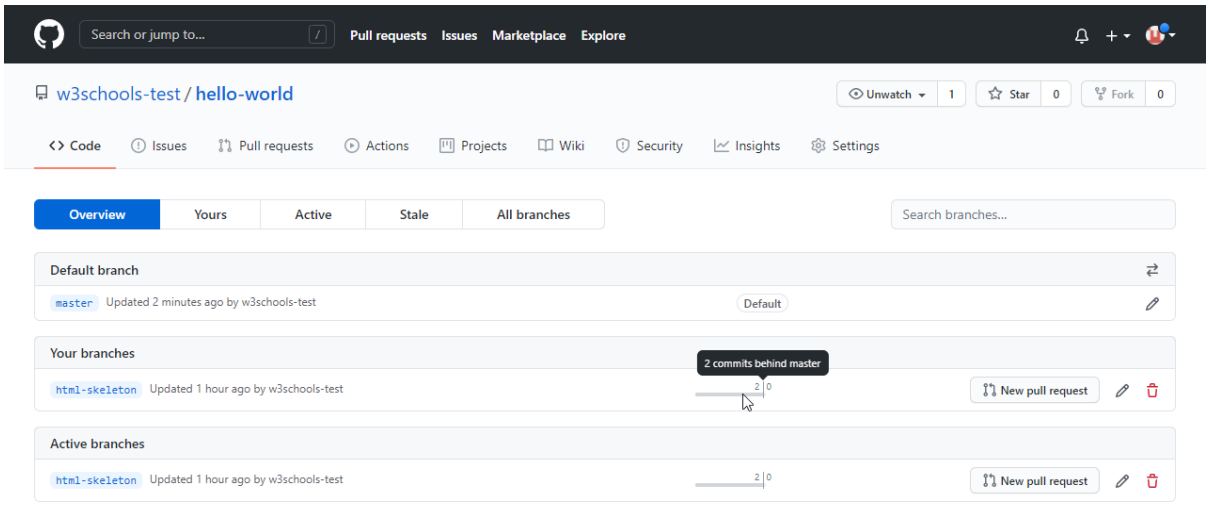
Theresult shouldbesomethinglikethis:



To keep the repo from getting overly complicated, you can delete the now unused branch byclicking"Deletebranch".



An after you confirm that the changes from the previous branch were included, delete that aswell:



CSSTutorial

CSS tutorial or CSS 3 tutorial provides basic and advanced concepts of CSS technology.Our CSS tutorial is developed for beginners and professionals. The major points of CSS aregivenbelow:

- CSSstandsforCascadingStyleSheet.
- CSSisused todesign HTMLtags.
- CSSis awidely usedlanguageonthe web.
- HTML, CSS and JavaScript are used for web designing. It helps the web designers toapplystyleon HTML tags.

CSSExample withCSS Editor

Inthistutorial,youwill getalotofCSS examples,youcanedit andruntheseexampleswithouronlineCSS editor tool.

```
1. <!DOCTYPE>
2. <html>
3. <head>
4. <style>
5.h1{
6. color:white;
7. background-color:red;
8. padding:5px;
9.}
10. p{
11. color:blue;
12.}
13. </style>
14. </head>
```

```
15. <body>
16. <h1>WriteYour FirstCSSExample</h1>
17. <p>ThisisParagraph.</p>
18. </body>
19. </html>
```

Testit Now

Output:

WriteYour First CSSExample

ThisisParagraph.

What is CSS

CSS stands for Cascading Style Sheets. It is a style sheet language which is used to describethe look and formatting of a document written in markup language. It provides an additionalfeature to HTML. It is generally used with HTML to change the style of web pages and userinterfaces. It can also be used with any kind of XML documents including plain XML, SVGandXUL.

CSS is used along with HTML and JavaScript in most websites to create user interfaces forwebapplications and user interfaces for many mobileapplications.

Whatdoes CSSdo

- Youcan add new looksto yourold HTML documents.
- You can completely change the look of your website with only a few changes in CSScode.

Whyuse CSS

Thesearethethreemajorbenefitsof CSS:

1) Solvesa bigproblem

Before CSS, tags like font, color, background style, element alignments, border and size hadto be repeated on every web page. This was a very long process. For example: If you aredeveloping a large website where fonts and color information are added on every single page,itwillbe becomea longandexpensiveprocess.CSSwascreatedtosolvethisproblem.ItwasaW3C recommendation.

2) Savesalotoftime

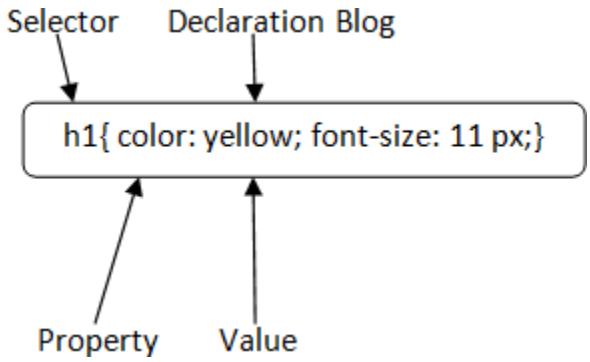
CSS style definitions are saved in external CSS files so it is possible to change the entirewebsiteby changing justonefile.

3) Providemoreattributes

CSS provides more detailed attributes than plain HTML to define the look and feel of thewebsite.

CSSSyntax

ACSSruleset containsaselectorandadeclarationblock.



Selector: SelectorindicatestheHTMLelementyouwant tostyle.Itcouldbeanytaglike <h1>,<title> etc.

Declaration Block: The declaration block can contain one or more declarations separated byasemicolon. For theaboveexample, therearetwo declarations:

1. color:yellow;
2. font-size: 11px;

Eachdeclarationcontainsapropertynameandvalue,separatedbyacolon.

Property: APropertyisatypeofattributeof HTMLelement.Itcouldbe color,borderetc.

Value: Values are assigned to CSS properties. In the above example, value "yellow" isassignedto colorproperty.

Selector{Property1:value1;Property2:value2;.....;}CSS Selector

CSS selectorsareused*to selectthecontentyouwantto style*.Selectors arethe partofCSS

ruleset.CSSselectorsselectHTMLelementsaccordingtoitsid,class,type,attributeetc.Therear

eseveral different types of selectors in CSS.

1. CSSElement Selector
2. CSSId Selector
3. CSSClassSelector
4. CSSUniversal Selector
5. CSSGroupSelector

1) CSSElementSelector

Theelementselector selectstheHTMLelement byname.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. p{
6.     text-align:center;
7.     color:blue;
8.}
9. </style>
10. </head>
11. <body>
12. <p>Thisstylewillbeappliedoneveryparagraph.</p>
13. <pid="para1">Metoo!</p>
14. <p>Andme!</p>
15. </body>
16. </html>
```

TestitNow

Output:

Thisstylewillbeappliedoneveryparagraph.

Me

too!And

me!

---

2) CSSIdSelector

The id selector selects the id attribute of an HTML element to select a specific element. An idisalways uniquewithin the pageso it ischosen toselecta single, unique element.

Itiswrittenwiththehashcharacter(#),followedbytheidofthe element.

Let?stake anexample withtheid"para1".

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. #para1{
6.     text-align:center;
7.     color:blue;
8.}
9. </style>
10. </head>
11. <body>
12. <pid="para1">HelloJavatpoint.com</p>
13. <p>Thisparagraphwill notbeaffected.</p>
14. </body>
15. </html>
```

TestitNow

Output:

HelloJavatpoint.com

Thisparagraphwillnotbeaffected.

---

3) CSSClassSelector

The class selector selects HTML elements with a specific class attribute. It is used with aperiodcharacter . (full stop symbol)followedby the class name.

Note: Aclassnameshouldnot bestartedwith anumber.

Let'stakeanexamplewith aclass"center".

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. .center{
6.     text-align:center;
7.     color:blue;
8.}
9. </style>
10. </head>
11. <body>
12. <h1class="center">Thisheadingisblue andcenter-aligned.</h1>
13. <pclass="center">Thisparagraphisblueandcenter-aligned.</p>
```

```
14. </body>
15. </html>
```

TestitNow

Output:

Thisheading is blue andcenter-aligned.

Thisparagraphisblueandcenter-aligned.

CSSClassSelector forspecificelement

Ifyouwantto specifythatonlyonespecific HTMLelementshould beaffectedthenyoushouldusethe element name with class selector.

Let'sseeanexample.

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.  <style>
5.  p.center{
6.      text-align:center;
7.      color:blue;
8.}
9.  </style>
10. </head>
11. <body>
12. <h1class="center">Thisheadingisnotaffected</h1>
13. <pclass="center">Thisparagraphisblueandcenter-aligned.</p>
14. </body>
15. </html>
```

TestitNow

Output:

Thisheadingis not affected

Thisparagraphisblueandcenter-aligned.

---

4) CSSUniversal Selector

Theuniversalselectorisusedasawildcardcharacter.Itselectsalltheelementsonthepages.

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.  <style>
5.* {
6.     color:green;
7.     font-size:20px;
8.}
9.  </style>
10. </head>
11. <body>
12. <h2>Thisis heading</h2>
13. <p>Thisstylewill beapplied oneveryparagraph.</p>
14. <pid="para1">Metoo!</p>
15. <p>Andme!</p>
16. </body>
17. </html>
```

TestitNow

Output:

Thisisheading

This style will be applied on every

paragraph.Metoo!

And me!

---

5) CSSGroupSelector

Thegroupingselector isusedto selectall theelementswith thesame styledefinitions.

Groupingselectorisusedtominimizethecode.Commasareusedtoseparateeachselectoringrouping
.

Let'sseetheCSS codewithoutgroupselector.

```
1.h1 {
2.      text-align:center;
3.      color:blue;
4.}
5.h2 {
6.      text-align:center;
```

```
7.      color:blue;
8.}
9.  p {
10.     text-align:center;
11.     color:blue;
12.}
```

Asyoucansee,youneedtodefineCSSpropertiesforalltheelements.Itcanbegroupedinfollowing ways:

```
1.h1,h2,p {
2.      text-align:center;
3.      color:blue;
4.}
```

Let'sseethefullexample ofCSSgroupselector.

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.  <style>
5.h1, h2, p {
6.      text-align:center;
7.      color:blue;
8.}
9.  </style>
10. </head>
11. <body>
12. <h1>HelloJavatpoint.com</h1>
13. <h2>HelloJavatpoint.com(Insmallerfont)</h2>
14. <p>Thisisaparagraph.</p>
15. </body>
16. </html>
```

Output:

HelloJavatpoint.com

HelloJavatpoint.com(In smallerfont)

Thisisaparagraph.

HowtoaddCSS

CSS is added to HTML pages to format the document according to information in the stylesheet.Therearethreeways to insertCSS in HTML documents.

1. InlineCSS
2. InternalCSS

3. ExternalCSS

---

1) InlineCSS

Inline CSS is used to apply CSS on a single line or

element.Forexample:

1. Hello

CSS Formorevisit here:InlineCSS

---

2) InternalCSS

InternalCSSisusedtoapplyCSSonasingledocumentorpage.
Itcanaffectalltheelementsofthepage.It iswritten insidethe styletagwithin head section ofhtml.

Forexample:

1. <style>
2. p{color:blue}
3. </style>

Formorevisithere:InternalCSS

---

3) ExternalCSS

External CSS is used to apply CSS on multiple pages or all pages. Here, we write all the CSScodein a css file.Its extension must be.cssforexamplestyle.css.

Forexample:

1. p{color:blue}

Youneedto linkthis style.cssfile toyour htmlpages likethis:

1.<link rel="stylesheet" type="text/css"

href="style.css">Thelink tag must beused insidehead

sectionofhtml.

Inline CSS

Wecan applyCSS ina singleelement byinlineCSStechnique.

The inline CSS is also a method to insert style sheets in HTML document. This methodmitigatessomeadvantages ofstylesheetsso itis advisedto usethis methodsparingly.

If you want to use inline CSS, you should use the style attribute to the relevant

tag.Syntax:

1.<htmltag style="cssproperty1:value;

cssproperty2:value;"></htmltag>Example:

1. <h2style="color:red;margin-left:40px;">InlineCSSisappliedonthisheading.</h2>
2. This paragraph is not

affected. Output:

InlineCSSis appliedonthisheading.

Thisparagraphisnotaffected.

Disadvantages of InlineCSS

- YoucannotusequotationswithininlineCSS. Ifyouusequotationsthebrowserwillinterpretthis as an end ofyourstylevalue.
- Thesestylescannotbereusedanywhereelse.
- Thesestylesaretoughtobeeditedbecausethey arenot storedata singleplace.
- Itisnotpossibletostylepseudo-codesandpseudo-classeswithinlineCSS.
- InlineCSSdoesnotprovidebrowsercacheadvantages.

Internal CSS

Theinternal style sheet isused to add auniquestyleforasingledocument.It is defined in <head> section of the HTML page inside the <style>

tag.Example:

1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. body {
6. background-color:

linen;7.}
8.h1 {

```
9.      color:red;
10.     margin-left:80px;
11.}
12. </style>
13. </head>
14. <body>
15. <h1>Theinternal stylesheetis appliedon thisheading.</h1>
16. <p>Thisparagraphwill notbeaffected.</p>
17. </body>
18. </html>
```

ExternalCSS

The external style sheet is generally used when you want to make changes on multiple pages.It is ideal for this condition because it facilitates you to change the look of the entire web sitebychanging just onefile.

It uses the <link> tag on every pages and the <link> tag should be put inside the head

section.Example:

```
1. <head>
2. <linkrel="stylesheet"type="text/css"href="mystyle.css">
3. </head>
```

The external style sheet may be written in any text editor but must be saved with a .cssextension.This fileshould not contain HTML elements.

Let's take an example of a style sheet file named

"mystyle.css".File:mystyle.css

```
1.  body {
2.      background-color:
lightblue;3.}
4.h1 {
5.      color:navy;
6.      margin-left:
20px;7.}
```

Note: You should not use a space between the property value and the unit. For example: Itshouldbemargin-left:20px not margin-left:20 px.

CSSComments

CSS comments are generally written to explain your code. It is very helpful for the users whoreadsyourcodeso that they caneasilyunderstand the code.

Commentsareignoredbybrowsers.

Commentsaresingleor multiple linesstatementand writtenwithin /*.....*/ .

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. p {
6.     color:blue;
7.     /*This isasingle-linecomment */
8.     text-align:
center;9.}
10. /*This is
11. amulti-line
12. comment*/
13. </style>
14. </head>
15. <body>
16. <p>HelloJavatpoint.com</p>
17. <p>ThisstatementisstyledwithCSS.</p>
18. <p>CSS commentsareignored bythebrowsersand notshowninthe output.</p>
19. </body>
20. </html>
```

Output:

HelloJavatpoint.com

Thisstatement isstyled with CSS.

CSScommentsareignoredby thebrowsers andnot shownin the output.

CSSBackground

CSS background property is used to define the background effects on element. There are 5CSSbackground properties that affects theHTMLelements:

1. background-color
2. background-image
3. background-repeat
4. background-attachment
5. background-position

---

1) CSSbackground-color

The background-color property is used to specify the background color of the

element.Youcan set thebackground color likethis:

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5.h2,p{
6.      background-color:
#b0d4de;7.}
8. </style>
9. </head>
10. <body>
11. <h2>MyfirstCSSpage.</h2>
12. <p>HelloJavatpoint. ThisisanexampleofCSS background-color.</p>
13. </body>
14. </html>
```

Output:

My first CSSpage.

HelloJavatpoint.Thisisan exampleofCSSbackground-color.

---

2) CSSbackground-image

The background-image property is used to set an image as a background of an element. Bydefaultthe imagecoverstheentireelement.You canset thebackgroundimagefor apagelikethis.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. body {
6. background-image:url("paper1.gif");
7. margin-
left:100px;8.}
9. </style>
10. </head>
11. <body>
12. <h1>HelloJavatpoint.com</h1>
13. </body>
14. </html>
```

Note:Thebackgroundimageshouldbechosenaccording totext color.Thebadcombination

oftext andbackgroundimagemaybe acauseofpoordesigned and notreadable webpage.

---

3) CSSbackground-repeat

By default, the background-image property repeats the background image horizontally andvertically.Some imagesarerepeatedonly horizontally or vertically.

Thebackgroundlooks betterifthe imagerepeatedhorizontally only.

background-repeat:repeat-x;

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. body {
6.     background-image:url("gradient_bg.png");
7.     background-repeat: repeat-
x;8.}
9. </style>
10. </head>
11. <body>
12. <h1>HelloJavatpoint.com</h1>
13. </body>
14. </html>
```

background-repeat:repeat-y;

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. body {
6.     background-image:url("gradient_bg.png");
7.     background-repeat: repeat-
y;8.}
9. </style>
10. </head>
11. <body>
12. <h1>HelloJavatpoint.com</h1>
13. </body>
14. </html>
```

---

4) CSSbackground-attachment

The background-attachment property is used to specify if the background image is fixed orscroll with the rest of the page in browser window. If you set fixed the background imagethen the image will not move during scrolling in the browser. Let?s take an example withfixedbackgroundimage.

```
1. background:white url('bbb.gif');
2. background-repeat:no-repeat;
3. background-attachment:fixed;
```

---

5) CSSbackground-position

Thebackground-positionpropertyisusedto definetheinitialpositionofthebackgroundimage.By default,the backgroundimageis placedon thetop-left ofthewebpage.

Youcanset the followingpositions:

1. center
2. top
3. bottom
4. left
5. right

```
1. background:whiteurl('good-morning.jpg');
2. background-repeat:no-repeat;
3. background-attachment:fixed;
4. background-position:center;
```

CSSBorder

TheCSSborder isashorthandproperty usedto settheborderon anelement.

The CSSborder properties are use to specify the style, color and size of the border of anelement.TheCSS borderproperties aregiven below

- border-style
- border-color
- border-width
- border-radius

1) CSSborder-style

The Border style property is used to specify the border type which you want to display on thewebpage.

There are some border style values which are used with border-style property to define aborder.

Value	Description
none	Itdoesn't defineanyborder.
dotted	It isusedtodefine adottedborder.
dashed	It isusedtodefineadashedborder.
solid	It isusedto defineasolid border.
double	ItdefinestwoborderswIththesameborder-widthvalue.
groove	It definesa3dgrooved border.effect isgeneratedaccordingtoborder-colorvalue.
ridge	Itdefinesa3dridgedborder.effectisgeneratedaccordingtoborder-colorvalue.
inset	It definesa 3dinset border.effectisgeneratedaccordingto border-colorvalue.
outset	Itdefinesa3doutsetborder.effectisgeneratedaccordingtoborder-colorvalue.

```
<!DOCTYPEhtml>
<html>
<head>
<style>
p.none{border-style:none;}
p.dotted{border-style:dotted;}
p.dashed{border-style:dashed;}
p.solid{border-style:solid;}
p.double{border-style:double;}
p.groove{border-style:groove;}
p.ridge{border-style:ridge;}
p.inset{border-style:inset;}
p.outset{border-style:outset;}
p.hidden{border-style:hidden;}
</style>
</head>
<body>
<pclass="none">Noborder.</p>
<pclass="dotted">Adottedborder.</p>
<pclass="dashed">Adashedborder.</p>
<pclass="solid">Asolidborder.</p>
<pclass="double">Adoubleborder.</p>
<pclass="groove">Agrooveborder.</p>
<pclass="ridge">Aridgeborder.</p>
<pclass="inset">Aninsetborder.</p>
<pclass="outset">Anoutsetborder.</p>
<pclass="hidden">Ahiddenborder.</p>
</body>
</html>
```

Output:

Noborder.

Adottedborder.

Adashedborder.

Asolidborder.

Adoubleborder.

Agrooveborder.

Aridgeborder.

Aninsetborder.

Anoutsetborder.

Ahiddenborder.

2) CSSborder-width

Theborder-widthpropertyis usedtoset theborder'swidth.It issetinpixels. Youcanalsouse the one of the three pre-defined values, thin, medium or thick to set the width of theborder.

Note: The border-width property is not used alone. It is always used with other border properties like"border-style"propertyto set the borderfirst otherwiseitwillnot work.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. p.one{
6.     border-style:solid;
7.      border-width: 5px;
8.}
9.  p.two {
10.    border-style:solid;
11.    border-width: medium;
12.}
13. p.three{
14.    border-style:solid;
15.    border-width: 1px;
16.}
17. </style>
18. </head>
```

```
19. <body>
20. <pclass="one">Writeyourtexthere.</p>
21. <pclass="two">Writeyourtext here.</p>
22. <pclass="three">Writeyourtexthere.</p>
23. </body>
24. </html>
```

3) CSSborder-color

Therearethreemethods to setthecolor ofthe border.

- Name: It specifiesthecolorname.Forexample:"red".
- RGB: It specifiestheRGBvalueofthecolor.Forexample:"rgb(255,0,0)".
- Hex:It specifiesthehexvalueofthecolor.Forexample:"#ff0000".

There is also a border color named "transparent". If the border color is not set it is inheritedfromthecolor property of theelement.

Note: The border-color property is not used alone. It is always used with other border properties like"border-style"propertyto set the borderfirstotherwiseitwillnot work.

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.  <style>
5.  p.one{
6.      border-style:solid;
7.      border-color:red;
8.}
9.  p.two {
10.     border-style:solid;
11.     border-color:#98bf21;
12.}
13. </style>
14. </head>
15. <body>
16. <pclass="one">This isasolidredborder</p>
17. <pclass="two">Thisisasolidgreenborder</p>
18. </body>
19. </html>
```

CSSborder-collapseproperty

This CSS property is used to set the border of the table cells and specifies whether the tablecellssharethe separate or common border.

This property has two main values that are **separate** and **collapse**. When it is set to the value**separate**, the distance between the cells can be defined using the **border-spacing** property.Whenthe**border-collapse** isset tothe value**collapse**, thenthe**inset**value of**border-style**

property behaves like **groove**, and the **outset** value behaves like

ridge.Syntax

1.border-collapse: separate | collapse | initial |

inherit;Thevalues ofthisCSS property aredefinedas follows.

PropertyValues

separate: It is the default value that separates the border of the table cell. Using this value,eachcell will display itsown border.

collapse: This value is used to collapse the borders into a single border. Using this, twoadjacent table cells will share a border. When this value is applied, the **border-spacing**propertydoes not affect.

initial: Itsets thepropertyto itsdefaultvalue.

inherit: Itinheritsthepropertyfromitsparentelement.

Now, let's understand this CSSproperty by using some examples. In the first example, we areusing the **separate** value of the **border-collapse** property. In the second example, we areusingthe**collapse**value ofthe **border-collapse**property.

Example-Using separatevalue

With this value, we can use the **border-spacing** property to set the distance between theadjacenttablecells.

```
1. <!DOCTYPEhtml>
2. <html>
3.
4. <head>
5. <title>border-collapseproperty</title>
6. <style>
7. table{
8. border:2px solidblue;
9. text-align:center;
10. font-size:20px;
11. width: 80%;
12. height:50%;
13.}
14. th{
15. border:5pxsolidred;
16. background-color:yellow;
17.}
18. td{
19. border:5pxsolidviolet;
20. background-color:cyan;
```

```
21.}
22.#t1{
23.border-collapse:separate;
24.}
25. </style>
26. </head>
27.27.
28. <body>
29.29.
30. <h1> Theborder-collapseProperty</h1>
31. <h2>border-collapse:separate;</h2>
32. <tableid ="t1">
33. <tr>
34. <th>First_Name </th>
35. <th>Last_Name</th>
36. <th> Subject</th>
37. <th>Marks </th>
38.</tr>
39. <tr>
40. <td>James</td>
41. <td>Gosling</td>
42. <td>Maths</td>
43.<td>92</td>
44.</tr>
45. <tr>
46. <td> Alan</td>
47. <td>Rickman</td>
48. <td>Maths</td>
49.<td>89</td>
50.</tr>
51. <tr>
52. <td> Sam </td>
53. <td>Mendes</td>
54. <td>Maths</td>
55.<td>82</td>
56.</tr>
57. </table>
58. </body>
59.59.
60. </html>
```

TestitNow

Output

Example-Usingcollapseproperty

The**border-spacing**and**border-radius**propertiescannotbeusedwiththisvalue.

```
1. <!DOCTYPEhtml>
```

```
2. <html>
3.
4. <head>
5. <title>border-collapseproperty</title>
6. <style>
7. table{
8. border:2px solidblue;
9. text-align:center;
10. font-size:20px;
11. width: 80%;
12. height:50%;
13.}
14. th{
15. border:5pxsolidred;
16. background-color:yellow;
17.}
18. td{
19. border:5pxsolidviolet;
20. background-color:cyan;
21.}
22.#t1{
23.border-collapse:collapse;
24.}
25. </style>
26. </head>
27. 27.
28. <body>
29. 29.
30. <h1> Theborder-collapseProperty</h1>
31. <h2>border-collapse:collapse;</h2>
32. <tableid ="t1">
33. <tr>
34. <th>First_Name </th>
35. <th>Last_Name</th>
36. <th> Subject</th>
37. <th>Marks </th>
38.</tr>
39. <tr>
40. <td>James</td>
41. <td>Gosling</td>
42. <td>Maths</td>
43.<td>92</td>
44.</tr>
45. <tr>
46. <td> Alan</td>
47. <td>Rickman</td>
48. <td>Maths</td>
49.<td>89</td>
50.</tr>
51. <tr>
52. <td> Sam </td>
53. <td>Mendes</td>
```

```
54. <td>Maths</td>
55.<td>82</td>
56.</tr>
57. </table>
58. </body>
59. </html>
```

TestitNow

Output

CSSborder-spacingproperty

This CSS property is used to set the distance between the borders of the adjacent cells in thetable. It applies only when the **border-collapse** property is set to **separate**. There will not beanyspacebetween the borders if the**border-collapse**is set to **collapse**.

Itcanbedefinedasoneor twovaluesfor determiningthevertical andhorizontalspacing.

- Whenonlyone valueisspecified,thenit setsbothhorizontal and vertical spacing.
- When we use the two-value syntax, then the first one is used to set the horizontal spacing (i.e.,the space between the adjacent columns), and the second value sets the vertical spacing (i.e.,thespace betweentheadjacentrows).

Syntax

```
1.border-spacing: length | initial |
```

inherit;PropertyValues

Thevalues ofthis CSSproperty aredefinedas follows.

length: This value sets the distance between the borders of the adjacent table cells in px, cm,pt,etc. Negativevalues arenot allowed.

initial: Itsets thepropertyto itsdefaultvalue.

inherit: Itinheritsthepropertyfromitsparentelement.

Let's understand this CSS property by using some examples. In the first example, we areusing the single value of the **border-spacing** property, and in the second example, we areusingtwo values ofthe **border-spacing** property.

Example

Here,weareusingthesingle valueofthe**border-spacing**property. The**border-collapse** propertyis setto **separate**,and thevalueofthe**border-spacing**is setto **45px**.

```
1. <!DOCTYPEhtml>
```

```
<html>

<head>
<title>border-spacingproperty</title>
<style>
table{
border:2px solidblue;
text-align:center;
font-size:20px;
background-color:lightgreen;
}
th{
border:5px solid red;
background-color:yellow;
}
td{
border:5pxsolid violet;
background-color:cyan;
}
#space{
border-collapse:separate;
border-spacing:45px;
}
</style>
</head>
27.
<body>
29.
<h1>Theborder-spacing Property</h1>
<h2>border-spacing: 45px;</h2>
<tableid="space">
<tr>
<th>First_Name </th>
<th>Last_Name</th>
<th> Subject</th>
<th>Marks </th>
</tr>
<tr>
<td>James</td>
<td>Gosling</td>
<td>Maths</td>
<td>92</td>
</tr>
<tr>
<td> Alan</td>
<td>Rickman</td>
<td>Maths</td>
<td>89</td>
</tr>
<tr>
<td> Sam </td>
<td>Mendes</td>
```

```
54. <td>Maths</td>
55.<td>82</td>
56.</tr>
57. </table>
58. </body>
59. 59.
60. </html>
```

Output

Example

Here, we are using two values of the **border-spacing** property. The **border-collapse** propertyissetto**separate**,andthe valueof the**border-spacing**issetto**20pt1em**.Thefirstvalue,i.e.,**20pt**sets thehorizontal spacing, and thevalue**1em**set thevertical spacing.

```
1. <!DOCTYPEhtml>
2. <html>
3.
4. <head>
5. <title>border-spacingproperty</title>
6. <style>
7. table{
8. border:2px solidblue;
9. text-align:center;
10. font-size:20px;
11. background-color:lightgreen;
12.}
13. th{
14. border:5px solid red;
15. background-color:yellow;
16.}
17. td{
18. border:5pxsolid violet;
19. background-color:cyan;
20.}
21. #space{
22. border-collapse:separate;
23. border-spacing: 20pt1em;
24.}
25. </style>
26. </head>
27. 27.
28. <body>
29. 29.
30. <h1>Theborder-spacing Property</h1>
31. <h2>border-spacing: 20pt1em; </h2>
32. <tableid="space">
33. <tr>
34. <th>First_Name </th>
```

```
35. <th>Last_Name</th>
36. <th> Subject</th>
37. <th>Marks </th>
38.</tr>
39. <tr>
40. <td>James</td>
41. <td>Gosling</td>
42. <td>Maths</td>
43.<td>92</td>
44.</tr>
45. <tr>
46. <td> Alan</td>
47. <td>Rickman</td>
48. <td>Maths</td>
49.<td>89</td>
50.</tr>
51. <tr>
52. <td> Sam </td>
53. <td>Mendes</td>
54. <td>Maths</td>
55.<td>82</td>
56.</tr>
57. </table>
58. </body>
59. 59.
60. </html>
```

CSSDisplay

CSS display is the most important property of CSS which is used to control the layout of theelement.It specifies howthe element isdisplayed.

Every element has a default display value according to its nature. Every element on thewebpage is a rectangular box and the CSSproperty defines the behavior of that rectangularbox.

CSSDisplaydefault properties

defaultvalue	inline
inherited	no
animationsupporting	no
version	css1
javascriptsyntax	object.style.display="none"

Syntax

```
1.display:value;
```

CSSdisplayvalues

TherearefollowingCSSdisplayvalueswhichare commonly used.

1. display:inline;
2. display:inline-block;
3. display:block;
4. display:run-in;
5. display:none;

---

1) CSSdisplay inline

The inline element takes the required width only. It doesn't force the line break so the flow oftextdoesn't break in inlineexample.

Theinlineelementsare:

-
- <a>
-
- <b>etc.

Let'sseeanexampleof CSSdisplayinline.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. p {
6. display:inline;
7.}
8. </style>
9. </head>
10. <body>
11. <p>HelloJavatpoint.com</p>
12. <p>JavaTutorial.</p>
13. <p>SQLTutorial.</p>
14. <p>HTMLTutorial.</p>
15. <p>CSSTutorial.</p>
16. </body>
17. </html>
```

Output:

HelloJavatpoint.comJavaTutorial. SQLTutorial.HTML Tutorial.CSSTutorial.

---

2) CSSdisplay inline-block

TheCSSdisplayinline-blockelementisverysimilartoinlineelementbut thedifferenceisthatyou areableto set thewidth and height.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. p {
6. display: inline-
block;7.}
8. </style>
9. </head>
10. <body>
11. <p>HelloJavatpoint.com</p>
12. <p>JavaTutorial.</p>
13. <p>SQLTutorial.</p>
14. <p>HTMLTutorial.</p>
15. <p>CSSTutorial.</p>
16. </body>
17. </html>
```

Output:

HelloJavatpoint.comJavaTutorial.SQLTutorial.HTMLTutorial. CSSTutorial.

---

3) CSSdisplay block

The CSS display block element takes as much as horizontal space as they can. Means theblockelementtakesthe fullavailablewidth.Theymakealinebreakbefore andafterthem.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. p {
6. display:block;
7.}
8. </style>
9. </head>
10. <body>
11. <p>HelloJavatpoint.com</p>
12. <p>JavaTutorial.</p>
13. <p>SQLTutorial.</p>
14. <p>HTMLTutorial.</p>
```

```
15. <p>CSSTutorial.</p>
16. </body>
17. </html>
```

Output:

Hello

Javatpoint.comJavaT

utorial.

SQLTutorial.

HTMLTutorial.

CSS Tutorial.

---

4) CSSdisplay run-in

This property doesn't work in Mozilla Firefox. These elements don't produce a specific boxby themselves.

- Iftherun-in boxcontains abock box,itwill besame asblock.
- If the block box follows the run-in box, the run-in box becomes the first inline box ofthe blockbox.
- Ifthe inlinebox follows therun-in box, therun-in boxbecomes ablock box.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. p {
6. display:run-in;
7.}
8. </style>
9. </head>
10. <body>
11. <p>HelloJavatpoint.com</p>
12. <p>JavaTutorial.</p>
13. <p>SQLTutorial.</p>
14. <p>HTMLTutorial.</p>
15. <p>CSSTutorial.</p>
16. </body>
17. </html>
```

Output:

JavaTutorial.

SQLTutorial.

HTMLTutorial.

CSSTutorial.

---

5) CSSdisplaynone

The"none"valuetotallyremovestheelement fromthepage.Itwillnot takeanyspace.

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. h1.hidden{
6.     display:
none;7.}
8. </style>
9. </head>
10. <body>
11. <h1>Thisheading isvisible.</h1>
12. <h1class="hidden">This isnotvisible.</h1>
13. <p>Youcanseethatthe hiddenheadingdoesnotcontainanyspace.</p>
14. </body>
15. </html>
```

Output:

Thisheadingisvisible.

Youcan seethat thehidden heading doesnot containany space.

Other CSSdisplay values

Property-value	Description
flex	Itisusedtodisplayanelementasanblock-levelflexcontainer. Itisnewin css3.
inline-flex	Itisusedtodisplayanelementasaninline-levelflexcontainer. Itisnewin css3.
inline-table	Itdisplaysan elementasan inline-leveltable.
list-Item	Itmakestheelementbehavelikea element.

table	Itmakestheelementbehavelikea <table> element.
table-caption	Itmakestheelementbehavelikea <caption>element.
table-column-group	Itmakestheelementbehave likea <colgroup>element.
table-header-group	Itmakesthe elementbehavelikea <thead>element.
table-footer-group	Itmakes theelement behavelikea <tfoot>element.
table-row-group	Itmakestheelementbehavelikea <tbody>element.
table-cell	Itmakestheelementbehavelikea <td>element.
table-row	Itmakesthe elementbehavelikea <tr>element.
table-column	Itmakestheelementbehavelikea <col> element.

CSSCursor

It is used to define the type of mouse cursor when the mouse pointer is on the element. Itallowsusto specifythecursortype, whichwill be displayed totheuser. Whenauserhoversonthe link, then bydefault, the cursortransforms intothe hand from apointer.

Let'sunderstandtheproperty valuesofthe cursor.

Values	Usage
alias	It is used to display the indication of the cursor of something that is to becreated.
auto	Itisthedefaultpropertyinwhichthebrowsersetsthecursor.
all-scroll	Itindicatesthescrolling.
col-resize	Usingit,thecursorwillrepresentthatthe columncanbehorizontally resized.
cell	Thecursorwillrepresentthatacellorthecollectionofcellsis selected.
context-menu	Itindicatestheavailabilityofthecontextmenu.
default	Itindicatesanarrow, whichisthedefaultcursor.
copy	Itisusedtoindicate thatsomethingiscopied.
crosshair	Init, thecursorchangesto thecrosshairor theplussign.
e-resize	It represents the east direction and indicates that the edge of the box is to beshiftedtowards right.
ew-resize	Itrepresentstheeast/westdirectionandindicatesabidirectionalresizecursor.
n-resize	It represents the north direction that indicates that the edge of the box is to beshifted to up.
ne-resize	Itrepresentsthenorth/eastdirection andindicates thattheedgeoftheboxistobeshifted towards upand right.
move	Itindicatesthatsomethingistobe shifted.
help	Itisintheform of aquestionmarkorballon, whichrepresentsthathelpisavailable.
None	Itisusedtoindicatethatnocursorisrenderedfor theelement.

No-drop	Itisusedtorepresentthatthedraggeditemcannotbe droppedhere.
s-resize	Itindicatesanedgeboxistobemoveddown.It indicatesthesouthdirection.
Row-resize	Itisusedtoindicatethattherowcanbeverticallyresized.
Se-resize	Itrepresentsthesouth/eastdirection,whichindicatesthatanedgeboxistobemovedd own and right.
Sw-resize	It represents south/west direction and indicates that an edge of the box is to beshiftedtowards down and left.
Wait	Itrepresentsanhourglass.
<url>	Itindicatesthesourceof thecursorimage file.
w-resize	Itindicatesthewest directionandrepresentsthat theedgeoftheboxistobeshifted left.
Zoom-in	Itisusedto indicatethatsomething canbezoomedin.
Zoom-out	Itisusedto indicatethatsomething canbezoomedout.

Theillustration ofusing theabovevaluesofcursorproperty isgiven below:

Example

```
<html>
  <head>
  </head>
  <style>
    body{
      background-color:lightblue;
      color:green;
      text-align:center;
      font-size:20px;
    }


  </style>

  <body>
    <p>Moveyourmouseoverthebelowwords forthecursorchange.</p>
    <divstyle="cursor:alias">aliasValue</div>
    <divstyle="cursor:auto">autoValue</div>
    <divstyle="cursor:all-scroll">all-scrollvalue</div>
    <divstyle="cursor:col-resize">col-resizevalue</div>
    <divstyle="cursor:crosshair">Crosshair</div>
    <divstyle="cursor:default">Defaultvalue</div>
    <divstyle="cursor:copy">copyvalue</div>
    <divstyle="cursor:pointer">Pointer</div>
    <divstyle="cursor:move">Move</div>
    <divstyle="cursor:e-resize">e-resize</div>
    <divstyle="cursor:ew-resize">ew-resize</div>
    <divstyle="cursor:ne-resize">ne-resize</div>
    <divstyle="cursor:nw-resize">nw-resize</div>
    <divstyle="cursor:n-resize">n-resize</div>
    <divstyle="cursor:se-resize">se-resize</div>
```

```
31.      <divstyle="cursor:sw-resize">sw-resize</div>
32.      <divstyle="cursor:s-resize">s-resize</div>
33.      <divstyle="cursor:w-resize">w-resize</div>
34.      <divstyle="cursor:text">text</div>
35.      <divstyle="cursor:wait">wait</div>
36.      <divstyle="cursor:help">help</div>
37.      <divstyle="cursor:progress">Progress</div>
38.      <divstyle="cursor:no-drop">no-drop</div>
39.      <divstyle="cursor:not-allowed">not-allowed</div>
40.      <divstyle="cursor:vertical-text">vertical-text</div>
41.      <divstyle="cursor:zoom-in">Zoom-in</div>
42.      <divstyle="cursor:zoom-out">Zoom-out</div>
43.   </body>
44. </html>
```

CSSButtons

InHTML,weusethebuttontagto create abutton,but byusingCSSproperties, wecanstylethe buttons. Buttons help us to create user interaction and event processing. They are one ofthewidely used elementsof web pages.

During the form submission, to view or to get some information, we generally use

buttons.Let'sseethe basicstyling in buttons.

Basic styling inButtons

There are multiple properties available that are used to style the button element. Let's discussthem oneby one.

background-color

As we have discussed earlier, this property is used for setting the background colorof thebuttonelement.

Syntax

```
1.  element{
2.      // background-color
style3.}
```

Example

```
1.  <!DOCTYPEhtml>
2.  <html>
3.
4.  <head>
5.      <title>
```

```
6.          buttonbackgroundColor
7.      </title>
8.
9.      <style>
10.     body{
11.       text-align:center;
12.     }
13.        button {
14.          color:lightgoldenrodyellow;
15.           font-size:30px;
16.        }
17.        .b1 {
18.           background-color:red;
19.        }
20.        .b2 {
21.           background-color:blue;
22.        }
23.        .b3 {
24.           background-color:violet;
25.        }
26.     </style>
27. </head>
28.
29. <body>
30.    <h1>Thebackground-colorproperty.</h1>
31.     <buttonclass="b1">Red colorbutton</button>
32.     <buttonclass="b2">Bluecolorbutton</button>
33.     <buttonclass="b3">Violet colorbutton</button>
34. </body>
35. </html>
```

border

It is used to set the [border](#)of the button. It is the shorthand property for **border-width,border-color,**and **border-style**.

Syntax

```
1.  element{
2.      // border
style3.}
```

Example

```
1.  <!DOCTYPEhtml>
2.  <html>
3.
4.  <head>
5.      <title>
```

```
6.          buttonbackgroundColor
7.      </title>
8.
9.      <style>
10.     body{
11.       text-align:center;
12.     }
13.        button {
14.          color:lightgoldenrodyellow;
15.           font-size:30px;
16.        }
17.        .b1 {
18.           background-color:red;
19.           border:none;
20.        }
21.        .b2 {
22.           background-color:blue;
23.           border:5pxbrownsolid;
24.        }
25.        .b3 {
26.           background-color:yellow;
27.           color:black;
28.           border:5pxredgroove;
29.        }
30.        .b4{
31.          background-color:orange;
32.          border:5px reddashed;
33.        }
34.        .b5{
35.          background-color:gray;
36.          border:5pxblackdotted;
37.        }
38.        .b6{
39.          background-color: lightblue;
40.          border:5px bluedouble;
41.        }
42.     </style>
43. </head>
44.
45. <body>
46.    <h1>Theborder property</h1>
47.     <buttonclass="b1">none</button>
48.     <buttonclass="b2">solid</button>
49.     <buttonclass="b3">groove</button>
50.     <buttonclass="b4">dashed</button>
51.     <buttonclass="b5">dotted</button>
52.     <button
class="b6">double</button>53.
54. </body>
55. </html>
```

border-radius

Itis used to maketheroundedcorners ofthe button. It setstheborderradius of thebutton.

Syntax

```
1. element{
2.      // border-radius
property3.}
```

Example

```
1.  <!DOCTYPEhtml>
2.  <html>
3.
4.  <head>
5.      <title>
6.          buttonbackgroundColor
7.      </title>
8.
9.      <style>
10.     body{
11.       text-align:center;
12.     }
13.       button {
14.          color:lightgoldenrodyellow;
15.           font-size:30px;
16.       }
17.       .b1 {
18.           background-color:red;
19.           border:none;
20.       }
21.       .b2 {
22.           background-color:blue;
23.           border:5pxbrownsolid;
24.           border-radius: 7px;
25.       }
26.       .b3 {
27.           background-color:yellow;
28.           color:black;
29.           border:5pxredgroove;
30.           border-radius: 10px;
31.       }
32.       .b4{
33.          background-color:orange;
34.          border:5px reddashed;
35.          border-radius: 20px;
36.       }
37.       .b5{
```

```
38.           background-color:gray;
39.           border:5pxblackdotted;
40.           border-radius: 30px;
41.         }
42.         .b6{
43.           background-color: lightblue;
44.           border:5px bluedouble;
45.           border-radius: 25px;
46.         }
47.     </style>
48. </head>
49.
50. <body>
51.    <h1>Theborder-radiusproperty</h1>
52.    <h2>Belowthereisthe bordernameand border-radius</h2>
53.     <buttonclass="b1">none</button>
54.     <buttonclass="b2">solid 7px</button>
55.     <buttonclass="b3">groove10px</button>
56.     <buttonclass="b4">dashed20px</button>
57.     <buttonclass="b5">dotted 30px</button>
58.     <button class="b6">double
25px</button>59.
60. </body>
61. </html>
```

box-shadow

As its name implies, it is used to create the shadow of the button box. It is used to add theshadowto the button. Wecanalsocreate ashadow during thehoveron thebutton.

Syntax

```
1.  box-shadow:[horizontal offset][verticaloffset][blurradius]
2.              [optionalspreadradius][color];
```

Example

```
1.  <!DOCTYPEhtml>
2.  <html>
3.
4.  <head>
5.      <title>
6.          buttonbackgroundColor
7.      </title>
8.
9.      <style>
10.     body{
11.       text-align:center;
12.     }
```

```
13.         button {
14.           color:lightgoldenrodyellow;
15.            font-size:30px;
16.         }
17.         .b1{
18.           background-color: lightblue;
19.           border:5px red double;
20.           border-radius: 25px;
21.           color:black;
22.           box-shadow: 0 8px16px 0 black,
23.                   06px 20px  0rgba(0,0, 0, 0.19);
24.         }
25.         .b2{
26.          background-color:lightblue;
27.           border:5pxreddotted;
28.           color:black;
29.           border-radius: 25px;
30.         }
31.         .b2:hover{
32.           box-shadow: 0 8px16px 0 black,
33.                   06px 20px0 rgba(0,0,0, 0.19);
34.         }
35.         </style>
36. </head>
37.
38. <body>
39.     <buttonclass="b1">Shadowonbutton</button>
40.     <buttonclass="b2">Box-shadowon hover</button>
41. </body>
42. </html>
```

padding

Itis usedto setthebuttonpadding.

Syntax

```
1.  element{
2.       // padding
style3.}
```

Let'sunderstanditusinganillustration.

Example

```
1.  <!DOCTYPEhtml>
2.  <html>
3.
4.  <head>
```

```
5.      <title>
6.          buttonbackgroundColor
7.      </title>
8.
9.      <style>
10.     body{
11.       text-align:center;
12.     }
13.         button {
14.           color:lightgoldenrodyellow;
15.            font-size:30px;
16.         }
17.         .b1 {
18.            background-color:red;
19.            border:none;
20.            padding: 16px;
21.         }
22.         .b2 {
23.            background-color:blue;
24.            border:5pxbrownsolid;
25.            padding:15px30px 25px 40px;
26.         }
27.         .b3 {
28.            background-color:yellow;
29.            color:black;
30.            border:5pxredgroove;
31.            padding-top:30px;
32.         }
33.         .b4{
34.           background-color:orange;
35.           border:5px reddashed;
36.           padding-bottom:40px;
37.         }
38.         .b5{
39.           background-color:gray;
40.           border:5pxblackdotted;
41.           padding-left: 40px;
42.         }
43.         .b6{
44.           background-color: lightblue;
45.           border:5px bluedouble;
46.           padding-right: 40px;;
47.         }
48.     </style>
49. </head>
50.
51. <body>
52.    <h1>Thepadding property</h1>
53.     <buttonclass="b1">none</button>
54.     <buttonclass="b2">solid</button>
```

```
55.    <buttonclass="b3">groove</button>
56.    <buttonclass="b4">dashed</button>
57.    <buttonclass="b5">dotted</button>
58.    <button
class="b6">double</button>59.
60. </body>
61. </html>
```

CSSLine Height

The **CSS line height property** is used *to define the minimal height of line boxes within theelement*.It sets thedifferences between twolinesof your content.

It defines the amount of space above and below inline elements. It allows you to set theheightof alineof independently from thefont size.

CSSline-height values

Therearesomeproperty valueswhichareusedwithCSSline-height property.

value	description
normal	Thisisadefaultvalue.itspecifiesanormal lineheight.
number	Itspecifiesanumberthatis multipliedwiththecurrentfont sizetosetthelineheight.
length	Itisused toset thelineheightin px,pt,cm,etc.
%	Itspecifiesthelineheightinpercentofthecurrentfont.
initial	Itsetsthisproperty toitsdefaultvalue.
inherit	Itinheritsthispropertyfromitsparent element.

CSSline-height example

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.  <style>
5.  h3.small {
6.      line-height:
70%;7.}
8.  h3.big {
9.      line-height:200%;
10.}
11. </style>
12. </head>
13. <body>
14.<h3>
15. Thisis aheadingwithastandardline-height.<br>
```

16. Thisis aheadingwithastandardline-height.
17. The default line height in most browsers is about 110% to 120%.
18.</h3>
19. <h3class="small">
20. Thisis aheadingwithasmallerline-height.
21. Thisis aheadingwithasmallerline-height.
22. Thisis aheadingwithasmallerline-height.
23. This is a heading with a smaller line-height.
24.</h3>
25. <h3class="big">
26. Thisisaheadingwitha biggerline-height.
27. Thisisaheadingwitha biggerline-height.
28. Thisisaheadingwitha biggerline-height.
29. This is a heading with a bigger line-height.
30.</h3>
31. </body>
32. </html>

CSSMargin

CSSMarginpropertyisusedtodefinethespace aroundelements. Itiscompletelytransparentanddoesn't have anybackground color.Itclears an area aroundtheelement.

Top,bottom,leftandrightmargincanbe changedindependentlyusingseparateproperties.Youcan alsochangeall propertiesat oncebyusing shorthand marginproperty.

TherearefollowingCSSmarginproperties:

CSSMarginProperties

Property	Description
margin	This property isused tosetalltheproperties inonedeclaration.
margin-left	itis usedto setleftmarginofanelement.
margin-right	It is usedto setrightmargin ofanelement.
margin-top	Itis usedto settopmarginof anelement.
margin-bottom	It isusedtoset bottommarginofanelement.

CSSMargin Values

Thesearesomepossible valuesfor marginproperty.

Value	Description

auto	Thisis usedto letthebrowser calculateamargin.
length	It is usedtospecifya marginpt, px, cm,etc.itsdefaultvalueis0px.
%	Itisusedtodefineamargininpercent ofthewidthofcontainingelement.
inherit	It isusedtoinheritmarginfromparentelement.

Note: Youcanalsouse negativevaluestooverlapcontent.

CSSmargin Example

Youcandefinedifferentmarginfordifferentsidesforan element.

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.  <style>
5.  p {
6.      background-color:pink;
7.}
8.  p.ex {
9.      margin-top:50px;
10.     margin-bottom:50px;
11.     margin-right:100px;
12.     margin-left:100px;
13.}
14. </style>
15. </head>
16. <body>
17. <p>Thisparagraphisnotdisplayedwithspecifiedmargin.</p>
18. <pclass="ex">Thisparagraphisdisplayedwithspecifiedmargin.</p>
19. </body>
20. </html>
```

Output:

Thisparagraphis notdisplayedwith specifiedmargin.

Thisparagraphisdisplayedwithspecifiedmargin.

Margin:Shorthand Property

CSSshorthandpropertyisusedtoshortenthecode. Itspecifiesallthemarginpropertiesin

oneproperty.

Thereare fourtypes to specifythemarginproperty. You canuseoneof them.

1. margin:50px 100px150px200px;
2. margin: 50px100px150px;
3. margin:50px100px;
4. margin50px;

---

1) margin:50px100px150px200px;

Itidentifiesthat:

topmarginvalueis50px**right**

margin value is 100px**bottom**

margin value is

150px**left**margin valueis

200px

```
1. <!DOCTYPEhtml>
2. <html>
3. <head>
4. <style>
5. p {
6.     background-color:pink;
7.}
8. p.ex {
9.     margin: 50px 100px150px 200px;
10.}
11. </style>
12. </head>
13. <body>
14. <p>Thisparagraphisnotdisplayed withspecifiedmargin.</p>
15. <pclass="ex">This paragraphisdisplayedwithspecifiedmargin.</p>
16. </body>
17. </html>
```

Output:

Thisparagraphis notdisplayedwith specifiedmargin.

Thisparagraphisdisplayedwithspecifiedma
rgin.

2) margin:50px100px150px;

Itidentifiesthat:

topmargin valueis 50px

leftandrightmarginvalues are100px

bottom marginvalueis150px

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.  <style>
5.  p {
6.      background-color:pink;
7.}
8.  p.ex {
9.      margin: 50px 100px150px;
10.}
11. </style>
12. </head>
13. <body>
14. <p>Thisparagraphisnotdisplayed withspecifiedmargin.</p>
15. <pclass="ex">This paragraphisdisplayedwithspecifiedmargin.</p>
16. </body>
17. </html>
```

Output:

Thisparagraphis notdisplayedwith specifiedmargin.

Thisparagraphisdisplayedwithspecifiedmargin.

3) margin:50px100px;

Itidentifiesthat:

topandbottommarginvaluesare50px

leftandrightmarginvalues are100px

```
1.  <!DOCTYPEhtml>
2.  <html>
3.  <head>
4.  <style>
5.  p {
6.      background-color:pink;
7.}
8.  p.ex {
9.      margin: 50px100px;
10.}
11. </style>
12. </head>
13. <body>
14. <p>Thisparagraphisnotdisplayed withspecifiedmargin.</p>
15. <pclass="ex">This paragraphisdisplayedwithspecifiedmargin.</p>
16. </body>
17. </html>
```

Output:

Thisparagraphis notdisplayedwith specifiedmargin.

Thisparagraphisdisplayedwithspecifiedmargin.

UNIT-II

FrontendDevelopment

Javascriptbasics

LearnJavaScriptTutorial

Our **JavaScript Tutorial** is designed for beginners and professionals both. JavaScript is usedtocreateclient-side dynamicpages.

JavaScriptis *anobject-basedscriptinglanguage*whichislightweightandcross-platform.

JavaScript is not a compiled language, but it is a translated language. The JavaScriptTranslator (embedded in the browser) is responsible for translating the JavaScript code fortheweb browser.

WhatisJavaScript

JavaScript (js) is a light-weight object-oriented programming language which is used byseveral websites for scripting the webpages. It is an interpreted, full-fledged programminglanguage that enables dynamic interactivity on websites when applied to an HTMLdocument. It was introduced in the year 1995 for adding programs to the webpages in theNetscape Navigator browser. Since then, it has been adopted by all other graphical webbrowsers. With JavaScript, users can build modern web applications to interact directlywithout reloading the page every time. The traditional website uses js to provide severalformsof interactivity and simplicity.

Although, JavaScript has no connectivity with Java programming language. The name wassuggested and provided in the times when Java was gaining popularity in the market. InadditiontowebbrowsersdatabasessuchasCouchDBandMongoDBusesJavaScriptastheirscripting and query language.

FeaturesofJavaScript

ThereareFollowingfeaturesofJavaScript:

1. AllpopularwebbrowserssupportJavaScriptastheyprovidebuilt-inexecutionenvironments.
2. JavaScript follows the syntax and structure of the C programming language. Thus, it is astructuredprogramming language.
3. JavaScript is a weakly typed language, where certain types are implicitly cast (depending ontheoperation).
4. JavaScript is an object-oriented programming language that uses prototypes rather than usingclassesfor inheritance.
5. Itisalight-weightedandinterpretedlanguage.
6. It isacase-sensitivelanguage.
7. JavaScriptis supportableinseveral operatingsystemsincluding,Windows,macOS,etc.
8. It providesgoodcontroltotheusers overthewebbrowsers.

History ofJavaScript

In 1993, **Mosaic**, the first popular web browser, came into existence. In the **year 1994**,**Netscape** was founded by **Marc Andreessen**. He realized that the web needed to becomemore dynamic. Thus, a 'glue language' was believed to be provided to HTML to make webdesigningeasyfordesignersandpart-timeprogrammers.Consequently,in1995,thecompany recruited **Brendan Eich** intending to implement and embed Scheme programminglanguage to the browser. But, before Brendan could start, the company merged with **SunMicrosystems** for adding Java into its Navigator so that it could compete with Microsoft overthe web technologies and platforms. Now, two languages were there: Java and the scriptinglanguage.Further,Netscapedecidedtogivea similarnametothescriptinglanguageasJava's. It led to 'Javascript'. Finally, in May 1995, Marc Andreessen coined the first code ofJavascriptnamed'**Mocha**'. Later,themarketing teamreplaced thenamewith '**LiveScript**'.
But, due to trademark reasons and certain other reasons, in December 1995, the language wasfinallyrenamed to 'JavaScript'.From then,JavaScriptcame into existence.

ApplicationofJavaScript

JavaScriptisusedtocreateinteractivewebsites.It ismainlyusedfor:

- Client-sidevalidation,
- Dynamicdrop-downmenus,
- Displayingdateandtime,
- Displaying pop-up windows and dialog boxes (like an alert dialog box, confirm dialog boxandpromptdialog box),
- Displayingclocksetc.

JavaScriptExample

```
1. <script>
2. document.write("HelloJavaScriptbyJavaScript");
3. </script>
```

JavaScriptExample

Javascriptexampleiseasytocode.JavaScriptprovides3placestoputtheJavaScriptcode:withinb ody tag, within head tagandexternal JavaScript file.

Let'screatethefirstJavaScriptexample.

```
1. <scripttype="text/javascript">
2. document.write("JavaScript isasimplelanguageforjavatpointlearners");
3. </script>
```

Testit Now

The**script**tagspecifies that weareusing JavaScript.

The **text/javascript** is the content type that provides information to the browser about thedata.

The **document.write()** function is used to display dynamic content through JavaScript. Wewilllearn about document object in detail later.

3Places toputJavaScriptcode

1. Betweenthe bodytag of html
2. Betweentheheadtagofhtml
3. In.jsfile (externaljavaScript)

---

1) JavaScriptExample :code betweenthebodytag

In the above example, we have displayed the dynamic content using JavaScript. Let's see thesimpleexampleof JavaScript that displays alertdialog box.

```
1. <scripttype="text/javascript">
2.  alert("HelloJavatpoint");
3. </script>
```

---

2) JavaScriptExample :codebetweentheheadtag

Let's see the same example of displaying alert dialog box of JavaScript that is containedinsidethe head tag.

Inthisexample,wearecreatingafunctionmsg().
TocreatefunctioninJavaScript,youneedtowritefunction with function_name as given below.

To call function, you need to work on event. Here we are using onclick event to call msg()function.

```
1. <html>
2. <head>
3. <scripttype="text/javascript">
4. functionmsg(){
5.  alert("Hello
Javatpoint");6.}
7. </script>
8. </head>
9. <body>
10. <p>WelcometoJavaScript</p>
11. <form>
12. <inputtype="button"value="click"onclick="msg()"/>
13. </form>
14. </body>
15. </html>
```

ExternalJavaScript file

Wecancreate externalJavaScriptfile andembeditinmanyhtml page.

Itprovides**codereusability** becausesingleJavaScriptfile canbeused inseveral htmlpages.

An external JavaScript file must be saved by .js extension. It is recommended to embed allJavaScriptfiles into asinglefile.It increasesthe speed of thewebpage.

Let'screateanexternal JavaScriptfilethatprints HelloJavatpointinaalertdialogbox.

message.js

```
1. functionmsg(){
2.  alert("Hello
Javatpoint");3.}
```

Let's include the JavaScript file into htmlpage. It calls the JavaScript functionon buttonclick.

index.html

```
1. <html>
2. <head>
3. <scripttype="text/javascript"src="message.js"></script>
4. </head>
5. <body>
6. <p>WelcometoJavaScript</p>
7. <form>
8. <inputtype="button"value="click"onclick="msg()"/>
```

9. </form>
10. </body>
11. </html>

Advantagesof ExternalJavaScript

Therewillbefollowingbenefitsif ausercreatesanexternaljavascript:

1. Ithelpsinthereusability ofcodeinmorethanone HTMLfile.
2. Itallowseasycodereadability.
3. It is time-efficient as web browsers cache the external js files, which further reducesthepageloading time.
4. Itenablesbothwebdesignersandcoderstoworkwithhtmlandjsfilesparallellyandseparatel y,i.e., without facing any codeconflictions.
5. Thelength of thecodereducesas only weneed tospecifythelocation ofthe js file.

Disadvantagesof ExternalJavaScript

Therearethe followingdisadvantagesof externalfiles:

1. Thestealermay download thecoder'scodeusing theurl ofthe js file.
2. If two js files are dependent on one another, then a failure in one file may affect theexecutionofthe other dependent file.
3. Thewebbrowser needsto makean additionalhttp requestto getthejscode.
4. A tiny to a large change in the js code may cause unexpected results in all itsdependentfiles.
5. Weneedtocheckeachfilethatdependsonthecommonlycreatedexternaljavascriptfile.
6. Ifit isa fewlines of code, thenbetter toimplement theinternal javascriptcode.

JavaScriptComment

1. JavaScriptcomments
2. AdvantageofjavaScriptcomments
3. Single-lineandMulti-linecomments

The **JavaScript comments** are meaningful way to deliver message. It is used to addinformation about the code, warnings or suggestions so that end user can easily interpret thecode.

TheJavaScriptcommentisignoredbytheJavaScriptenginei.e.embedded inthebrowser.

Advantagesof JavaScriptcomments

TherearemainlytwoadvantagesofJavaScriptcomments.

1. **To make code easy to understand** It can be used to elaborate the code so that end user caneasily understandthe code.

2. **To avoid the unnecessary code** It can also be used to avoid the code being executed.Sometimes, we add the code to perform some action. But after sometime, there may be needtodisablethecode. In suchcase,itisbetter to usecomments.

Types of JavaScriptComments

Therearetwo typesofcomments inJavaScript.

1. Single-lineComment
2. Multi-lineComment

JavaScriptSingleline Comment

Itisrepresentedbydoubleforwardslashes(//).

Itcanbeusedbeforeandafterthestatement.Let'sseethe exampleofsingle-linecomment i.e.added

beforethe statement.

```
1. <script>
2. //Itissinglelinecomment
3. document.write("hellojavascript");
4. </script>
```

TestitNow

Let'sseethe exampleof single-linecommenti.e.addedafterthestatement.

```
1. <script>
2. vara=10;
3. varb=20;
4. varc=a+b;//Itadds valuesof aandbvariable
5. document.write(c);//printssumof10and 20
6. </script>
```

JavaScriptMulti lineComment

Itcanbeused toaddsingle aswellas multilinecomments. So,itismoreconvenient.

Itisrepresentedbyforwardslashwithasteriskthenasteriskwithforwardslash.For example:

```
1./* yourcodehere*/
```

Itcanbeusedbefore, afterand middleofthestatement.

```
1. <script>
2. /*It ismultilinecomment.
3. Itwillnot bedisplayed */
4. document.write("exampleofjavascriptmultilinecomment");
5. </script>
```

javaScriptVariable

A **JavaScript variable** is simply a name of storage location. There are two types of variablesinJavaScript : local variable and global variable.

Therearesomeruleswhiledeclaring aJavaScriptvariable(alsoknownasidentifiers).

1. Namemuststart witha letter (a tozor Ato Z), underscore(_), ordollar($) sign.
2. Afterfirstletterwecanusedigits(0to9),forexamplevalue1.
3. JavaScriptvariablesarecasesensitive,forexamplexandXaredifferentvariables.

CorrectJavaScriptvariables

```
1. varx =10;
2. var_value="sonoo";
```

IncorrectJavaScript variables

```
1.var123=30;
2.var *aa=320;
```

Example of JavaScriptvariable

Let’ssee asimpleexampleofJavaScriptvariable.

```
1. <script>
2. var x= 10;
3. vary =20;
4. var z=x+y;
5. document.write(z);
6. </script>
```

Outputofthe aboveexample

30

JavaScriptlocalvariable

A JavaScript local variable is declared inside block or function. It is accessible within thefunctionorblock only. For example:

```
1. <script>
2. functionabc(){
3. varx=10;//local variable
4. }
5. </script>
```

Or,

```
1. <script>
2. If(10<13){
3. vary=20;//JavaScriptlocalvariable
4. }
5. </script>
```

JavaScriptglobalvariable

A **JavaScript global variable** is accessible from any function. A variable i.e. declaredoutside the function or declared with window object is known as global variable. Forexample:

```
1. <script>
2. vardata=200;//gloabal variable
3. functiona(){
4. document.writeln(data);
5.}
6. functionb(){
7. document.writeln(data);
8.}
9.a();//callingJavaScript function
10.b();
11.</script>
```

JavaScriptGlobalVariable

A **JavaScript global variable** is declared outside the function or declared with windowobject.It can beaccessedfrom anyfunction.

Let'sseethesimpleexampleofglobalvariableinJavaScript.

```
1. <script>
2. varvalue=50;//globalvariable
```

```
3. functiona(){
4. alert(value);
5.}
6. functionb(){
7. alert(value);
8.}
9.</script>
```

DeclaringJavaScriptglobalvariablewithinfunction

To declare JavaScript global variables inside function, you need to use **window object**. Forexample:

```
1.window.value=90;
```

Now it can be declared inside any function and can be accessed from any function. Forexample:

```
1. functionm(){
2. window.value=100;//declaringglobalvariablebywindowobject
3.}
4. functionn(){
5. alert(window.value);//accessingglobalvariable fromotherfunction
6.}
```

Internalsofglobal variable inJavaScript

When you declare a variable outside the function, it is added in the window object internally.Youcan access it through window objectalso. For example:

```
1. varvalue=50;
2. functiona(){
3. alert(window.value);//accessingglobalvariable
4.}
```

OOPSASPECTSINJAVASCRIPT

WhatIsObject-orientedProgramming?

Object-oriented Programming treats data as a crucial element in program development anddoesn'tallowittoflowfreelyaroundthesystem.Ittiesdatamoresecurelytothefunctionthat operates on it and protects it from accidental modification from an outside function. OOPbreaks down a problem into several entities called objects and builds data and functionsaroundtheseobjects.

Basicconceptsof Object-orientedProgramming

Objects

Objectsare the basic run-time bodies in an object-oriented framework. They may represent aplace,aperson,anaccount, atable ofdata, or anythingthat theprogram needsto handle. Objectscanalsorepresentuser-defineddatasuchasvectors,time,andlists.

Consider two objects, “customer” and “account” in a program. The customer object may sendamessagerequesting thebank balance.

Classes

We know that objects hold the data and the functions to manipulate the data. However, thetwo can be bound together in a user-defined data type with the help of classes. Any numberof objects can be created in a class. Each object is associated with the data of type class. Aclassis thereforeacollection ofobjects of similartypes.

For example, consider the class “Fruits”. We can create multiple objects for this class -

FruitMango;

This will create an object mango belonging to the class

fruit.Encapsulation

Encapsulation is the wrapping up/binding of data and function into a single unit called class.Data encapsulation is the most prominent feature of a class wherein the data is not accessibleto the outside world, and only those functions wrapped inside the class can access it. Thesefunctionsserveasthe interfacebetweentheobject’s dataand theprogram.

Inheritance

The phenomenon where objects of one class acquire the properties of objects of another classis called Inheritance. It supports the concept of hierarchical classification. Consider the object“car”that fallsin theclass “Vehicles”and “LightWeight Vehicles”.

In OOP, the concept of inheritance ensures reusability. This means that additional featurescan be added to an existing class without modifying it. This is made possible by deriving anewclass from the existing one.

OOP ConceptsinJavaScript

Now that you are familiar with OOP concepts, this section will show you how JavaScriptimplementsthem.

CreatingObjectsinJavaScript

- Wecancreatean objectusingthestringliteralinJavaScript.

```
varstudent ={
    name:
    "pp",age:21
    ,
    studies:"ComputerScience",
};
document.getElementById("demo").innerHTML=student.name+"
oftheage"+student.age+" studies "+student.studies;
```

- Creatingobjectsusingthenew keyword.

```
var student = new
Object();student.name =
"pp",student.age=21,
student.studies="ComputerScience";
document.getElementById("demo").innerHTML=student.name+"
oftheage"+student.age+" studies "+student.studies;
```

- Creatinganobject usingtheobjectconstructor.

```
function stud(name, age,
    studies){this.name=name;
    this.age =
    age;this.studies=studies;
}
varstudent = stud("Chris", 21,"Computer
Science");document.getElementById("demo").innerHTML=student.name+"
oftheage"+
student.age+" studies"+student.studies;
```

ClassImplementation in JavaScript

JavaScriptusestheES6 standardtodefineclasses.Considerthefollowingexample.

```
classCars{
    constructor(name, maker, price)
     {this.name=name;
     this.maker
     =maker;this.price=pri
     ce;
    }
    getDetails(){
       return(`Thename ofthecar is${this.name}.`)
    }
  }
  let car1 = new Cars('Rolls Royce Ghost', 'Rolls Royce',
  '$315K');letcar2=newCars('Mercedes
  AMGOne','Mercedes','$2700K');console.log(car1.name);
  console.log(car2.maker);conso
le.log(car1.getDetails());Theout
```

put of theabovecodeis

EncapsulationinJavaScript

Encapsulation includes wrapping the property and the function within a single unit. Considerthefollowing example:

```
classEmp_details{
```

```
    constructor(name,id){
        this.name =
        name;this.id = id;
    }
    add_Address(add){
        this.add=add;
    }
    getDetails(){
        console.log(`EmployeeName:${this.name},Address:${this.add}`);
    }
}
letperson1=newEmp_details('Anand',27);person1.ad
d_Address('Bangalore');person1.getDetails();
```

Here,the classholdsthe datavariablesnameandidalongwiththefunctionsadd_AddressandgetDetails. All areencapsulated within theclass Emp_details.

MemoryManagementin JavaScript

Memory management is an essential task when writing a good and effective program in someprogramming languages. This article will help you to understand different concepts ofmemory management in JavaScript. In low-level languages like C and C++, programmersshould careabouttheusage ofmemory insome manualfashion. Onthe other hand,Javascript automatically allocates memory when objects are created into the environment andalso it cleans the memory when an object is destroyed. JavaScript can manage all of these onits own but this does not imply that the developers do not need to worry about the memorymanagementin JavaScript.

Memorymanagementinanyprogramminglanguageinvolvesthreeimportantphases,termedasmemory life-cycle−

- Allocatingthememory whichisrequiredinour program.
- Utilizethe allocatedmemory unit.
- Aftercompletion,clearthememory block.

DifferentStrategiesto AllocateMemoryinJavaScript

Allocatingbyvalueinitialization

InJavaScript,wedonotneedtocareaboutallocatingmemoryforsimplevariables.Wecandirectlya ssignvaluestosomevariables anditwillallocatenecessary memoryonitsown.

Syntax

```
var      variable1      =
<value>var variable2 =
<value>
```

Example

Forsimpleallocationbyvalues,seethe followingexample.

SourceCode

```
<head>
<title>HTMLConsole</title>
</head>
<body>
<h3>OutputConsole </h3>
<p>Output:</p>
<divid="output">
</div>
<divid="opError"style="color:#ff0000">
</div>
<script>
var content
="var error ="
varopDiv=document.querySelector('#output')varopErrDiv=docu
ment.querySelector('#opError')

// actual javascript
codetry{
var
number=52;varst
='my_string';var
student ={
          name:'Smith',
          roll:5,age:23,
};
vararr=[15,null,'another_string'];
        content +="Allocated memory for number:
        "+JSON.stringify(number)+'<br>'content+="Allocatedmemoryforstring:"+JS
        ON.stringify(st)+'<br>'content +="Allocated memory for student:
        "+JSON.stringify(student)+'<br>'content+="Allocatedmemoryforarray:"+JS
        ON.stringify(arr)+'<br>'
}catch(err){
        error+=err
}finally{

// display on output
consoleopDiv.innerHTML=
contentopErrDiv.innerHTM
L=error
}
</script>
</body>
</html>
```

From the above example, it is clear that numbers and strings are single values, and allocationis also simple. But for objects and arrays, JavaScript can also easily allocate the memorybasedon theirvalues.

AllocatingbyFunctionCall

Like variable value assignment, we can also create some memory blocks by calling somefunctions.For example, whenafunctionreturnsa separateobjectitwillautomaticallyassignanew memory block to thesystem.

Syntax

```
Memory_reference=<functioncallwhichreturnsanyvalue>
```

Examples

The following example uses a function that works on an HTML document. So this programwillrun on abrowser orHTML editor.

SourceCode

```
<!DOCTYPEhtml>
<htmllang="en">
<head>
<metacharset="UTF-8"/>
</head>
<body>
<script>
var e
=document.createElement('div');e.innerHTML="<h1
> Header from JavaScript
</h1>"document.body.appendChild(e);
</script>
</body>
</html>
```

In thisexample,theJavaScriptcodeispresentinsidethe <script> tag inHTML.Pleasenotice, in this case, initially, the document does not have any block inside <body>. TheJavaScript creates a new component by calling createElement(), and then a new div block iscreated. This block allocates the memory but only when a function is called. After that, thenewcomponent isaddedasachild ofthebodytagto usethis insidetheHTML document.

UsingpreviouslyAllocatedMemoryinJavaScript

Using previously allocated memory is just reading or writing values from some variableswhichareassignedpreviously.Wecanupdateitsexistingvaluewithsomeothervalues.Seet hefollowing examplefor abetter understanding–

Example

Initially allocating memory for a variable, then reading the value from it. Writing a new valueandagain reading from it.

SourceCode

```
<!DOCTYPEhtml>
<html>
<head>
<title>HTMLConsole</title>
</head>
<body>
<h3>OutputConsole </h3>
<p>Output:</p>
<divid="output">
</div>
<divid="opError"style="color:#ff0000">
</div>
<script>
var content
="var error ="
opDiv=document.querySelector('#output')varopErrDiv=docume
nt.querySelector('#opError')

// actual javascript
codetry{
vara=52;//allocatememory
        content +="Reading value of variable a:
        "+JSON.stringify(a)+'<br>'a=100
        content+="Readingvalueofvariablea:"+JSON.stringify(a)+'<br>'
}
catch(err){
        error+=err
}
finally{

// display on output
consoleopDiv.innerHTML=
contentopErrDiv.innerHTM
L=error
}
</script>
</body>
</html>
```

Deallocatingmemoryblocksin JavaScript

When our purpose is served, we can remove the allocated memory block. In some low-levellanguages, this is a necessary step, otherwise, it may occupy memory spaces over time andthe total system may crash. JavaScript also has native support of Garbage Collector, whichcleans unnecessary memory blocks and cleans up the memory. But sometimes the compilercannot understand whether a block will be used in later cases or not. In such cases, theGarbage Collector does not clean up that memory. To manually remove allocated locations,wecan usethe ‘delete’ keyword beforethe variable name.

Syntax

```
delete<variable_name>
```

The variable must be allocated beforehand, otherwise, it will raise an error while trying todeletethat variable. Let us seeoneexampleto understand this conceptclearly.

Example

SourceCode

```
<!DOCTYPEhtml>
<html>
<head>
<title>HTMLConsole</title>
</head>
<body>
<h3>OutputConsole </h3>
<p>Output:</p>
<divid="output">
</div>
<divid="opError"style="color:#ff0000">
</div>
<script>
var content
="var error ="
varopDiv=document.querySelector('#output')varopErrDiv=docu
ment.querySelector('#opError')

// actual javascript
codetry{
        a="asimplevariable";//allocatememory
        content +="Reading value of variable a:
"+JSON.stringify(a)+'<br>'delete a
        content+="Readingvalueofvariablea:"+JSON.stringify(a)+'<br>'
}
catch(err){
        error+=err
}
finally{

// display on output
consoleopDiv.innerHTML=
contentopErrDiv.innerHTM
L=error
}
</script>
</body>
</html>
```

Note − The ‘delete’ keyword will only work when the variable is allocated directly (withoutusingthe var orlet keyword).

Conclusion

Working with any programming language, the programmer should know the overall conceptin depth. Memory management is one of the concerning issues, in which developers shouldproperly manage the memory otherwise it will occupy unnecessary memory blocks and createmajor problems in the environment. JavaScript provides an additional garbage collector toolthat automatically cleans the unused memory blocks. However, we can also deallocatememoryby using the ‘delete’ keywordjust before the variable name

AJAXfor dataexchangewithserverjQueryFramework

ShortDescriptionofAJAX

Ajaxis onlya namegiven to aset oftools that werepreviously existing.

The main part is XMLHttpRequest, a server-side object usable in JavaScript, that wasimplementedin InternetExplorer sincethe4.0 version.

Togetdataontheserver, XMLHttpRequestprovidestwomethods:

1. open: Creates aconnection
2. send: Sends arequest totheserver

Datafurnishedbytheserver willbefoundin theattributesoftheXMLHttpRequestobject:

1. responseXmlforan XMLfile, or
2. responseTextforaplaintext

TakenotethatanewXMLHttpRequestobjecthastobecreatedforeachnew datarequest.

We have to wait for the data to be available to process it, and in this purpose, the state ofavailabilityof datais given bythereadyStateattributeofXMLHttpRequest.

AttributesofXMLHttpRequestClass

1. *readyState*:Thecodesuccessivelychangesvaluefrom0to4

   0:Notinitialized
   1:Connectionestablished
   2: Request
   received3: Answer
   in process4:Finished

2. *status*:200is OK

   404 ifthepageis not found

3. *responseText*:Holdsloadeddataasastringofcharacters.
4. *responseXml*:HoldsanXMLloadedfile,DOM'smethodallowstoextractdata.
5. *onreadystatechange*: Propertythattakesa functionasvaluethatisinvoked whenthe readystatechangeeventisdispatched.

MethodsofXMLHttpRequestClass

1. *open(mode,url,boolean)*:*mode*:typeof request, GET orPOST

   url:thelocationofthefile,withapath
   boolean:true (asynchronous)/false(synchronous)
   optionally,alogin andapassword maybeadded toarguments

2. *send("string")*:string: POSTdata, nullfora GETcommand
3. *abort()*: CancelsthecurrentHTTPrequest
4. *getAllResponseHeaders()*:RetrievesthevaluesofalltheHTTPheaders
5. getResponseHeader(string):RetrievesthevalueofanHTTPheaderfromtheresponsebody
   string: nameofhttpheader
6. *setRequestHeader(name,value)*:Addsanewhttpheaderintherequest
   name:name/identifieroftheheader
   value: value oftheheader

UsingtheCode

Hereisasimplefunction'AjaxRequest' whichisimplementedtoperform the AJAXrequests.

JavaScript

Shrink▲

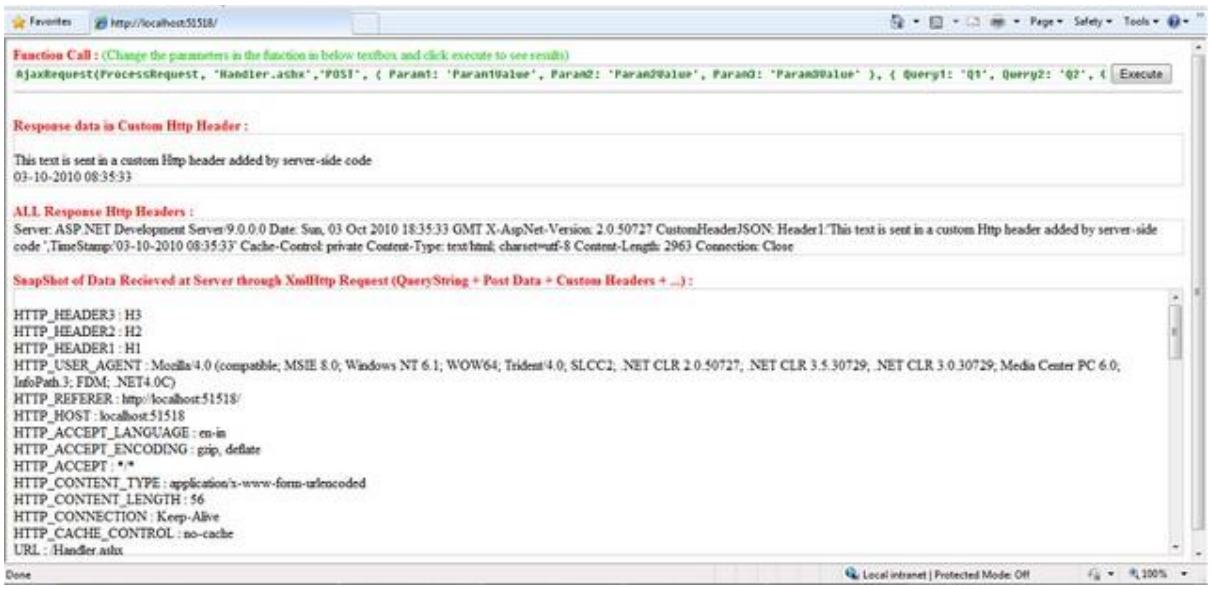
```
functionAjaxRequest(ReadyHandler,URL,Method,Params,QueryString,HttpHeaders){if
(URL ==null) { alert("RequestURL isEmpty");}
else{

if (window.XMLHttpRequest) {// code for IE7+, Firefox, Chrome, Opera,
Safarixmlhttp=newXMLHttpRequest();
      }
else{//codeforIE6,IE5
xmlhttp=newActiveXObject("Microsoft.XMLHTTP");
      }

//An anonymous function is assigned to the event
indicator.xmlhttp.onreadystatechange=function() {

//200 statusmeansok,otherwise someerror code isreturned,404forexample
//The4 statemeansfortheresponseisready andsentbytheserver.if
(xmlhttp.readyState==4&&xmlhttp.status==200){
ResponseText = xmlhttp.responseText;//get text data in the
responseResponseXML = xmlhttp.responseXML; //get xml data in the
responseResponseHeaderJSON= xmlhttp.getResponseHeader
                        ("CustomHeaderJSON");// Extract Data in http
headerResponseHeaders=xmlhttp.getAllResponseHeaders();//Getastring
                                    //containing allhttpheadersreturnedby server

// Make all the results available in the ReadyHandler via
prototyping.ReadyHandler.prototype.ResponseText =
ResponseText;ReadyHandler.prototype.ResponseHeaderJSON=Response
HeaderJSON;ReadyHandler.prototype.ResponseXML =
ResponseXML;ReadyHandler.prototype.ResponseHeaders=ResponseHea
ders;
// Execute function passed as
ReadyHandelrReadyHandler();
         }
      }

//IfquerystringisprovidedAttachittotheurl
                        if (QueryString != "")
{varQueryStringData="";
for (QueryStringAttributeinQueryString)
{QueryStringData=QueryStringAttribute+"="+
                        QueryString[QueryStringAttribute]+"&"+QueryStringData;
         }
```

```
QueryStringData=QueryStringData.substring(0,
                                          QueryStringData.lastIndexOf('&'));
        URL=URL+ "?"+escape(QueryStringData);          //Here iswhere the
                                          //querystringiaattached totherequesturl.
    }

//POSTorGETURLofthescripttoexecute.trueforasynchronous
//(false for
synchronous).xmlhttp.open(Metho
d,URL,true);
xmlhttp.setRequestHeader("Content-type", "application/x-www-form-
urlencoded");if (HttpHeaders!="") {
varHttpHeadersData= "";
for (HttpHeaderNameinHttpHeaders)
{xmlhttp.setRequestHeader(HttpHeaderNam
e,
                          HttpHeaders[HttpHeaderName]);//Herethecustomheadersareadded
        }
    }

            //Post data provided then assemble it into single string to be posted to
            serverif (Params!="") {
varParamsData= "";
for(ParamNameinParams){
ParamsData=ParamName+ "="+Params[ParamName]+"&"+ParamsData;
        }
ParamsData=ParamsData.substring(0,ParamsData.lastIndexOf('&'));
    }

xmlhttp.send(ParamsData);//Sendtherequestwiththepostdata
  }
}
```

[You can find the complete implementation with sufficient comments in the source

code.]Itcan give amoreclear ideaof usingAJAX in your applications.

In the demo application, you can test the 'AjaxRequest' function by changing the parametersthat arepassed to it.



Actuallyallthecodethatistyped inthetextboxisexecutedasJavaScriptcodeonclickof'Execute'button.This is doneusing theeval()function.

JavaScript

```
FunctionCall =
document.getElementById('FunctionCode').value;eval(FunctionC
all);
```

Function UsageJavaScrip t

```
functionAjaxRequest(ReadyHandler,URL,Method,Params,QueryString,HttpHeaders)
```

Description

->*ReadyHandler*:Functiontobecalledaftersuccessfulcompletionofthe AJAXrequest

Note: On successful completion of the request, the result of the request will be available in thefunctionpassedas ReadyHandler.
Theresult ofrequest willbein4variables,namely:

- ResponseText: Textresponsefromserver
- ResponseHeaderJSON:CustomHTTPHeaderStringvalue

This header string may contain a single string value or a you can also use a JSON format formultiplevalues which thencan beparsedinReadyHandler(as shownin theexample).

- ResponseHeaders:String containingallResponseHTTPHeaders
- ResponseXML: XML response from server (XML object available only when the Responsecontainsa proper XML)

->URL:ThisparametertakestheURLtowhichtherequest istobesent

->Method:Methodofrequest"GET"/"POST"

->Params:POST datatobe senttoserver.ExpectsaJSONformattednamevaluepairs

->QueryString: Data to be sent to the server as QueryString. Expects a JSON formatted namevaluepairs

->HttpHeaders:Datatobe sentas HTTPHeaders.ExpectsJSONformattedname valuepairs

Note: While sending the data in headers, you have to take care only ASCII characters where charCoderanging from 32 to 126 are sent or you may get unexpected results. See RFC documentation forHTTP.

The ReadyHandlercan contain the code which will dynamically change the contents of thewebpagebased on theresponsedata.

For example, in the demo application, I have used 'ProcessRequest()' as the Ready handlerwhichsets theresponse in therespective<Div>.

```
functionProcessRequest(){

// // Assign the content to the
formdocument.getElementById('ResponseTextDiv').innerHTML=ResponseText;

document.getElementById('ResponseXMLDiv').innerHTML =
ResponseHeaders;eval("var CustomHeaders={"+ResponseHeaderJSON +"};");
var
header;varallHeaders="
<br/>";
if(CustomHeaders!= ""){
for(headerinCustomHeaders){
allHeaders=allHeaders+CustomHeaders[header]+"<br/>"
      }
   }
document.getElementById('ResponseHeadersDiv').innerHTML=allHeaders;
}
```

Example:

JavaScript

```
AjaxRequest(ProcessRequest,'Handler.ashx','POST',
            {Param1:'Param1Value',Param2:'Param2Value',Param3:'Param3Value'},
            {Query1:'Q1',Query2: 'Q2', Query3: 'Q3'},
            {Header1: 'H1',Header2:'H2',Header3: 'H3'}
              );
```

Forhandlingtheclientrequest,Ihaveimplementedasimple**GenericHandler(.ashx).**

You can access all the data (query string + Post Data + HTTP Headers) that is sent by theclientbrowser in AJAX request.

Inthe Generichandler,thedata isaccessibleviathecontext.Requestobject.

Though you can access all the data together in context.Request.Params[], you can access the dataseparatelyas follows:

- QueryString:context.Request.QueryString[[index/string]]
- HttpHeaders:context.Request.Headers[[index/string]]

In the example application, what I have done is just echo back the data which is received intherequest along with acustom HTTP header added.

JavaScript

```
foreach(stringParamincontext.Request.Params)
 {
ParamsData="<br/>"+ Param+"
            :"+context.Request.Params[Param].ToString()+ParamsDat
            a;
 }
context.Response.Write(ParamsData);
```

The above lines capture the data in the request and send it back in the

response.Foraddingan extra customHTTP header in response:

C#

```
context.Response.AddHeader("CustomHeaderJSON",CustomHeaderJSON);
```

As you see, the context.Responseobject is used to assemble the response which is to be sentbackto thebrowser.

Differentmethods of *context.Response*can beusedto do this.

'*CustomHeaderJSON*' can contain a string , but I have created a JSON format string forsupportingmultiplevalues.Thevaluesarethenparsed atclientsideusing JavaScript.

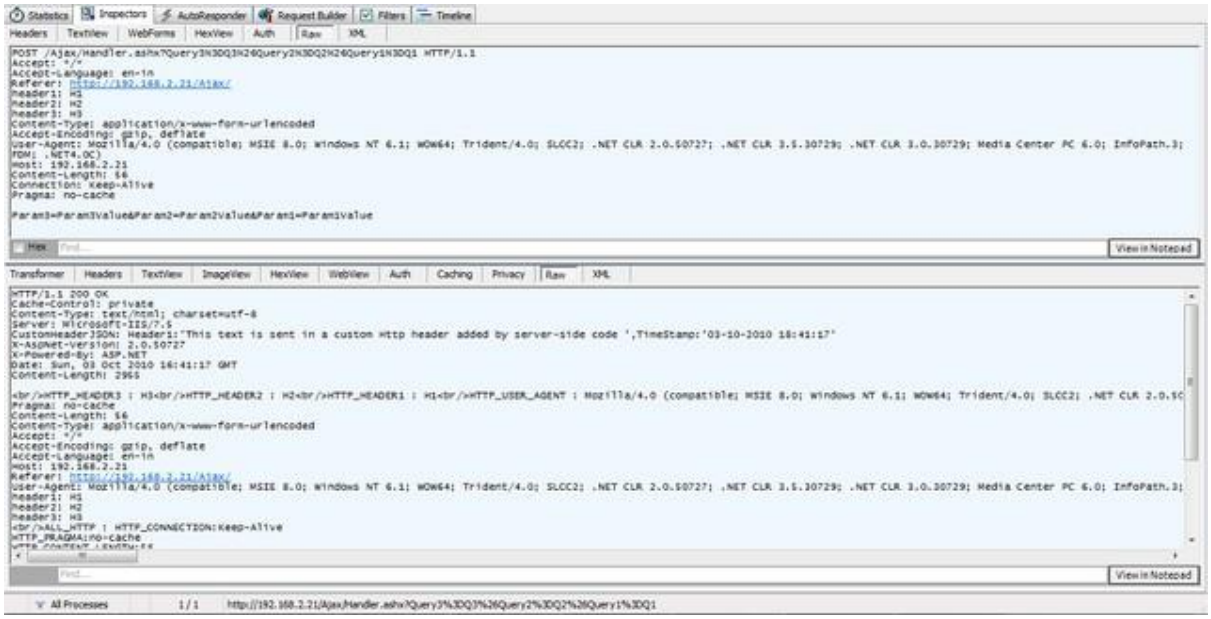
I have just used string concatenate for creating it, but you can also use different JSONparsers/Encoders available athttp://www.json.org/.

You can also use JSON strings to exchange data through AJAX. It is sometimes better to useJSONthan XML. Using JSONresults in less bytestransferred than XML.

Pointsof Interest

This is a basic implementation of AJAX and the function can be tuned and modifiedaccordingto needs and reconfigurability.

Hereishowthe request andresponselookslike[HTTP requestinFiddler]:



jQueryEvents

jQueryeventsarethe actionsthatcan bedetected byyourwebapplication.They areusedtocreatedynamicweb pages.An eventshowstheexactmoment whensomething happens.

Thesearesomeexamplesofevents.

- Amouse click
- AnHTMLformsubmission
- Aweb pageloading
- Akeystrokeon thekeyboard
- Scrollingofthewebpageetc.

Theseeventscanbe categorizedonthebasistheir types:

Mouse Events

- click
- dblclick
- mouseenter
- mouseleave

KeyboardEvents

- keyup
- keydown
- keypress

Form Events

- submit
- change
- blur
- focus

Document/WindowEvents

- load
- unload
- scroll
- resize

Note: A term "fires" is generally used with events. For example: The click event fires in the momentyou press akey.

Syntaxforeventmethods

Most of the DOM events have an equivalent jQuery method. To assign a click events to allparagraph onapage, dothis:

```
1.$("p").click();
```

Thenextstepdefines whatshouldhappen whentheevent fires.Youmust passafunctiontotheevent.

UNIT –III

REACTJS

ReactIntroduction

ReactJS is a declarative, efficient, and flexible JavaScript library for building reusable UIcomponents. It is an open-source, component-based front end library responsible only for theview layer of the application. It was created by **Jordan Walke,** who was a software engineerat **Facebook.** It was initially developed and maintained by Facebook and was later used in itsproducts like **WhatsApp**&**Instagram.** Facebook developed ReactJS in **2011** in its newsfeedsection,but it was released to thepublicin themonthof**May 2013.**

Today, most of the websites are built using MVC (model view controller) architecture. InMVC architecture, React is the 'V' which stands for view, whereas the architecture isprovidedby the Redux orFlux.

A ReactJS application is made up of multiple components, each component responsible foroutputtingasmall,reusablepieceof HTMLcode.Thecomponentsarethe heartof all Reactapplications. These Components can be nested with other components to allow complexapplications to be built of simple building blocks. ReactJS uses virtual DOM basedmechanism to fill data in HTML DOM. The virtual DOM works fast as it only changesindividualDOM elements insteadof reloadingcompleteDOM every time.

To create React app, we write React components that correspond to various elements. Weorganize these components inside higher level components which define the applicationstructure. For example, we take a form that consists of many elements like input fields,labels, or buttons. We can write each element of the form as React components, and then wecombine it into a higher-level component, i.e., the form component itself. The formcomponentswould specify the structureof theform along with elements inside ofit.

WhylearnReactJS?

Today, many JavaScript frameworks are available in the market(like angular, node), but still,React came into the market and gained popularity amongst them. The previous frameworksfollowthetraditionaldata flowstructure,which usestheDOM(DocumentObjectModel).
DOM is an object which is created by the browser each time a web page is loaded. Itdynamicallyaddsorremovesthedataatthebackendandwhenanymodificationsweredone,then each time a new DOM is created for the same page. This repeated creation of DOMmakesunnecessarymemory wastageand reducesthe performanceof theapplication.

Therefore, a new technology ReactJS framework invented which remove this drawback.ReactJS allows you to divide your entire application into various components. ReactJS stillused the same traditional data flow, but it is not directly operating on the browser's DocumentObjectModel(DOM) immediately;instead,it

operatesonavirtualDOM.Itmeansrather

than manipulating the document in a browser after changes to our data, it resolves changes ona DOM built and run entirely in memory. After the virtual DOM has been updated, Reactdetermines what changes made to the actual browser's DOM. The React Virtual DOM existsentirely in memory and is a representation of the web browser's DOM. Due to this, when wewrite a React component, we did not write directly to the DOM; instead, we are writingvirtualcomponents that react will turn into theDOM.

ReactRouterand SinglePageApplications

PreparingtheReact App

Installingthecreate-react-appPackage

Ifyou'veeverhadthe chancetotryReact,you'veprobablyheardaboutthe**create-react-app** package, which makes it super easy to start with a React development

environment.Inthis tutorial, wewill usethis packageto initiateour Reactapp.

So, first of all, make sure you have Node.js installed on your computer. It will also installnpm foryou.

Inyourterminal,run`npm install-g create-react-app`.Thiswillgloballyinstall **create-react-app** onyourcomputer.

Once it is done, you can verify whether it is there by typing `create-react-app -`

v.Creatingthe React Project

Now it's time to build our React project. Just run `create-react-app multi-page-app`. You can, ofcourse,replace`multi-page-app`with anything you want.

Now,**create-react-app**willcreateafoldernamed**multi-page-app**.Justtype`cd multi-page-app` to change directory, and now run `npm start` to initialize a local

server.That'sall. You have aReact apprunning on your localserver.

Nowit'stimetocleanthedefaultfilesand prepareourapplication.

Inyour`src`folder,delete everythingbut`App.js`and `index.js`.Thenopen`index.js`andreplacethecontent withthecodebelow.

```
importReactfrom'react';
importReactDOMfrom'react-dom';
importAppfrom'./App';

ReactDOM.render(<App/>,document.getElementById('root'));
```

Ibasicallydeleted the`registerServiceWorker`relatedlinesandalsothe`import'./index.css';`line.

Also,replaceyourApp.jsfilewith thecodebelow.

```
importReact,{Component}from'react';

classApp extendsComponent{
render(){
return(
<divclassName="App">

</div>

  );
 }
}

exportdefault App;
```

Nowwewillinstall therequired modules.

In your terminal, type the following commands to install the **react-router** and **react-transition-group** modules respectively.

```
npminstallreact-router-dom--save

npminstallreact-transition-group@1.x --save
```

After installing the packages, you can check the package.json file inside your main projectdirectoryto verify thatthemodules areincludedunder**dependencies.**

Router Components

Therearebasicallytwodifferentrouteroptions:**HashRouter**and**BrowserRouter**.

As the name implies, **HashRouter** uses hashes to keep track of your links, and it is suitablefor static servers. On the other hand, if you have a dynamic server, it is a better option touse**BrowserRouter**,consideringthefact thatyour URLs willbeprettier.

Once you decide which one you should use, just go ahead and add the component toyourindex.jsfile.

```
import{HashRouter }from 'react-router-dom'
```

The next thing is to wrap our <App>component with the router

component.Soyourfinal index.jsfileshould look like this:

```
importReactfrom'react';
```

```
importReactDOMfrom'react-dom';
import{HashRouter} from'react-router-dom'
importAppfrom'./App';

ReactDOM.render(<HashRouter><App/></HashRouter>,document.getElementById('root'));
```

If you're using a dynamic server and prefer to use **BrowserRouter**, the only difference wouldbeimporting the**BrowserRouter**and usingit to wrap the <App>component.

By wrapping our <App>component, we are serving the **history** object to our application, andthusotherreact-router components cancommunicate with each other.

Inside<App/>Component

Insideour<App>component,wewill havetwocomponents named <Menu>and <Content>.Asthenamesimply,theywill holdthenavigationmenu anddisplayedcontentrespectively.

Createafoldernamed**"components"**inyoursrcdirectory,andthencreate theMenu.js andContent.jsfiles.

Menu.js

Let'sfillin ourMenu.jscomponent.

Itwillbe astateless functionalcomponent sincewedon'tneed states andlife-cyclehooks.

```
importReactfrom'react'

const Menu =()=>{
return(
<ul>
<li>Home</li>

<li>Works</li>

<li>About</li>

</ul>

  )
}

exportdefaultMenu
```

Herewehavea<ul>tag with<li>tags,which will beourlinks.

Nowaddthe followinglinetoyour **Menu** component.

```
import{Link}from'react-router-dom'
```

Andthen wrapthecontentof the<li>tags withthe <Link>component.

The<Link>component isessentially a**react-router** componentacting likean<a>tag,but itdoesnot reload yourpagewith a new target link.

Also,if youstyleyouratagin CSS, youwill noticethatthe<Link>componentgets thesamestyling.

Notethat thereis amoreadvancedversion ofthe<Link>component, whichis<NavLink>.Thisoffersyouextrafeaturesso that youcan style theactivelinks.

Nowweneedto define whereeach linkwill navigate.For thispurpose, the<Link>componenthasatoprop.

```
importReactfrom'react'
import{Link}from'react-router-dom'

const Menu =()=>{
return(
<ul>
<li><Linkto="/">Home</Link></li>
<li><Linkto="/works">Works</Link></li>
<li><Linkto="/about">About</Link></li>
</ul>

 )
}

exportdefaultMenu
```

Content.js

Insideour<Content>component, wewilldefinethe**Routes**to match the**Links.**

WeneedtheSwitchandRoutecomponents from**react-router-dom.**So,firstofall,importthem.

```
import{Switch,Route}from'react-router-dom'
```

Second of all, import the components that we want to route to. These are the Home, WorksandAboutcomponentsforour example.Assuming you havealready createdthosecomponentsinside the**components**folder,wealso need toimport them.

```
importHomefrom'./Home'
```

```
import Works from

'./Works'importAboutfrom'./

About'
```

Those components can be anything. I just defined them as stateless functional componentswith minimum content. An example template is below. You can use this for all threecomponents,but just don't forget to changethe names accordingly.

```
importReactfrom'react'

const Home=()=>{
return(
<div>
    Home
</div>

 )
}

exportdefaultHome
```

Switch

Weusethe<Switch>component togroup our<Route>components.**Switch**looksforallthe**Routes** and thenreturns thefirst matching one.

Route

Routesarecomponentscalling yourtargetcomponent ifitmatches

thepathprop.Thefinal version of ourContent.jsfilelooks likethis:

```
importReactfrom'react'
import{Switch,Route}from'react-router-dom'
import Homefrom'./Home'
 importWorksfrom'./Works'
 importAboutfrom'./About'

const Content=()=>{
return(
<Switch>
<Routeexactpath="/"component={Home}/>

<Routepath="/works"component={Works}/>
```

```
<Routepath="/about"component={About}/>

</Switch>

  )
}

exportdefault Content
```

Noticethat the extra`exact`propis requiredforthe**Home**component, whichis themaindirectory. Using `exact`forces the **Route** to match the exact pathname. If it's not used, otherpathnames starting with `/` would also be matched by the **Home** component, and for each link,it would only display the**Home**component.

Nowwhen youclick themenulinks, your appshould beswitchingthecontent.

AnimatingtheRoute Transitions

So far, we have a working router system. Now we will animate the route transitions. In ordertoachievethis, wewill usethe**react-transition-group**module.

We will be animating the *mounting* state of each component. When you route differentcomponents with the **Route** component inside **Switch**, you are essentially *mounting* and*unmounting*different components accordingly.

We will use **react-transition-group** in each component we want to animate. So you can havea different mounting animation for each component. I will only use one animation for all ofthem.

Asanexample,let's use the`<Home>`component.First,

we need to import

CSSTransitionGroup.`import{CSSTransitionGroup}from`

`'react-transition-group'`

Thenyou needto wrapyour contentwith it.

Sincewearedealingwith themountingstate ofthe component,weenable`transitionAppear`andset a timeout for it. We also disable `transitionEnter` and `transitionLeave`, since these are only validonce the component is mounted. If you are planning to animate any children of thecomponent,you havetousethem.

Lastly,addthe specific`transitionName`so thatwecan referto itinsidethe CSSfile.

```
importReactfrom'react'
import{CSSTransitionGroup}from'react-transition-group'
import'../styles/homeStyle.css'
```

```
const Home=()=>{
return(
<CSSTransitionGroup
transitionName="homeTransition"
transitionAppear={true}
transitionAppearTimeout={500}
transitionEnter={false}
transitionLeave={false}>
<div>
      Home
</div>

</CSSTransitionGroup>

 )
}

exportdefaultHome
```

Wealsoimported aCSS file,wherewedefinetheCSStransitions.

```
.homeTransition-appear{
opacity: 0;
}

.homeTransition-appear.homeTransition-appear-active{
opacity: 1;
transition:all.5sease-in-out;
}
```

Ifyou refresh thepage, you shouldseethe fade-ineffect of the**Home**component.

If you apply the same procedure to all the other routed components, you will see theirindividualanimations when you changethe content with your**Menu.**

Conclusion

In this tutorial, we covered the **react-router-dom** and **react-transition-group** modules.However, there's more to both modules than we covered in this tutorial. Here is a **workingdemo**of what was covered.

So,tolearn morefeatures, alwaysgothrough the documentation ofthemodules youare

using.

Over the last couple of years, React has grown in popularity. In fact, we have a number ofitems in the marketplace that are available for purchase, review, implementation, and so on. Ifyou'relookingforadditionalresourcesaroundReact,don't hesitatetocheckthemout.

ReactForms

HTML form elements work a bit differently from other DOM elements in React, becauseform elements naturally keep some internal state. For example, this form in plain HTMLacceptsa singlename:

```
<form>
<label>
   Name:
<inputtype="text"name="name"/>
</label>
<inputtype="submit"value="Submit"/>
</form>
```

This form has the default HTML form behavior of browsing to a new page when the usersubmits the form. If you want this behavior in React, it just works. But in most cases, it'sconvenient to have a JavaScript function that handles the submission of the form and hasaccess to the data that the user entered into the form. The standard way to achieve this is withatechniquecalled "controlled components".

ControlledComponents

In HTML, form elements such as <input>, <textarea>, and <select>typically maintain their ownstate and update it based on user input. In React, mutable state is typically kept in the statepropertyofcomponents, and only updated with setState().

We can combine the two by making the React state be the "single source of truth". Then theReact component that renders a form also controls what happens in that form on subsequentuser input. An input form element whose value is controlled by React in this way is called a"controlledcomponent".

For example, if we want to make the previous example log the name when it is submitted, wecanwritetheform asacontrolled component:

```
classNameFormextendsReact.Component{
constructor(props){
super(props);this.state={v
alue:''};
this.handleChange=this.handleChange.bind(this);this.handleSub
mit=this.handleSubmit.bind(this);
}

handleChange(event){this.setState({value:event.target.value});}
handleSubmit(event){
alert('A name was submitted:
'+this.state.value);event.preventDefault();
}
```

```
render(){
return(
<form
        onSubmit={this.handleSubmit}><label>
        Name:
<inputtype="text"value={this.state.value}onChange={this.handleChange}/></label>
<inputtype="submit"value="Submit"/>
</form>
);
}
}
```

TryitonCodePen

Sincethevalueattributeisset onour formelement, thedisplayed valuewillalwaysbethis.state.value, making the React state the source of truth. Since handleChange runs on everykeystroketo updatethe React state,thedisplayedvalue will updateas theuser types.

With a controlled component, the input's value is always driven by the React state. While thismeans you have to type a bit more code, you can now pass the value to other UI elements too,orreset it from other event handlers.

ThetextareaTag

In HTML,a<textarea>elementdefinesitstextbyitschildren:

```
<textarea>
  Hello there, thisissometextinatextarea
</textarea>
```

InReact,a<textarea>usesavalueattributeinstead.Thisway,aformusinga<textarea>canbewrittenvery similarly to aform that uses asingle-lineinput:

```
classEssayFormextendsReact.Component{
constructor(props){
super(props);
this.state={value:'Pleasewriteanessayaboutyourfavorite DOMelement.'};this.handleChange=this.
handleChange.bind(this);this.handleSubmit=this.handleSubmit.bind(this);
}

handleChange(event){this.setState({value:event.target.value});}
handleSubmit(event){
alert('An essay was submitted:
'+this.state.value);event.preventDefault();
}

render(){
return(
<formonSubmit={this.handleSubmit}>
<label>
        Essay:
<textareavalue={this.state.value} onChange={this.handleChange}/></label>
<inputtype="submit"value="Submit"/>
</form>
```

```
);
}
}
```

Notice that this.state.value is initialized in the constructor, so that the text area starts off withsome textin it.

The select Tag

In HTML,<select>createsadrop-downlist.For example,this HTMLcreatesadrop-downlistofflavors:

```
<select>
<optionvalue="grapefruit">Grapefruit</option>
<optionvalue="lime">Lime</option>
<optionselectedvalue="coconut">Coconut</option>
<optionvalue="mango">Mango</option>
</select>
```

NotethattheCoconut optionisinitiallyselected, becauseofthe selectedattribute.React,insteadofusingthisselectedattribute,usesavalueattributeon theroot selecttag. Thisismoreconvenient in a controlled component because you only need to update it in one place. Forexample:

```
classFlavorFormextendsReact.Component{
constructor(props){
super(props);this.state={value:'
coconut'};
this.handleChange=this.handleChange.bind(this);this.handleSub
mit=this.handleSubmit.bind(this);
}

handleChange(event){this.setState({value:event.target.value});}
handleSubmit(event){
alert('Your favoriteflavor is:
'+this.state.value);event.preventDefault();
}

render(){
return(
<formonSubmit={this.handleSubmit}>
<label>
      Pickyourfavoriteflavor:
<selectvalue={this.state.value}onChange={this.handleChange}><optionv
alue="grapefruit">Grapefruit</option>
<optionvalue="lime">Lime</option>
<optionvalue="coconut">Coconut</option>
<optionvalue="mango">Mango</option>
</select>
</label>
<inputtype="submit"value="Submit"/>
</form>
);
}
}
```

TryitonCodePen

Overall, this makes it so that <input type="text">, <textarea>, and <select>all work very similarly - theyall accept avalueattributethatyou can usetoimplement acontrolled component.

Note

Youcanpassanarray intothevalueattribute,allowing youto selectmultipleoptions ina selecttag:

<selectmultiple={true}value={['B','C']}>

ThefileinputTag

In HTML, an <input type="file">lets the user choose one or more files from their device storagetobe uploaded to a server ormanipulated by JavaScriptviatheFileAPI.

<inputtype="file"/>

Because its value is read-only, it is an **uncontrolled** component in React. It is discussedtogetherwith otheruncontrolled componentslater in thedocumentation.

HandlingMultipleInputs

Whenyouneedto handle multiplecontrolledinputelements,you canaddanameattributetoeach element and let the handler function choose what to do based on the value ofevent.target.name.

Forexample:

```
classReservationextendsReact.Component{
constructor(props){
super(props);this.st
ate={isGoing:true,
numberOfGuests:2
};

this.handleInputChange=this.handleInputChange.bind(this);
}

handleInputChange(event){
consttarget =event.target;
const value
=target.type==='checkbox'?target.checked:target.value;constname=
target.name;
this.setState({[n
ame]:value});
}

render(){
return(
<form>
```

```
<label>
        Isgoing:
<input
name="isGoing"
                                type="checkbox"
          checked={this.state.isGoing}
onChange={this.handleInputChange}/>
</label>
<br/>
<label>
        Numberofguests:
<input
name="numberOfGuests"
                                        type="number"
          value={this.state.numberOfGuests}
onChange={this.handleInputChange}/>
</label>
</form>
);
}
}
```

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Note how we used the ES6 computed property namesyntax to update the state keycorrespondingto thegiven input name:

```
this.setState({[n
ame]:value});
```

ItisequivalenttothisES5code:

```
varpartialState={};partialState[name]=value;this.setState(partialS
tate);
```

Also, since setState() automatically merges a partial state into the current state, we only neededtocall it with thechanged parts.

ControlledInputNullValue

Specifyingthevaluepropona controlled componentpreventstheuser fromchanging theinput unless you desire so. If you've specified a value but the input is still editable, you mayhaveaccidentally setvalueto undefinedornull.

Thefollowingcodedemonstratesthis. (Theinputislockedat firstbutbecomeseditable afterashortdelay.)

```
ReactDOM.createRoot(mountNode).render(<inputvalue="hi"/>);

setTimeout(function(){ReactDOM.createRoot(mountNode).render(<
inputvalue={null}/>);
},1000);
```

AlternativestoControlled Components

It can sometimes be tedious to use controlled components, because you need to write an eventhandler for every way your data can change and pipe all of the input state through a Reactcomponent. This can become particularly annoying when you are converting a preexistingcodebase to React, or integrating a React application with a non-React library. In thesesituations, you might want to check out uncontrolled components, an alternative technique forimplementinginput forms.

IntroductiontoRedux

ReduxToolkit

Redux Toolkitis our official recommended approach for writing Redux logic. It wrapsaround the Redux core, and contains packages and functions that we think are essential forbuilding a Redux app. Redux Toolkit builds in our suggested best practices, simplifies mostReduxtasks,preventscommonmistakes,andmakesit easiertowriteReduxapplications.

RTK includes utilities that help simplify many common use cases, including store setup,creating reducers and writing immutable update logic, and even creating entire "slices" ofstateat once.

Whether you're a brand new Redux user setting up your first project, or an experienced userwho wants to simplify an existing application, **Redux Toolkit**can help you make your Reduxcodebetter.

Redux Toolkit is available as a package on NPM for use with a module bundler or in a Nodeapplication:

```
# NPM
npminstall@reduxjs/toolkit

# Yarn
yarnadd @reduxjs/toolkit
```

CreateaReactReduxApp

The recommended way to start new apps with React and Redux is by using the officialRedux+JS templateor Redux+TS templatefor Create React App, which takes advantage of**ReduxToolkit**and ReactRedux's integration withReact components.

```
# Redux +PlainJStemplate
npxcreate-react-appmy-app--templateredux

#Redux+TypeScripttemplate
npxcreate-react-appmy-app--templateredux-typescript
```

ReduxCore

The Redux core library is available as a package on NPM for use with a module bundler or inaNodeapplication:

```
# NPM
npminstallredux
```

```
#
Yarnyarnaddredux
```

ItisalsoavailableasaprecompiledUMDpackagethatdefinesawindow.Reduxglobalvariable.TheUMDpackagecan beusedasa<script>tagdirectly.

Formoredetails,seetheInstallationpage.

Basic Example

The whole global state of your app is stored in an object tree inside a single *store*. The onlyway to change the state tree is to create an *action*, an object describing what happened, and*dispatch* it to the store. To specify how state gets updated in response to an action, you writepure*reducer* functionsthat calculate anewstate basedon theold stateandtheaction.

```
import{createStore}from'redux'

/**
 * Thisisareducer- afunction thattakesacurrentstatevalueand an
 * actionobjectdescribing"whathappened",andreturnsanewstatevalue.
 * Areducer'sfunctionsignatureis:(state,action)=>newState
 *
 * TheReduxstateshouldcontainonlyplainJSobjects,arrays,andprimitives.
 * Therootstatevalueisusually an object. It'simportantthatyou should
 * notmutatethestateobject,butreturn anewobject ifthestatechanges.
 *
 * Youcan useanyconditionallogicyou wantin areducer.Inthisexample,
 * weuseaswitch statement,butit'snotrequired.
 */
functioncounterReducer(state = { value: 0 }, action)
 switch (action.type){
case'counter/incremented' retur
n { value: state.value + 1
 case'counter/decremented' ret
urn { value: state.value - 1
 default:
return state
  }
}

//CreateaRedux storeholding thestateofyourapp.
// Its API is { subscribe, dispatch, getState
}.letstore= createStore(counterReducer)

//You can use subscribe()toupdatetheUIinresponsetostatechanges.
//Normallyyou'duseaviewbindinglibrary(e.g.ReactRedux)ratherthansubscribe()directly.
//Theremaybeadditionalusecaseswhereit'shelpfulto

subscribeaswell.store.subscribe(()=> console.log(store.getState()))

//Theonly way to mutatetheinternalstateistodispatch anaction.
// The actions can be serialized, logged or stored and later
replayed.store.dispatch({ type: 'counter/incremented' })
//{value: 1}
store.dispatch({ type: 'counter/incremented' })
//{value: 2}
store.dispatch({ type: 'counter/decremented' })
```

```
//{value: 1}
```

Instead of mutating the state directly, you specify the mutations you want to happen withplain objects called *actions*. Then you write a special function called a *reducer* to decide howeveryaction transforms theentireapplication's state.

In a typical Redux app, there is just a single store with a single root reducing function. Asyour app grows, you split the root reducer into smaller reducers independently operating onthe different parts of the state tree. This is exactly like how there is just one root componentina React app, but it is composed outof many small components.

This architecture might seem like a lot for a counter app, but the beauty of this pattern is howwell it scales to large and complex apps. It also enables very powerful developer tools,because it is possible to trace every mutation to the action that caused it. You can record usersessionsand reproducethem just by replaying every action.

ReduxToolkitExample

ReduxToolkitsimplifiestheprocessof writingReduxlogicandsettingupthestore. WithReduxToolkit, that samelogiclooks like:

```
import { createSlice, configureStore }

from'@reduxjs/toolkit'constcounterSlice= createSlice({
name:
'counter' initial
State: value 0
  },
reducers:
 incremented:state=>{
//Redux Toolkitallowsustowrite"mutating"logicinreducers.It
//doesn'tactuallymutatethestatebecauseitusestheImmerlibrary,
//which detectschangestoa"draftstate"and producesabrand new
// immutable state based off those
changes:state.value+=1
  },
decremented: state =>
{state.value -= 1
  }
 }
})

exportconst { incremented, decremented } =

counterSlice.actions;const store =configureStore({
reducer:counterSlice.reducer
})

//Canstillsubscribetothestore
store.subscribe(()=>console.log(store.getState()))

// Still pass action objects to `dispatch`, but they're created for
us:store.dispatch(incremented())
// {value:
1}store.dispatch(incremented
())
//{value: 2}
```

```
store.dispatch(decremented())
//{value: 1}
```

Redux Toolkit allows us to write shorter logic that's easier to read, while still following thesameRedux behaviorand data flow.

LearnRedux

We have a variety of resources available to help you learn

Redux.ReduxEssentials Tutorial

The **Redux Essentials tutorial**is a "top-down" tutorial that teaches "how to use Redux theright way", using our latest recommended APIs and best practices. We recommend startingthere.

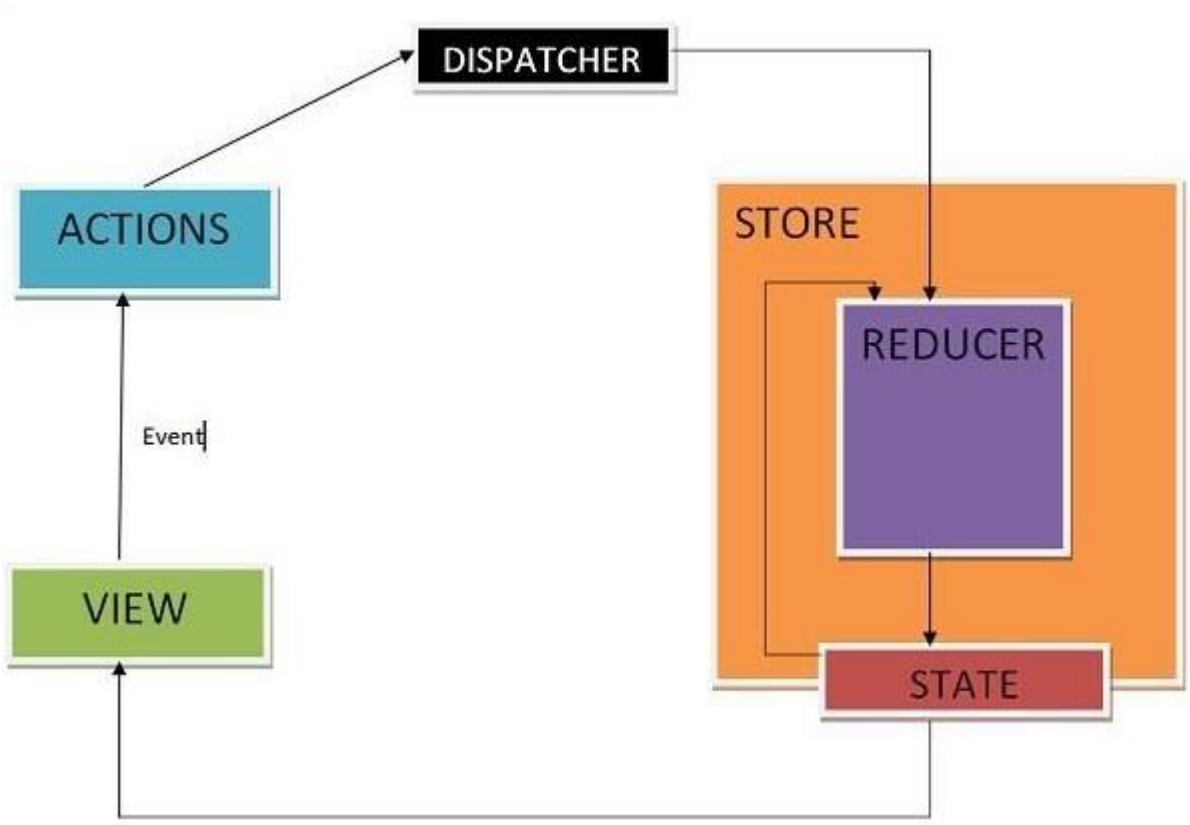
ReduxFundamentalsTutorial

The **Redux Fundamentals tutorial**is a "bottom-up" tutorial that teaches "how Reduxworks" from first principles and without any abstractions, and why standard Redux usagepatternsexist.

Redux - Data FlowRedux- DataFlow

Redux follows the unidirectional data flow. It means that your application data will follow inone-way binding data flow. As the application grows & becomes complex, it is hard toreproduce issues and add new features if you have no control over the state of yourapplication.

Redux reduces the complexity of the code, by enforcing the restriction on how and when stateupdate can happen. This way, managing updated states is easy. We already know about therestrictions as the three principles of Redux. Following diagram will help you understandReduxdata flow better −



- Anactionisdispatchedwhenauserinteractswiththeapplication.
- The root reducer function is called with the current state and the dispatched action.The root reducer may divide the task among smaller reducer functions, whichultimatelyreturns anewstate.
- Thestorenotifiestheview byexecutingtheir callbackfunctions.
- Theviewcan retrieveupdatedstateandre-renderagain.

Client-ServerCommunication

Let's expand the application so that the notes are stored in the backend. We'll use [json-server](),familiarfrom part 2.

The initial state of the database is stored in the file *db.json*, which is placed in the root of theproject:

```
{
  "notes":[
    {
      "content": "the app state is in redux
      store","important":true,
      "id":1
    },
    {
      "content": "state changes are made with
      actions","important":false,
      "id":2
    }
  ]
```

```
}
```

We'llinstalljson-serverfortheproject...

```
npminstalljson-server--save-dev
```

andaddthefollowing linetothe *scripts*partofthe file*package.json*

```
"scripts":{
  "server":"json-server-p3001--watchdb.json",
  //...
}
```

Nowlet'slaunchjson-serverwiththe command *npmrunserver*.

Next, we'll create a method into the file *services/notes.js*, which uses *axios* to fetch data fromthebackend

```
importaxiosfrom'axios'

constbaseUrl =

'http://localhost:3001/notes'constgetAll=

async () =>{
const response = await
  axios.get(baseUrl)returnresponse.data
}

exportdefault{getAll }
```

We'lladdaxiostotheproject

```
npm installaxios
```

We'll change the initialization of the state in *noteReducer*, so that by default there are nonotes:

```
constnoteSlice =
  createSlice({name:'notes',
initialState:[],//...
})
```

Let'salso add anew action *appendNote*foradding anote object:

```
constnoteSlice =
  createSlice({name:'notes',
initialState:
  [],reducers:{
createNote(state, action)
{constcontent=action.payload

state.push({
      content,importa
      nt:
      false,id:generate
      Id(),
```

```
})
```

```
    },
toggleImportanceOf(state, action)
{constid= action.payload

constnoteToChange=state.find(n=>n.id===id)con

stchangedNote= {
       ...noteToChange,
       important:!noteToChange.important
     }

     returnstate.map(note=>note.id!
==id?note:changedNote
     )
    },
appendNote(state,action){       state.push(action.payload)}},
})

exportconst{createNote,toggleImportanceOf,appendNote}=noteSlice.actionsexportde
faultnoteSlice.reducer
```

A quick way to initialize the notes state based on the data received from the server is to fetchthe notes in the *index.js* file and dispatch an action using the *appendNote* action creator foreachindividual note object:

```
//...
importnoteServicefrom'./services/notes'importnoteReducer,{appendNote}from'./reducers/noteReducer'const
store = configureStore({
  reducer:{
    notes:
    noteReducer,filter:f
    ilterReducer,
  }
})

noteService.getAll().then(notes=>notes.forEach(note=> {store.dispatch(appendNote(note))}))
//...
```

Dispatching multiple actions seems a bit impractical. Let's add an action creator *setNotes*whichcanbeusedtodirectlyreplacethe notesarray.We'llgetthe actioncreatorfrom the*createSlice* function by implementing the*setNotes* action:

```
//...

constnoteSlice =
  createSlice({name:'notes',
initialState:
  [],reducers:{
createNote(state, action)
{constcontent=action.payload

state.push({
       content,importa
       nt:
       false,id:generate
       Id(),
     })
    },
toggleImportanceOf(state, action)
```

{constid= action.payload

```
constnoteToChange=state.find(n=>n.id===id)con

stchangedNote= {
       ...noteToChange,
       important:!noteToChange.important
     }

     returnstate.map(note=>note.id!
==id?note:changedNote
     )
   },
appendNote(state, action)
{state.push(action.payload)
   },
setNotes(state,action){       returnaction.payload     }},
})

exportconst{createNote,toggleImportanceOf,appendNote,setNotes}=noteSlice.actionsexportdef
aultnoteSlice.reducer
```

Now,the codeinthe*index.js*filelooksalot better:

```
//...
importnoteServicefrom'./services/notes'
importnoteReducer,{setNotes}from'./reducers/noteReducer'conststo
re = configureStore({
  reducer:{
    notes:
    noteReducer,filter:f
    ilterReducer,
  }
})

noteService.getAll().then(notes=>store.dispatch(setNotes(notes
)))
```

NB: why didn't we use await in place of promises and event handlers (registered to *then*-methods)?

Await only works inside *async* functions, and the code in *index.js* is not inside a function, sodueto thesimple natureof theoperation, we'llabstain from using*async*this time.

We do, however, decide to move the initialization of the notes into the *App* component, and,asusual, when fetching data from aserver, we'll usethe*effect hook*.

```
import{useEffect}from'react'importNewNotefrom'./components/NewNote'imp
ortNotesfrom'./components/Notes'
importVisibilityFilterfrom'./components/VisibilityFilter'
importnoteServicefrom'./services/notes'import{setNotes}from'./reducers/noteReducer'import{useDispatch
} from 'react-
redux'constApp=()
=>{
constdispatch =useDispatch()useEffect(()=>{  noteService              .getAll().then(notes
=>dispatch(setNotes(notes)))}, [])
  return(
<div>
<NewNote/>
```

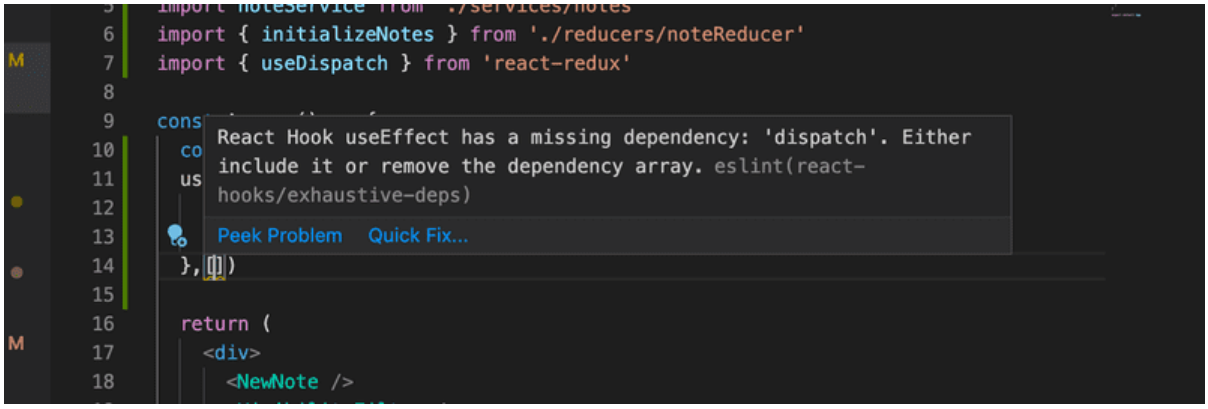
<VisibilityFilter/>

<Notes/>

)
}

exportdefaultApp

UsingtheuseEffecthookcausesaneslintwarning:



Wecan get rid of it by doing thefollowing:

```
constApp =()=> {
const dispatch =
useDispatch()useEffect(()=>{
noteService
.getAll().then(notes=>dispatch(setNotes(notes)))
  },[dispatch])
  //...
}
```

Now the variable *dispatch* we define in the *App* component, which practically is the dispatchfunction of the redux store, has been added to the array useEffect receives as a parameter. **If**the value of the dispatch variable would change during runtime, the effect would be executedagain.This howevercannot happenin ourapplication, sothewarningis unnecessary.

Anotherwayto getrid of the warningwouldbe todisableESlinton thatline:

```
constApp =()=> {
const dispatch =
useDispatch()useEffect(()=>{
noteService
.getAll().then(notes=>dispatch(setNotes(notes)))
  },[])//eslint-disable-linereact-hooks/exhaustive-deps
  //...
}
```

Generally disabling ESlint when it throws a warning is not a good idea. Even though theESlintrule in questionhas caused somearguments, wewill usethefirst solution.

Moreabout theneed to definethe hooks dependencies inthereact documentation.

Wecan dothe same thingwhen itcomes to creatinganewnote. Let's expandthe code

communicatingwiththeserver asfollows:

```
constbaseUrl =

'http://localhost:3001/notes'constgetAll=

async () =>{
const response = await
  axios.get(baseUrl)returnresponse.data
}

constcreateNew=async(content)=>{constobject={content,important:false}constresponse=awaitaxios.post(baseUrl,
object)returnresponse.data}
export default
{getAll,createN
ew,
}
```

Themethod*addNote*ofthecomponent*NewNote* changesslightly:

```
import{useDispatch }from 'react-redux'
import { createNote } from
'../reducers/noteReducer'import
noteServicefrom'../services/notes'constNewNote=
(props) =>{
constdispatch=useDispatch()

constaddNote = async (event)
=>{event.preventDefault()const content =
event.target.note.valueevent.target.note.value= ''
constnewNote=awaitnoteService.createNew(content)dispatch(createNote(newNote))}

  return(
<formonSubmit={addNote}>
<inputname="note"/>
<buttontype="submit">add</button>
</form>
  )
}

exportdefaultNewNote
```

Becausethe backendgenerates idsforthenotes, we'll changetheactioncreator*createNote* accordingly:

```
createNote(state, action)
{state.push(action.payloa
d)
}
```

Changing the importance of notes could be implemented using the same principle, by makinganasynchronousmethod callto theserver andthendispatching anappropriate action.

UNIT– IV

JavaWebDevelopment

Web development is known as website development or web application development. Thewebdevelopmentcreates,maintains, andupdates webdevelopmentapplicationsusingabrowser. This web development requires web designing, backend programming, and databasemanagement.Thedevelopment process requires softwaretechnology.

Web development creates web applications using servers. We can use a web server ormachine server like a CPU. The Web server or virtual server requires web application usingtechnology. Web development requires server-side programming language or technology.MostlyJava, PHP,and other server-sidelanguagesrequireforweb development.

Java web development creates a server-side website and web application. The majority ofJava web apps do not execute on the server directly. A web container on the server hosts Javawebapplications.

For Java web applications, the container acts as a runtime environment. What the Java VirtualMachineisforlocallyrunningJavaapplications,thecontainer isforJavawebapplications. JVMis used torun thecontainer itself.

Java distinguishes between two types of containers: web and Java EE. Additionalfunctionality, such as server load distribution, can be supported by a container. A webcontainer supports Java servlets and JSP (JavaServer Pages). In Java technology, Tomcat isacommon web container.

A web container is usually a minimal need for web frameworks. GWT, Struts, JavaServerFaces, and the Spring framework are common Java web frameworks. Servlets are at the heartofmost modern Javaweb frameworks.

FunctionsofJavaWebDevelopment

Java web development creates applications and websites using static and dynamic resources.The static resource refers to HTML pages with images, and a dynamic resource refers toclasses, jars, Servlet, and JSP. Java web development uses several packages, files, and onlinelinks.Javaweb developmentrequires web archivefilesknown asaWARfiles.

Javawebdevelopmentworksonthreemain factors.Thesedevelopmentfactorsshowbelow.

- Front-endwebdevelopmentusingJavatechnology.
- BackendwebdevelopmentusingJavaservertechnology.
- Databasemanagement usingJavadatabasedriver.

Theabovethreefactorscreate, update,remove,display andoperatedata or information.

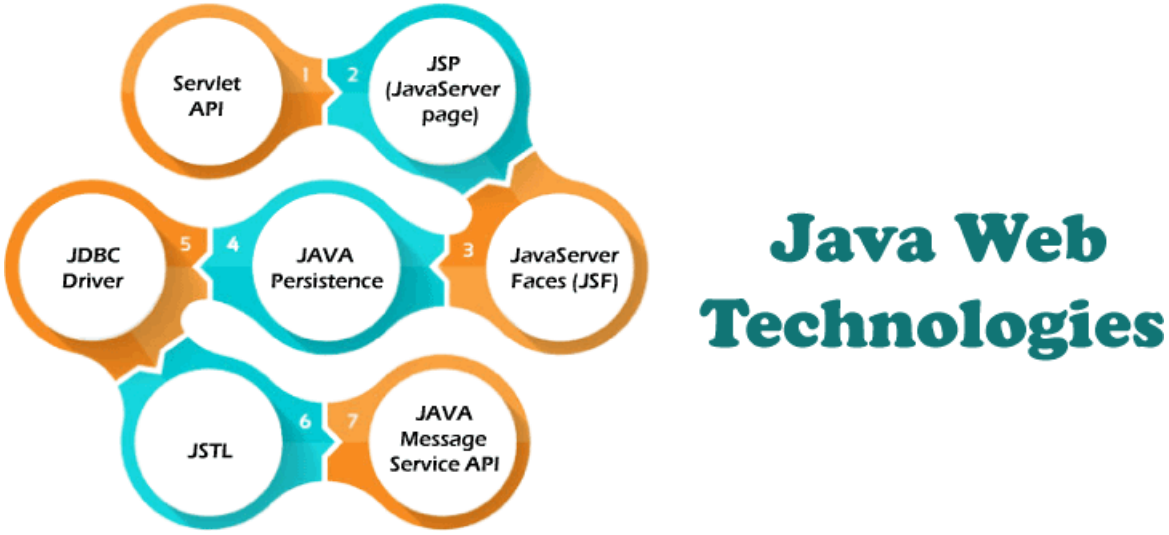
Front-end web development: The front-end technology interacts with the user and Javainterface. It helps to insert and submit data. Java web development uses JavaServer Pages orJSPforthe front-end form or table.

Backend web development: The backend technology maintains and updates data of thedatabase.Javauses Servlet, spring,and other advanced technology.

Database management handles or fetches data from the database using the Java databasedriver.TheJavatechnology usesJDBC, Hibernateto handlethe database.

Types of the JavaWebTechnologies

- Servlet API
- JSP(JavaServerpage)
- JDBCDriver
- JAVAPersistence
- JavaServerFaces(JSF)
- JSTL
- JAVAMessageServiceAPI



ServletAPI(JAVAWeb applicationprogramming interface)

Servlet, filter, filter chain, servlet config, and other interfaces are available in the javax.Servletpackage.Thecapabilitiesofserversthathostappsareincreasedbyusing Servlet.

The request-response model is used in web development applications written with Javaservlets.From initializationto garbage collection,aservlet hasalifecycle.

Servlets are useful for various tasks, including collecting data via web page forms, presentingdatafrom adatabaseor any otherthird-party source, etc.

ServletsareJavaprogramsthatrunonawebapplicationandsendclientrequeststodatabasesor servers. After talking with the database, the servlets help process the client's request andprovideresults.

JSP(JavaServerPageWebapplicationprogrammingtechnology)

Developers employ JavaServer Pages or JSP technology to quickly produce platform-andserver-independent online content. Normally, the developer works on separate CommonGateway Interface files to embed dynamic elements in HTML pages. Java JSP technologycanbeused,as it has accessto the whole JavaAPIfamily.

The JSP technology pieces code to control web information and moves dynamically. A JSPpagecomprises staticdatawritten in HTML,WML, XML, andothermarkup languages. Special JSP tags simplify Java code into HTML pages, making web development user-friendly.

The JSP technology allows embedding bits of servlet code in a text-based document. JSP is apopular Java EE technology that allows programmers to create complex dynamic web pagesquickly.

JDBCDriveror JavaDatabaseConnectivity

JDBC Driver is a connector between database and Java web application. Java databaseconnectivity helps to update and modify data using queries. The jdbc driver is an essentialpart of Java web development. This driver helps to send data to the database and retrieve datafromthedatabase.

WithinaJavaprogram,theJDBCdriverallowstoperformthe followingtasks:

- Makeadata sourceconnection
- Tothedatasource,sendqueriesandupdatestatements
- Displaysrequiredatafroma database.
- Organizeapplicationinformation.

JDBC is a set of methods and queries for accessing databases written in Java. Clients can usewebapplications usingJDBC drivers toupdate anyinformation in thedatabase.

JDBC drivers connect to databases in four ways: JDBC-ODBC Bridge Driver, NetworkProtocolDriver, NativeDriver, and ThinDriver.

PersistenceAPIfor Java

For web development, the Java Persistence API employs object-relational mapping. Thismapping connects a database to an object-oriented model. Java Persistence makes it simple tomanage relational data in Java web applications. The Java Persistence API aids in databasedatamanagement. This APIsends data to adatabaseand retrievesdata from it regularly.

Largeamountsofcode,proprietary frameworks,andotherfilesarenotrequired.JPAgivesastraightforward technique of database communication. A database is an object-relationalapproach for interacting with Java web development. JPA is a set of lightweight classes andmethodsforinteracting with databases.

TechnologyoftheJavaServer Faces

JavaServer Faces is called a JSF Technology. This technology provides a framework fordeveloping web-based interfaces. JSF provides a simple model for components in variousscriptingor markuplanguages.

The data sources and server-side event handlers are coupled to the User Interface widgets.JSF aids in the creation and maintenance of web applications by minimizing the time andeffortrequired.

- ConstructJavawebdevelopment pages.
- Dropcomponents on awebpage byaddingcomponenttagstoa web page.
- ConnectJavawebdevelopment pagecomponentstoserver-sidedata.
- Connectcomponent-generatedevents toapplicationcode runningon theserver.
- Extendthelifeofserverrequestsbystoringandrestoringtheapplicationstate.

StandardTagLibraryfor JavaServerPages(JSTL)

The JavaServer Pages Standard Tag Library or JSTL abstracts common functionality of JSP-based applications. We use a single standard set of tags to incorporate tags from variousvendors into web applications. This standardization enables the establishment of Javaapplications on any JSP container. It supports JSTL and increases the tags to optimize duringimplementation.

JSTL includes iterator and conditional tags for controlling flow. These tags work formanipulating XML documents and tags for internationalization. This JSTL is also used forSQLdatabaseaccess andtagsfor frequently usedfunctions.

APIfor JavaMessageService

Messaging is a way for software components or apps to communicate with one another. Amessaging system is a type of peer-to-peer network. In other words, a messaging client cancommunicatewith and becommunicatedwith byany otherclient.

Eachclientestablishes a connectionwithamessagingagent,facilitatingthecreation,transmission,receipt, andreading of messages.

The Java Message Service (JMS) API provides a strong tool for resolving enterprisecomputingproblems by integratingJavatechnology andenterprisemessaging.

Enterprise messaging enables the secure and flexible sharing of business data. The JMS APIextends this by providing a uniform API and provider framework that facilitates the buildingofportable message-based Javaapplications.

SpecialFeaturesof the Javawebdevelopment

- Javaisamature,versatile,andpowerful programminglanguage.
- Additionally, it is popular, which means that tools and assistance for Java web developmentarereadily available.
- Java's platform freedom is one of its strongest characteristics. Java code can be executed

onanyplatform,includingaMacoraWindowscomputer.Onanyoperatingsystem,wecanrun

aJavawebapplication.

- Javais alsocapableofrunningmobileapplicationsonsmartphonesandtablets.
- Java web development does not require additional effort to design and run web apps acrossseveralplatforms.
- Java also includes an enormous standard library. This library readily works with commontasks such as input and output, networking, and graphic user interfaces. It provides tools tohelpweb applicationdevelopers.

Conclusion

Java programming language is easy to handle and programmer's first choice for webdevelopment. Java web development has basic rules apart from operating data. Thistechnologydoes notneedan extraoperation oradvancedprogramming.

Java web development creates multiple web applications using a single type of code onmultiple pages. If we know the working procedure, then JAVA technology develops anyapplication.

JAVAPROGRAMMINGBASICS

Whatis Java?

Java is a high-level, general-purpose, object-oriented, and secure programming languagedeveloped by James Gosling at Sun Microsystems, Inc. in 1991. It is formally known asOAK. In 1995, Sun Microsystem changed the name to Java. In 2009, Sun Microsystemtakeoverby Oracle Corporation.

EditionsofJava

EacheditionofJavahasdifferentcapabilities.Therearethreeeditionsof Java:

- **JavaStandardEditions(JSE):** Itisusedto createprogramsforadesktopcomputer.
- **Java Enterprise Edition (JEE):** It is used to create large programs that run on theserver and manages heavytrafficand complex transactions.
- **Java Micro Edition (JME):** It is used to develop applications for small devices suchasset-top boxes, phone,and appliances.

Types of JavaApplications

Thereare fourtypes ofJavaapplicationsthat canbecreatedusing Javaprogramming:

- **Standalone Applications:** Java standalone applications uses GUI components suchas AWT, Swing, and JavaFX. These components contain buttons, list, menu, scrollpanel,etc.It is also knownas desktop alienations.
- **Enterprise Applications:** An application which is distributed in nature is calledenterprise applications.
- **WebApplications:** Anapplicationsthatrunontheserveriscalledwebapplications.

WeuseJSP,Servlet,Spring,andHibernatetechnologiesforcreatingwebapplic
ations.

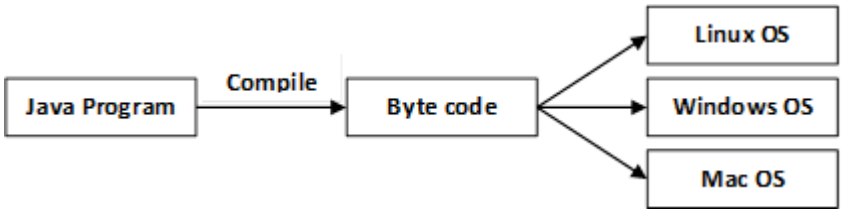
- **Mobile Applications:** Java ME is a cross-platform to develop mobile applicationswhichrunacrosssmartphones.Javaisaplatformfor AppDevelopmentinAndroid.

JavaPlatform

Java Platform is a collection of programs. It helps to develop and run a program written in theJava programming language. Java Platform includes an execution engine, a compiler and setoflibraries. Javais a platform-independent language.

FeaturesofJava

- **Simple:** Java is a simple language because its syntax is simple, clean, and easy tounderstand. Complex and ambiguous concepts of C++ are either eliminated or re-implemented in Java. For example, pointer and operator overloading are not used inJava.
- **Object-Oriented:** In Java, everything is in the form of the object. It means it hassomedataandbehavior.Aprogrammusthave atleastoneclassandobject.
- **Robust:** Java makes an effort to check error at run time and compile time. It uses astrong memory management system called garbage collector. Exception handling andgarbage collection features makeit strong.
- **Secure:** Java is a secure programming language because it has no explicit pointer andprograms runs in the virtual machine. Java contains a security manager that definestheaccess of Javaclasses.
- **Platform-Independent:** Java provides a guarantee that code writes once and runanywhere.Thisbytecodeisplatform-independent andcanbe runon anymachine.



- **Portable:** Java Byte code can be carried to any platform. No implementation-dependent features. Everything related to storage is predefined, for example, the sizeofprimitive data types.
- **High Performance:** Java is an interpreted language. Java enables high performancewiththeuseof theJust-In-Time compiler.
- **Distributed:** Java also has networking facilities. It is designed for the distributedenvironment of the internet because it supports TCP/IP protocol. It can run over theinternet.EJB and RMIareused to createadistributedsystem.
- **Multi-threaded:** Java also supports multi-threading. It means to handle more thanonejoba time.

OOPs(ObjectOrientedProgrammingSystem)

Object-oriented programming is a way of solving a complex problem by breaking them into asmall sub-problem. An object is a real-world entity. It is easier to develop a program by usinganobject.In OOPs,wecreateprogramsusing classand objectin astructuredmanner.

Class: A class is a template or blueprint or prototype that defines data members and methodsof an object. An object is the instance of the class. We can define a class by using the classkeyword.

Object: An object is a real-world entity that can be identified distinctly. For example, a desk,acirclecanbeconsidered asobjects. An objecthas aunique behavior, identity,and state. Data fields with their current values represent the state of an object (also known as itspropertiesorattributes).

Abstraction: An abstraction is a method of hiding irrelevant information from the user. Forexample, the driver only knows how to drive a car; there is no need to know how does the carrun. We can make a class abstract by using the keyword abstract. In Java, we use abstractclassand interfaceto achieveabstraction.

Encapsulation: An encapsulation is the process of binding data and functions into a singleunit.Aclassisanexampleofencapsulation.In Java,Javabeanisafullyencapsulatedclass.

Inheritance: Inheritance is the mechanism in which one class acquire all the features ofanother class. We can achieve inheritance by using the extends keyword. It facilitates thereusabilityof thecode.

Polymorphism: The polymorphism is the ability to appear in many forms. In other words,single action in different ways. For example, a boy in the classroom behaves like a student, inhouse behaves like a son. There are two types of polymorphism: run time polymorphism andcompile-timepolymorphism.

JavaVariables

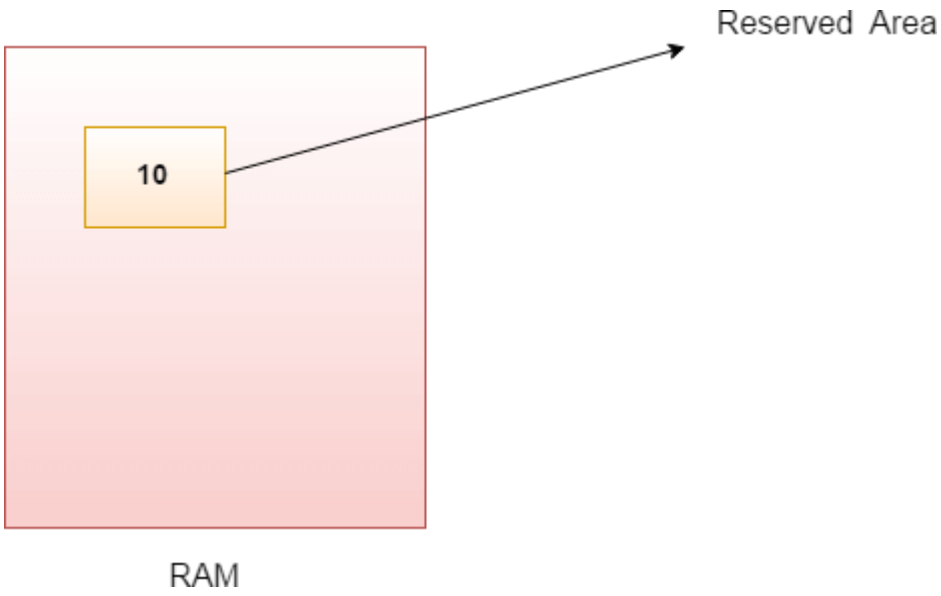
A variable is a container which holds the value while the Java programis executed. Avariableis assigned withadata type.

Variable is a name of memory location. There are three types of variables in java: local,instanceand static.

Therearetwo typesofdatatypesin Java:primitive andnon-primitive.

Variable

Avariableisthenameofareserved areaallocated inmemory. Inotherwords,it isanameofthe memory location. It is a combination of "vary + able" which means its value can bechanged.

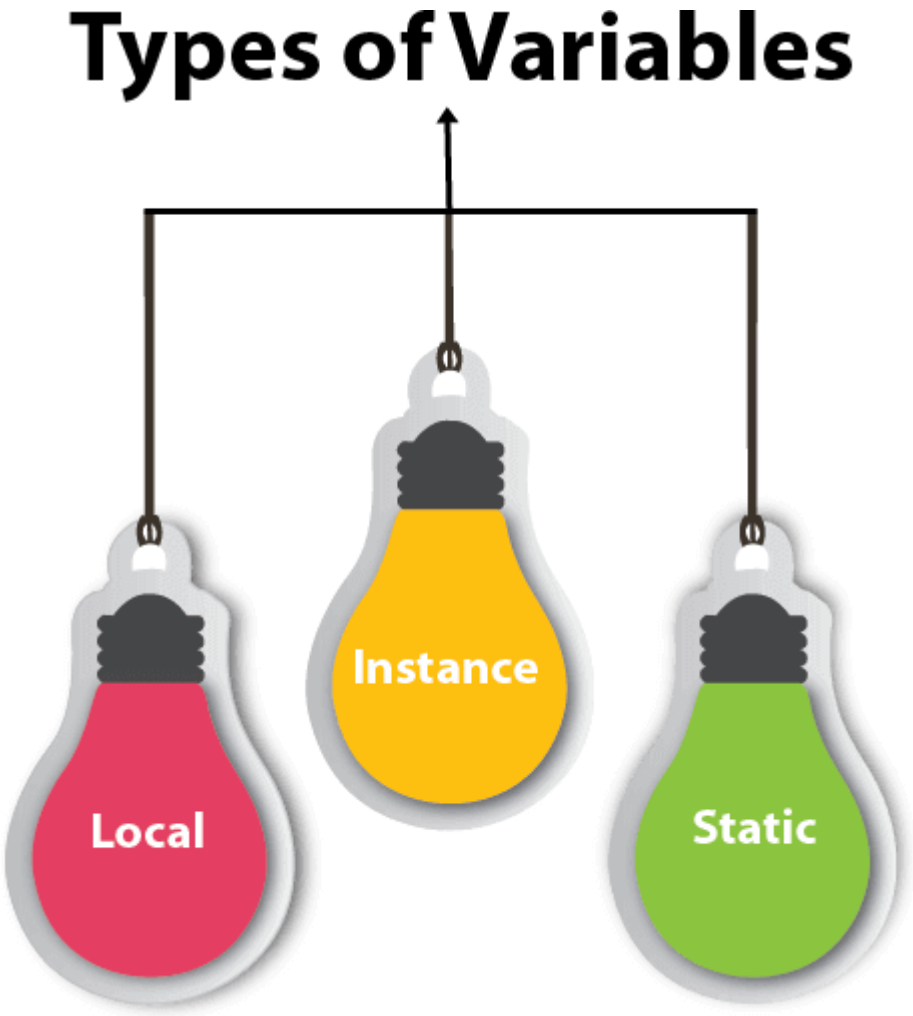


1.int data=50;//Here data is

variableTypesof Variables

Therearethreetypesof variablesinJava:

- localvariable
- instancevariable
- staticvariable



1) LocalVariable

A variable declared inside the body of the method is called local variable. You can use thisvariable only within that method and the other methods in the class aren't even aware that thevariableexists.

Alocal variablecannot bedefined with"static" keyword.

2) InstanceVariable

A variable declared inside the class but outside the body of the method, is called an instancevariable. It is not declared asstatic.

It is called an instance variable because its value is instance-specific and is not shared amonginstances.

3) Staticvariable

A variable that is declared as static is called a static variable. It cannot be local. You cancreateasinglecopy of thestatic variableandshareit amongall theinstances of theclass.

Memory allocation for static variables happens only once when the class is loaded in thememory.

Exampleto understandthetypesofvariables injava

```
1. publicclass A
2.{
3.      staticint m=100;//staticvariable
4.      voidmethod()
5.      {
6.         intn=90;//localvariable
7.      }
8.      publicstaticvoidmain(Stringargs[])
9.      {
10.        intdata=50;//instancevariable
11.     }
12.}//end ofclass
```

JavaVariableExample:AddTwoNumbers

```
1. publicclass Simple{
2. publicstaticvoidmain(String[]args){
3. int a=10;
4. intb=10;
5. intc=a+b;
6. System.out.println(c);
7.}
8.  }
```

Output:

```
20
```

JavaVariableExample:Widening

```
1. publicclass Simple{
2. publicstaticvoidmain(String[]args){
3. int a=10;
4. floatf=a;
5. System.out.println(a);
6. System.out.println(f);
7.}}
```

Output:

```
10
10.0
```

JavaVariableExample: Narrowing(Typecasting)

```
1. publicclass Simple{
2. publicstaticvoidmain(String[]args){
3. floatf=10.5f;
```

```
4. //inta=f;//Compiletimeerror
5. inta=(int)f;
6. System.out.println(f);
7. System.out.println(a);
8.}}
```

Output:

```
10.5
10
```

JavaVariableExample:Overflow

```
1. classSimple{
2. publicstaticvoidmain(String[]args){
3. //Overflow
4.inta=130;
5. byteb=(byte)a;
6. System.out.println(a);
7. System.out.println(b);
8.}}
```

Output:

```
130
-126
```

JavaVariableExample:AddingLowerType

```
1. classSimple{
2. publicstaticvoidmain(String[]args){
3. bytea=10;
4. byteb=10;
5. //bytec=a+b;//Compile TimeError:becausea+b=20will beint
6. bytec=(byte)(a+b);
7. System.out.println(c);
8.}}
```

Output:

```
20
```

Java OOPsConcepts

1. Object-OrientedProgramming
2. AdvantageofOOPsover Procedure-orientedprogramminglanguage
3. DifferencebetweenObject-orientedandObject-basedprogramminglanguage.

In this page, we will learn about the basics of OOPs. Object-Oriented Programming is aparadigm that provides many concepts, such as **inheritance**, **data binding**, **polymorphism**,etc.

Simula is considered the first object-oriented programming language. The programmingparadigm where everything is represented as an object is known as a truly object-orientedprogramminglanguage.

Smalltalk is considered the first truly object-oriented programming

language.Thepopularobject-orientedlanguagesare Java, C#, PHP, Python, C++,

etc.

The main aim of object-oriented programming is to implement real-world entities, forexample,object, classes, abstraction, inheritance,polymorphism,etc.

OOPs(Object-OrientedProgrammingSystem)

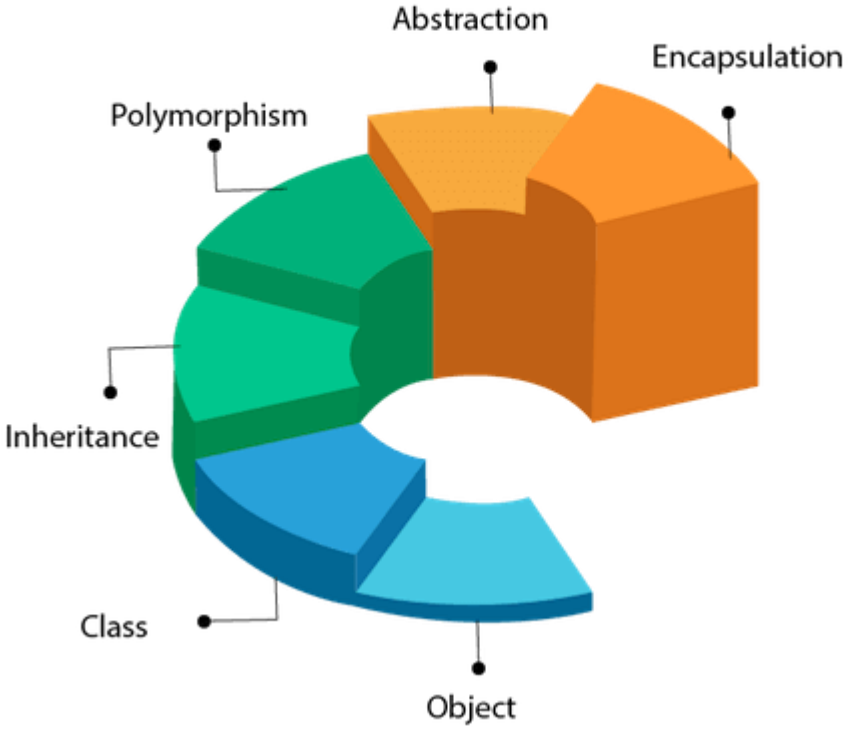
Object means a real-world entity such as a pen, chair, table, computer, watch, etc. **Object-Oriented Programming** is a methodology or paradigm to design a program using classesand objects. It simplifies software development and maintenance by providing someconcepts:

- Object
- Class
- Inheritance
- Polymorphism
- Abstraction
- Encapsulation

Apart from these concepts, there are some other terms which are used in Object-Orienteddesign:

- Coupling
- Cohesion
- Association
- Aggregation
- Composition

OOPs (Object-Oriented Programming System)



Object

Any entity that has state and behavior is known as an object. For example, a chair, pen, table,keyboard,bike,etc.It can bephysical orlogical.

AnObjectcanbedefinedasan instanceofaclass.Anobject containsan address andtakes

up some space in memory. Objects can communicate without knowing the details of eachother's data or code. The only necessary thing is the type of message accepted and the type ofresponsereturned by theobjects.

Example: A dog is an object because it has states like color, name, breed, etc. as well asbehaviorslikewagging thetail, barking, eating, etc.

Class

*Collectionofobjects*iscalledclass. Itisalogicalentity.

A class can also be defined as a blueprint from which you can create an individual object.Classdoesn't consume any space.

Inheritance

When one object acquires all the properties and behaviors of a parent object, it is known asinheritance.Itprovidescodereusability.Itis used toachieveruntimepolymorphism.

Polymorphism

If *one task is performed in different ways*, it is known as polymorphism. For example: toconvince the customer differently, to draw something, for example, shape, triangle, rectangle,etc.

InJava, weusemethodoverloading and methodoverriding toachievepolymorphism.

Another example can be to speak something; for example, a cat speaks meow, dog barkswoof,etc.

Abstraction

Hiding internal details and showing functionality is known as abstraction. For example phonecall,wedon't know the internal processing.

InJava,weuseabstractclass andinterfaceto achieveabstraction.

Encapsulation

Binding (or wrapping) code and data together into a single unit are known as encapsulation.Forexample, acapsule, it is wrappedwith different medicines.

A java class is the example of encapsulation. Java bean is the fully encapsulated classbecause all the data members areprivatehere.

Coupling

Coupling refers to the knowledge or information or dependency of another class. It ariseswhen classes are aware of each other. If a class has the details information of another class,there is strong coupling. In Java, we use private, protected, and public modifiers to displaythe visibility level of a class, method, and field. You can use interfaces for the weakercouplingbecausethereisno concreteimplementation.

Cohesion

Cohesion refers to the level of a component which performs a single well-defined task. Asingle well-defined task is done by a highly cohesive method. The weakly cohesive methodwill split the task into separate parts. The java.io package is a highly cohesive packagebecause it has I/O related classes and interface. However, the java.util package is a weaklycohesivepackagebecauseit hasunrelatedclassesand interfaces.

Association

Association represents the relationship between the objects. Here, one object can beassociatedwithoneobjectormanyobjects.Therecanbefourtypesof associationbetweentheobjects:

- One to One
- One toMany
- ManytoOne,and
- ManytoMany

Let's understand the relationship with real-time examples. For example, One country canhave one prime minister (one to one), and a prime minister can have many ministers (one tomany). Also, many MP's can have one prime minister (many to one), and many ministers canhavemany departments (many to many).

Associationcanbeundirectionalorbidirectional.

Aggregation

Aggregation is a way to achieve Association. Aggregation represents the relationship whereone object contains other objects as a part of its state. It represents the weak relationshipbetweenobjects. Itisalsotermedasa*has-a*relationshipinJava.Like,inheritance representsthe*is-a* relationship.It is anotherway toreuseobjects.

Composition

The composition is also a way to achieve Association. The composition represents therelationship where one object contains other objects as a part of its state. There is a strongrelationship between the containing object and the dependent object. It is the state wherecontainingobjectsdonothaveanindependentexistence.Ifyou deletethe parentobject,allthechild objects willbedeleted automatically.

Advantage of OOPs over Procedure-orientedprogramminglanguage

1) OOPs makes development and maintenance easier, whereas, in a procedure-orientedprogramminglanguage,itisnoteasytomanageif codegrowsasprojectsizeincreases.

2) OOPs provides data hiding, whereas, in a procedure-oriented programming language,globaldatacan beaccessed from anywhere.

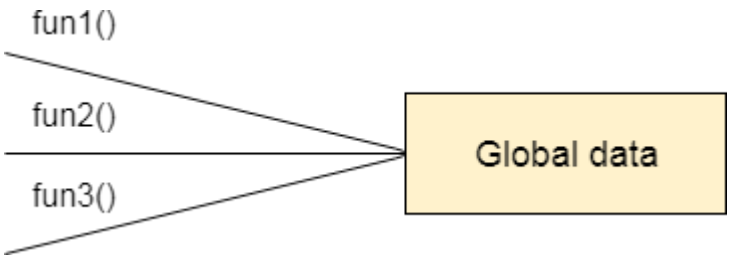


Figure:DataRepresentationinProcedure-OrientedProgramming

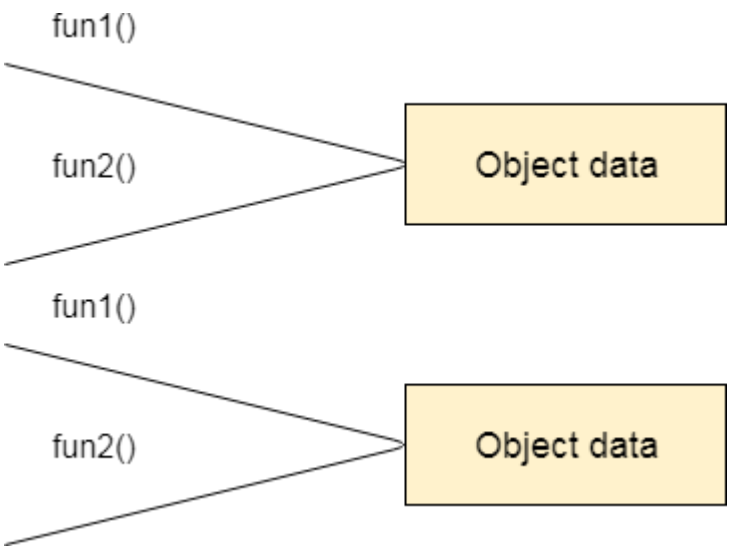


Figure:DataRepresentationinObject-OrientedProgramming

3) OOPs provides the ability to simulate real-world event much more effectively. We canprovide the solution of real word problem if we are using the Object-Oriented Programminglanguage.

What is the difference between an object-orientedprogramming language and object-based programminglanguage?

Object-based programming language follows all the features of OOPs except Inheritance.JavaScriptand VBScriptareexamples ofobject-based programminglanguages.

MVCArchitecture inJava

The Model-View-Controller (MVC) is a well-known design patternin the web developmentfield. It is way to organize our code. It specifies that a program or application shall consist ofdata model, presentation information and control information. The MVC pattern needs allthesecomponents to beseparated as different objects.

In this section, we will discuss the MVC Architecture in Java, alongwith its advantages anddisadvantagesandexamplesto understand theimplementation ofMVC in Java.

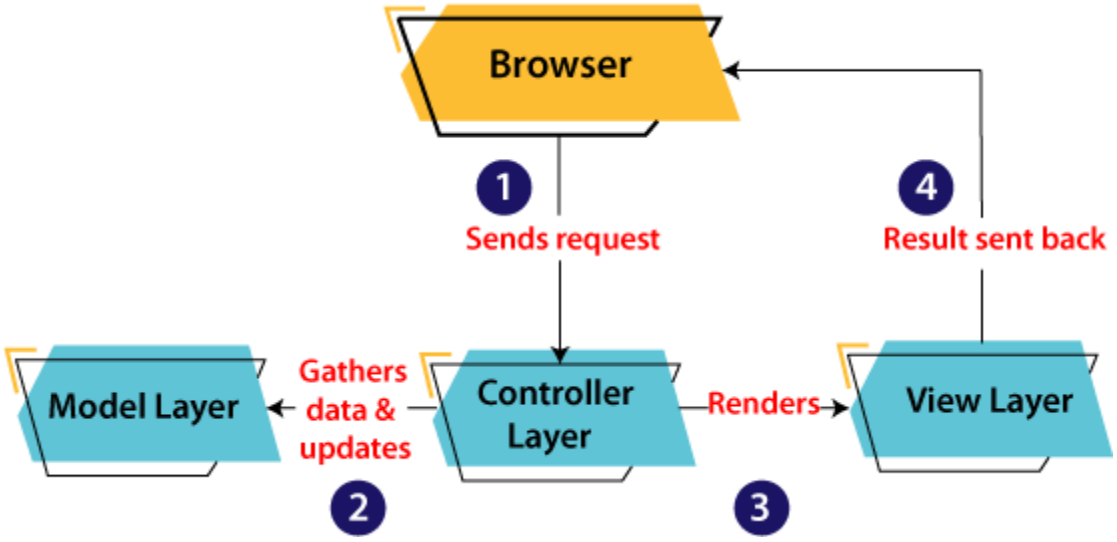
WhatisMVCarchitectureinJava?

The model designs based on the MVC architecture follow MVC design pattern. Theapplicationlogicisseparatedfromtheuserinterfacewhiledesigningthesoftwareusingmodel designs.

TheMVC patternarchitectureconsistsofthreelayers:

- **Model:** It represents the business layer of application. It is an object to carry the data that canalsocontain the logicto updatecontrollerifdata ischanged.
- **View:** It represents the presentation layer of application. It is used to visualize the data thatthemodel contains.
- **Controller:** It works on both the model and view. It is used to manage the flow ofapplication, i.e. data flow in the model object and to update the view whenever data ischanged.

In Java Programming, the Model contains the simple Java classes, the View used to displaythe data and the Controller contains the servlets. Due to this separation the user requests areprocessed as follows:



1. Aclient(browser)sendsarequesttothecontrolleronheserver side,forapage.
2. Thecontrollerthencallsthemodel.Itgathersrequesteddata.
3. Thenthecontrollertransfersthedataretrievedtotheviewlayer.
4. Nowtheresultissent backtothe browser(client)bytheview.

AdvantagesofMVCArchitecture

Theadvantages ofMVCarchitectureareasfollows:

- MVChasthefeatureofscalabilitythatin turnhelpsthe growthofapplication.
- Thecomponents areeasytomaintainbecausethereisless dependency.
- Amodelcanbereused bymultipleviews thatprovides reusabilityofcode.
- Thedeveloperscanworkwiththethreelayers(Model,View,andController)simultaneously.
- UsingMVC,theapplicationbecomesmoreunderstandable.
- Using MVC, each layer is maintained separately therefore we do not require to deal withmassivecode.
- Theextendingandtestingofapplicationiseasier.

ImplementationofMVCusingJava

ToimplementMVC patternin Java,wearerequired tocreate thefollowingthreeclasses.

- **EmployeeClass**,will act asmodellayer
- **EmployeeView Class**, willactas aviewlayer
- **EmployeeContollerClass**,willactacontrollerlayer

MVCArchitectureLayers

ModelLayer

TheModelintheMVCdesign patternactsasadatalayerfortheapplication.Itrepresents thebusiness logic for application and also the state of application. The model object fetch andstore the model state in the database. Using the model layer, rules are applied to the data thatrepresentstheconcepts of application.

Let's consider the following code snippet that creates a which is also the first step toimplementMVC pattern.

Employee.java

```
1.  //classthatrepresents model
2.  publicclassEmployee {
3.
4.      //declaringthevariables
5.       privateStringEmployeeName;
6.      privateStringEmployeeId;
7.       privateStringEmployeeDepartment;
8.
9.      //defininggetterandsettermethods
10.     publicStringgetId(){
11.        returnEmployeeId;
12.     }
13.
14.     publicvoidsetId(Stringid){
15.        this.EmployeeId=id;
16.     }
17.
18.     publicStringgetName() {
19.        returnEmployeeName;
20.     }
21.
22.     publicvoidsetName(Stringname){
23.        this.EmployeeName=name;
24.     }
25.
26.     publicStringgetDepartment(){
27.          returnEmployeeDepartment;
28.        }
29.
30.     publicvoidsetDepartment(StringDepartment){
31.          this.EmployeeDepartment=Department;
32.        }
33.
```

```
34.     }
```

The above code simply consists of getter and setter methods to the Employee

class.ViewLayer

As the name depicts, view represents the visualization of data received from the model. Theview layer consists of output of application or user interface. It sends the requested data to theclient,that is fetched from model layer bycontroller.

Let'stakeanexamplewherewecreateaviewusing theEmployeeView class.

EmployeeView.java

```
1.  //classwhichrepresentstheview
2.  publicclassEmployeeView{
3.
4.      // methodtodisplay theEmployeedetails
5.  public void printEmployeeDetails (String EmployeeName, String EmployeeId,
    StringEmployeeDepartment){
6.          System.out.println("EmployeeDetails:");
7.          System.out.println("Name:"+EmployeeName);
8.          System.out.println("EmployeeID:"+EmployeeId);
9.          System.out.println("EmployeeDepartment: "+EmployeeDepartment);
10.     }
11.

        }Cont
```

rollerLayer

The controller layer gets the user requests from the view layer and processes them, with thenecessary validations. It acts as an interface between Model and View. The requests are thensent to model for data processing. Once they are processed, the data is sent back to thecontrollerand then displayed on the view.

Let's consider the following code snippet that creates the controller using theEmployeeControllerclass.

EmployeeController.java

```
1.  //classwhichrepresent thecontroller
2.  publicclassEmployeeController{
3.
4.      //declaringthevariablesmodelandview
5.       privateEmployeemodel;
6.       privateEmployeeViewview;
7.
8.      //constructortoinitialize
9.       publicEmployeeController(Employee model,EmployeeViewview){
10.        this.model=model;
```

```
11.         this.view=view;
12.     }
```

```
13.
14.     //getterandsettermethods
15.      publicvoid setEmployeeName(String name){
16.        model.setName(name);
17.      }
18.
19.      publicStringgetEmployeeName(){
20.        returnmodel.getName();
21.      }
22.
23.      publicvoid setEmployeeId(Stringid){
24.        model.setId(id);
25.      }
26.
27.      publicStringgetEmployeeId(){
28.        returnmodel.getId();
29.      }
30.
31.      publicvoidsetEmployeeDepartment(StringDepartment){
32.           model.setDepartment(Department);
33.      }
34.
35.         publicStringgetEmployeeDepartment(){
36.           returnmodel.getDepartment();
37.      }
38.
39.      //method to updateview
40.      publicvoidupdateView() {
41.         view.printEmployeeDetails(model.getName(), model.getId(),
    model.getDepartment());
42.      }
43.   }
```

MainClassJavafile

The following example displays the main file to implement the MVC architecture. Here, weareusing the MVCMainclass.

MVCMain.java

```
1.  //main class
2.  publicclass MVCMain{
3.       publicstatic void main(String[]args){
4.
5.         //fetchingtheemployeerecordbased onthe employee_id from thedatabase
6.         Employeemodel=retriveEmployeeFromDatabase();
7.
8.         //creatinga viewtowriteEmployee details onconsole
9.          EmployeeViewview=newEmployeeView();
10.10.
11.         EmployeeControllercontroller =new EmployeeController(model,view);
```

```
12.12.
13.         controller.updateView();
14.14.
15.         //updating themodeldata
16.        controller.setEmployeeName("Nirnay");
17.         System.out.println("\nEmployeeDetailsafterupdating:");
18.18.
19.         controller.updateView();
20.      }
21.
22.      privatestaticEmployeeretriveEmployeeFromDatabase(){
23.         EmployeeEmployee=newEmployee();
24.        Employee.setName("Anu");
25.         Employee.setId("11");
26.        Employee.setDepartment("Salesforce");
27.         returnEmployee;
28.      }
29.   }
```

The **MVCMain** class fetches the employee data from the method where we have entered thevalues. Then it pushes those values in the model. After that, it initializes the view(EmployeeView.java). When view is initialized, the Controller (EmployeeController.java) isinvoked and bind it to Employee class and EmployeeView class. At last the updateView()method(method ofcontroller)updatetheemployeedetailsto beprinted totheconsole.

Output:

```
EmployeeDetails:
Name:
AnuEmployeeID
:11
EmployeeDepartment:Salesforce

EmployeeDetailsafterupdating:
Name:
NirnayEmployee
ID:11
EmployeeDepartment:Salesforce
```

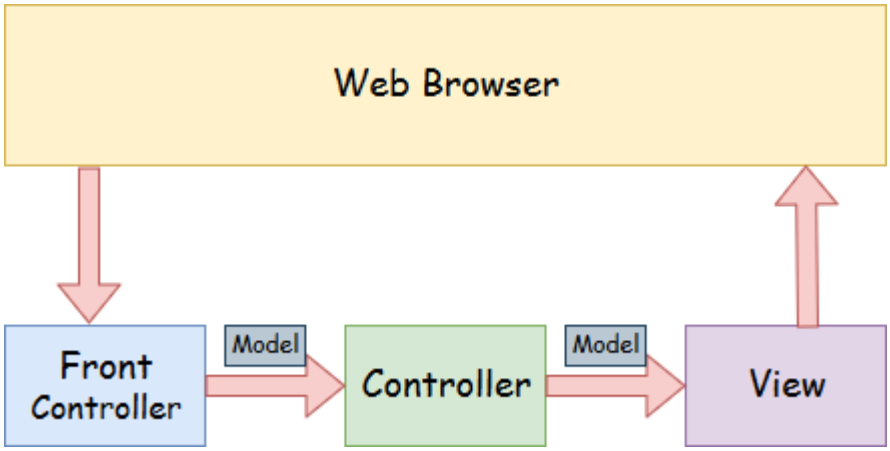
In this way, we have learned about MVC Architecture, significance of each layer and itsimplementationin Java.

SpringMVCTutorial

A Spring MVC is a Java framework which is used to build web applications. It follows theModel-View-Controllerdesignpattern.
ItimplementsallthebasicfeaturesofacorespringframeworklikeInversion ofControl,DependencyInjection.

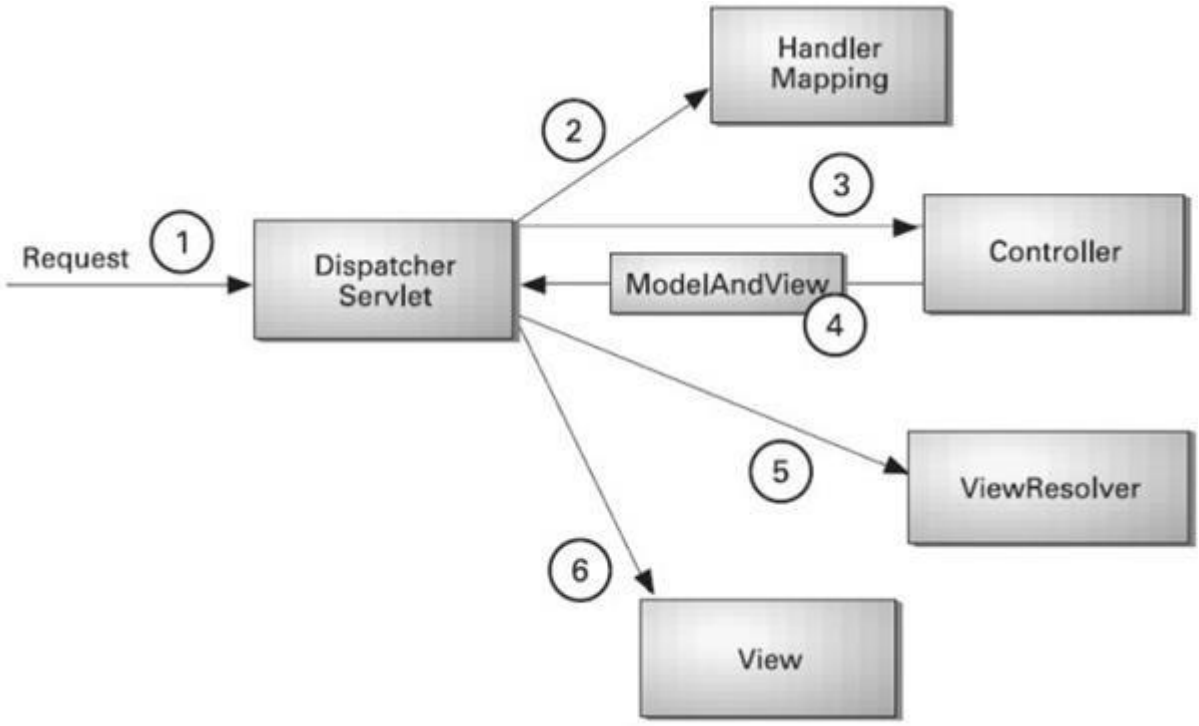
A Spring MVC provides an elegant solution to use MVC in spring framework by the help of**DispatcherServlet**. Here, **DispatcherServlet** is a class that receives the incoming requestandmaps it to theright resourcesuch as controllers, models, and views.

SpringWebModel-View-Controller



- **Model** - A model contains the data of the application. A data can be a single object or acollectionofobjects.
- **Controller** - A controller contains the business logic of an application. Here, the @Controllerannotationis usedtomark the classasthecontroller.
- **View** - A view represents the provided information in a particular format. Generally,JSP+JSTL is used to create a view page. Although spring also supports other viewtechnologiessuch asApache Velocity, ThymeleafandFreeMarker.
- **Front Controller** - In Spring Web MVC, the DispatcherServlet class works as the frontcontroller.It isresponsibleto managetheflowofthe SpringMVCapplication.

Understandingthe flowofSpringWeb MVC



- As displayed in the figure, all the incoming request is intercepted by the DispatcherServletthat works asthefrontcontroller.
- The DispatcherServlet gets an entry of handler mapping from the XML file and forwards therequesttothecontroller.
- Thecontrollerreturnsanobject ofModelAndView.
- The DispatcherServlet checks the entry of view resolver in the XML file and invokes thespecifiedview component.

Advantagesof SpringMVCFramework

Let'sseesomeof theadvantagesof SpringMVCFramework:-

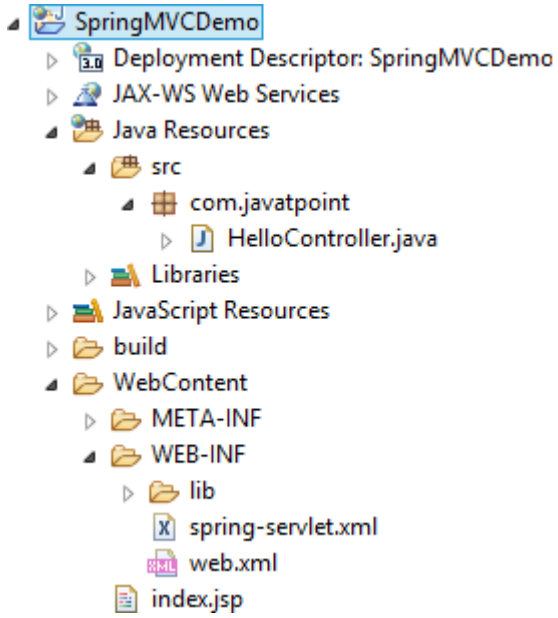
- **Separate roles** - The Spring MVC separates each role, where the model object, controller,command object, view resolver, DispatcherServlet, validator, etc. can be fulfilled by aspecializedobject.
- **Light-weight**-Ituseslight-weightservlet containertodevelopanddeployyourapplication.
- **Powerful Configuration** - It provides a robust configuration for both framework andapplication classes that includes easy referencing across contexts, such as from webcontrollersto businessobjectsand validators.
- **Rapiddevelopment**-TheSpringMVCfacilitatesfastandparallel development.
- **Reusable business code** - Instead of creating new objects, it allows us to use the existingbusinessobjects.
- **Easy to test** - In Spring, generally we create JavaBeans classes that enable you to inject testdatausing the settermethods.
- **FlexibleMapping** -It providesthespecificannotationsthat easilyredirectthepage.

SpringWebMVCFrameworkExample

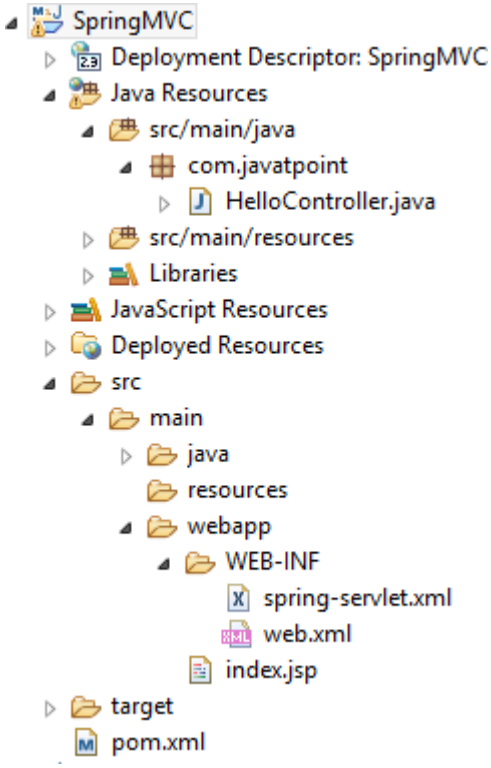
Let'sseethe simpleexampleof aSpringWeb MVCframework. Thestepsareasfollows:

- Loadthespringjarfilesoradd dependenciesinthecaseofMaven
- Createthecontrollerclass
- Providetheentryofcontrollerintheweb.xmlfile
- Definethebeaninthe separateXMLfile
- Display themessageintheJSP page
- Start theserver anddeploytheproject

DirectoryStructure of SpringMVC



Directory Structure of SpringMVCusingMaven



RequiredJar filesorMavenDependency

Torunthisexample,youneedto load:

- SpringCorejarfiles

- SpringWebjarfiles
- JSP + JSTL jar files (If you are using any another view technology then load thecorrespondingjarfiles).

Download Link: Downloadallthe jarfilesforspringincludingJSP andJSTL.

If you are using Maven, you don't need to add jar files. Now, you need to add mavendependencyto thepom.xml file.

1. Provideprojectinformationand configurationinthepom.xmlfile.

pom.xml

```
1. <projectxmlns="http://maven.apache.org/POM/4.0.0"xmlns:xsi="http://www.w3.org
   /2001/XMLSchema-instance"
2.   xsi:schemaLocation="http://maven.apache.org/POM/4.0.0http://maven.apache.org/maven-
   v4_0_0.xsd">
3.   <modelVersion>4.0.0</modelVersion>
4.   <groupId>com.javatpoint</groupId>
5.   <artifactId>SpringMVC</artifactId>
6.   <packaging>war</packaging>
7.   <version>0.0.1-SNAPSHOT</version>
8.   <name>SpringMVCMavenWebapp</name>
9.   <url>http://maven.apache.org</url>
10.  <dependencies>
11.    <dependency>
12.      <groupId>junit</groupId>
13.      <artifactId>junit</artifactId>
14.      <version>3.8.1</version>
15.      <scope>test</scope>
16.    </dependency>
17.17.
18.    <!--https://mvnrepository.com/artifact/org.springframework/spring-webmvc-->
19. <dependency>
20.    <groupId>org.springframework</groupId>
21.    <artifactId>spring-webmvc</artifactId>
22.    <version>5.1.1.RELEASE</version>
23. </dependency>
24.24.
25. <!--https://mvnrepository.com/artifact/javax.servlet/javax.servlet-api-->
26. <dependency>
27.    <groupId>javax.servlet</groupId>
28.    <artifactId>servlet-api</artifactId>
29.    <version>3.0-alpha-1</version>
30. </dependency>
31.31.
32.  </dependencies>
33.  <build>
34.    <finalName>SpringMVC</finalName>
35.  </build>
36. </project>
```

2. Createthe controllerclass

To create the controller class, we are using two annotations @Controller and@RequestMapping.

The@Controllerannotationmarksthisclass asController.

The@Requestmapping annotationis used tomap theclasswith thespecifiedURL name.

HelloController.java

```
1. packagecom.javatpoint;
2. importorg.springframework.stereotype.Controller;
3. importorg.springframework.web.bind.annotation.RequestMapping;
4. @Controller
5. publicclassHelloController{
6. @RequestMapping("/")
7.     publicStringdisplay()
8.     {
9.         return"index";
10.    }
11.}
```

3. Providethe entry ofcontroller in theweb.xml file

In this xml file, we are specifying the servlet class DispatcherServlet that acts as the frontcontroller in Spring Web MVC. All the incoming request for the html file will be forwardedtotheDispatcherServlet.

web.xml

```
1. <?xml version="1.0" encoding="UTF-8"?>
2. <web-appxmlns:xsi="http://www.w3.org/2001/XMLSchema-
   instance" xmlns="http://java.sun.com/xml/ns/javaee"
   xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
   http://java.sun.com/xml/ns/javaee/web-
   app_3_0.xsd"id="WebApp_ID"version="3.0">
3.   <display-name>SpringMVC</display-name>
4.    <servlet>
5.     <servlet-name>spring</servlet-name>
6.     <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-class>
7.     <load-on-startup>1</load-on-startup>
8.  </servlet>
9.  <servlet-mapping>
10.    <servlet-name>spring</servlet-name>
11.    <url-pattern>/</url-pattern>
12. </servlet-mapping>
13. </web-app>
```

4. Definethe beanin the xml file

Thisistheimportant configurationfilewherewe needtospecify theView components.

The context:component-scan element defines the base-package where DispatcherServlet willsearchthecontrollerclass.

Thisxml fileshould belocated insidethe WEB-INFdirectory.

spring-servlet.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<beansxmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:context="http://www.springframework.org/schema/context"
    xmlns:mvc="http://www.springframework.org/schema/mvc"
    xsi:schemaLocation="
        http://www.springframework.org/schema/beans
        http://www.springframework.org/schema/beans/spring-beans.xsd
        http://www.springframework.org/schema/context
        http://www.springframework.org/schema/context/spring-context.xsd
        http://www.springframework.org/schema/mvc
        http://www.springframework.org/schema/mvc/spring-mvc.xsd">
13. 13.
    <!--Providesupportforcomponent scanning -->
    <context:component-scanbase-package="com.javatpoint" />
16. 16.
    <!--Providesupportforconversion,formatting andvalidation-->
    <mvc:annotation-driven/>
19. 19.
</beans>
```

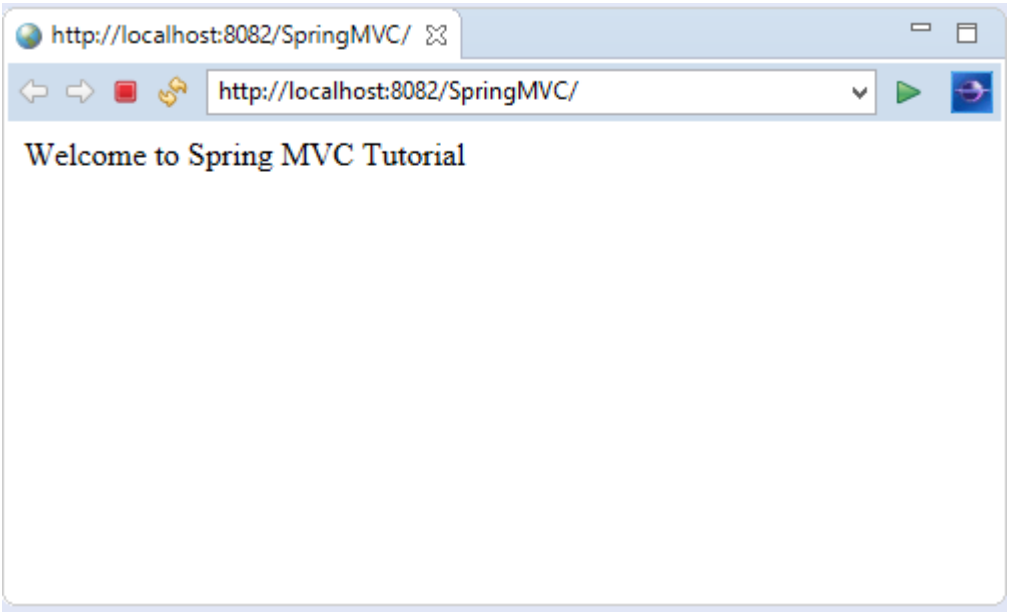
5. Displaythe messagein the JSP page

Thisisthe simpleJSPpage,displaying themessagereturnedbythe Controller.

index.jsp

```
<html>
<body>
<p>WelcometoSpringMVCTutorial</p>
</body>
</html>
```

Output:



RESTfulAPIusingSpringFramework

BuildingRESTserviceswithSpring

REST has quickly become the de-facto standard for building web services on the webbecausethey'reeasytobuild and easy to consume.

There's a much larger discussion to be had about how REST fits in the world ofmicroservices,but —for thistutorial—let'sjustlookatbuildingRESTfulservices.

Why REST? REST embraces the precepts of the web, including its architecture, benefits, andeverything else. This is no surprise given its author, Roy Fielding, was involved in probably adozenspecswhich govern how theweb operates.

Whatbenefits?Thewebanditscoreprotocol,HTTP,provideastackof features:

- Suitableactions(GET,POST,PUT,DELETE,…)
- Caching
- Redirectionandforwarding
- Security(encryptionandauthentication)

These are all critical factors on building resilient services. But that is not all. The web is builtout of lots of tiny specs, hence it's been able to evolve easily, without getting bogged down in"standardswars".

Developers are able to draw upon 3rd party toolkits that implement these diverse specs andinstantlyhaveboth client and servertechnology attheirfingertips.

Bybuildingon topof HTTP,REST APIsprovidethemeans tobuild:

- BackwardscompatibleAPIs
- EvolvableAPIs
- Scaleableservices
- Securableservices
- Aspectrumofstatelesstostatefulservices

What's important to realize is that REST, however ubiquitous, is not a standard, *per se*, butan approach, a style, a set of *constraints* on your architecture that can help you build web-scale systems. In this tutorial we will use the Spring portfolio to build a RESTful servicewhileleveraging thestackless features of REST.

GettingStarted

As we work through this tutorial, we'll use Spring Boot. Go to Spring Initializrand add thefollowingdependencies to a project:

- Web
- JPA
- H2

ChangetheNameto "Payroll"andthen choose"GenerateProject".A.zipwilldownload.Unzip it. Inside you'll find a simple, Maven-based project including a pom.xml build file(NOTE:You*can* useGradle. Theexamplesin this tutorialwill be Maven-based.)

Spring Boot can work with any IDE. You can use Eclipse, IntelliJ IDEA, Netbeans, etc. TheSpring Tool Suiteis an open-source, Eclipse-based IDE distribution that provides a supersetof the Java EE distribution of Eclipse. It includes features that make working with Springapplications even easier. It is, by no means, required. But consider it if you want that extra**oomph** for your keystrokes. Here's a video demonstrating how to get started with STS andSpringBoot. This is ageneral introductionto familiarizeyou with thetools.

TheStorysoFar…

Let's start off with the simplest thing we can construct. In fact, to make it as simple aspossible, we can even leave out the concepts of REST. (Later on, we'll add REST tounderstandthe difference.)

Big picture: We're going to create a simple payroll service that manages the employees of acompany. We'll store employee objects in a (H2 in-memory) database, and access them (viasomething called JPA). Then we'll wrap that with something that will allow access over theinternet(called the Spring MVC layer).

Thefollowing codedefines an Employeein our system.

nonrest/src/main/java/payroll/Employee.java

```
packagepayroll;
```

```
importjava.util.Objects;

importjavax.persistence.Entity;importjav
ax.persistence.GeneratedValue;importjav
ax.persistence.Id;

@EntityclassE
mployee{

private@Id@GeneratedValueLong
id;privateString name;
privateString

role;Employee(){

}

Employee(Stringname,Stringrole){

this.name =
name;this.role=rol
e;
}

publicLonggetId(){
returnthis.id;
}

publicStringgetName(){
returnthis.name;
}

publicStringgetRole(){
returnthis.role;
}

publicvoidsetId(Long
id){this.id = id;
}

publicvoidsetName(String
name){this.name = name;
}

publicvoidsetRole(String
role){this.role=role;
}

@Overridepublicbooleanequals
(Objecto){

if(this==
o)returntru
e;
if(!(o
instanceofEmployee))returnfalse;E
mployeeemployee=(Employee)o;
returnObjects.equals(this.id, employee.id)&&Objects.equals(this.name,
employee.name)&&Objects.equals(this.role,employee.role);
}
```

```
@Overridepublicinth
ashCode(){
```

```
returnObjects.hash(this.id,this.name,this.role);
}

@OverridepublicStrin
gtoString(){
return"Employee{"+"id="+this.id+",name='"+this.name+'\"+",role='"+this.role+'\"+'}';
}
}
```

Despitebeingsmall, thisJavaclasscontains much:

- @Entityisa JPAannotation tomakethisobject readyfor storagein aJPA-based datastore.
- id,name, androleareattributes ofourEmployeedomain object.iddismarked withmoreJPA annotations to indicate it's the primary key and automatically populated by theJPAprovider.
- a custom constructor is created when we need to create a new instance, but don't yethavean id.

With this domain object definition, we can now turn to Spring Data JPAto handle the tediousdatabaseinteractions.

Spring Data JPA repositories are interfaces with methods supporting creating, reading,updating, and deleting records against a back end data store. Some repositories also supportdata paging, and sorting, where appropriate. Spring Data synthesizes implementations basedonconventions found in the naming ofthemethods in theinterface.

There are multiple repository implementations besides JPA. You can use Spring Data MongoDB,SpringDataGemFire,SpringDataCassandra,etc.Forthistutorial,we'll stickwithJPA.

Springmakesaccessingdataeasy.BysimplydeclaringthefollowingEmployeeRepository interfaceweautomaticallywillbeableto

- CreatenewEmployees
- Updateexistingones
- DeleteEmployees
- FindEmployees(one,all,orsearchbysimpleorcomplexproperties)

nonrest/src/main/java/payroll/EmployeeRepository.java

```
package

payroll;importorg.springframework.data.jpa.repository.JpaRepository;i

nterfaceEmployeeRepositoryextendsJpaRepository<Employee,Long>{

}
```

To get all this free functionality, all we had to do was declare an interface which extendsSpring Data JPA's JpaRepository, specifying the domain type as Employee and the id type asLong.

Spring Data's repository solutionmakes it possible to sidestep data store specifics and insteadsolveamajority of problems using domain-specific terminology.

Believe it or not, this is enough to launch an application! A Spring Boot application is, at aminimum, a public static void main entry-point and the @SpringBootApplication annotation. ThistellsSpring Boot to helpout, wherever possible.

nonrest/src/main/java/payroll/PayrollApplication.java

```
packagepayroll;

importorg.springframework.boot.SpringApplication;importorg.springfr
amework.boot.autoconfigure.SpringBootApplication;

@SpringBootApplicationpubli
cclassPayrollApplication{

publicstaticvoidmain(String...args){SpringApplicatio
n.run(PayrollApplication.class,args);
}
}
```

@SpringBootApplicationis ameta-annotation that pullsin**component scanning**,**autoconfiguration**, and **property support**. We won't dive into the details of Spring Boot inthistutorial, but inessence, it will fireup aservlet containerand serveupourservice.

Nevertheless, an application with no data isn't very interesting, so let's preload it. Thefollowingclass will get loaded automatically by Spring:

nonrest/src/main/java/payroll/LoadDatabase.java

```
packagepayroll;

importorg.slf4j.Logger;import
org.slf4j.LoggerFactory;
importorg.springframework.boot.CommandLineRunner;impor
torg.springframework.context.annotation.Bean;importorg.spri
ngframework.context.annotation.Configuration;

@Configurationclas
sLoadDatabase{

privatestaticfinalLogger log

=LoggerFactory.getLogger(LoadDatabase.class);@Bean
CommandLineRunnerinitDatabase(EmployeeRepositoryrepository){

returnargs->{
log.info("Preloading "+repository.save(newEmployee("Bilbo
Baggins","burglar")));log.info("Preloading"+repository.save(newEmployee("Frodo
Baggins","thief")));
};
}
}
```

Whathappenswhenitgetsloaded?

- Spring Boot will run ALL CommandLineRunner beans once the application context isloaded.
- ThisrunnerwillrequestacopyoftheEmployeeRepositoryyoujustcreated.
- Usingit,it willcreate twoentitiesandstorethem.

Right-clickand**Run**PayRollApplication,and thisiswhat youget:

Fragment ofconsoleoutputshowingpreloadingof data

```
...
2018-08-09 11:36:26.169INFO 74611 --- [main] payroll.LoadDatabase : Preloading
Employee(id=1,name=Bilbo Baggins, role=burglar)
2018-08-0911:36:26.174INFO74611---
[main]payroll.LoadDatabase:PreloadingEmployee(id=2,name=FrodoBaggins, role=thief)
...
```

This isn't the **whole** log, but just the key bits of preloading data. (Indeed, check out the wholeconsole.It's glorious.)

HTTP isthe Platform

To wrap your repository with a web layer, you must turn to Spring MVC. Thanks to SpringBoot,thereis littlein infrastructuretocode.Instead, wecanfocus onactions:

nonrest/src/main/java/payroll/EmployeeController.java

```
package

payroll;importjava.

util.List;

importorg.springframework.web.bind.annotation.DeleteMapping;importorg.springframework.web.bind.annotation.Get
Mapping;importorg.springframework.web.bind.annotation.PathVariable;importorg.springframework.web.bind.ann
otation.PostMapping;importorg.springframework.web.bind.annotation.PutMapping;importorg.springframework.we
b.bind.annotation.RequestBody;importorg.springframework.web.bind.annotation.RestController;

@RestControllerclassEmp
loyeeController{

privatefinalEmployeeRepositoryrepository;

EmployeeController(EmployeeRepository
repository){this.repository=repository;
}


//Aggregateroot
// tag::get-aggregate-
root[]@GetMapping("/emplo
yees")List<Employee>all(){r
eturnrepository.findAll();
}
//end::get-aggregate-root[]
```

```
@PostMapping("/employees")EmployeenewEmployee(@Request
BodyEmployeenewEmployee){returnrepository.save(newEmploye
e);
}

//Singleitem

@GetMapping("/employees/{id}")Emp
loyeeone(@PathVariableLongid){

returnrepository.findById(id)
.orElseThrow(()->newEmployeeNotFoundException(id));
}

@PutMapping("/employees/{id}")EmployeereplaceEmployee(@RequestBodyEmployeenewEmployee,@PathVari
ableLongid){

returnrepository.findById(id)
.map(employee -
>{employee.setName(newEmployee.getName(
));employee.setRole(newEmployee.getRole());
returnrepository.save(employee);
})
.orElseGet(()-
>{newEmployee.setId(id);returnrepos
itory.save(newEmployee);
});
}

@DeleteMapping("/employees/{id}")voiddele
teEmployee(@PathVariableLong
id){repository.deleteById(id);
}
}
```

- @RestController indicates that the data returned by each method will be written straightintothe response body instead of rendering atemplate.
- AnEmployeeRepositoryisinjectedbyconstructorintothecontroller.
- Wehaveroutesforeachoperation (@GetMapping,@PostMapping,@PutMappingand@DeleteMapping, corresponding to HTTP GET, POST, PUT, and DELETE calls). (NOTE:It'suseful to read each methodand understandwhat they do.)
- EmployeeNotFoundException is an exception used to indicate when an employee is lookedup but not found.

nonrest/src/main/java/payroll/EmployeeNotFoundException.java

```
packagepayroll;

classEmployeeNotFoundExceptionextendsRuntimeException{

EmployeeNotFoundException(Longid){
super("Couldnotfind employee"+id);
}
}
```

When an EmployeeNotFoundException is thrown, this extra tidbit of Spring MVC configuration isusedto renderan **HTTP 404**:

nonrest/src/main/java/payroll/EmployeeNotFoundAdvice.java

```
packagepayroll;

importorg.springframework.http.HttpStatus;importorg.springframe
work.web.bind.annotation.ControllerAdvice;importorg.springframe
work.web.bind.annotation.ExceptionHandler;importorg.springframe
work.web.bind.annotation.ResponseBody;importorg.springframewo
rk.web.bind.annotation.ResponseStatus;

@ControllerAdviceclassEmploye
eNotFoundAdvice{

@ResponseBody@ExceptionHandler(EmployeeNotFoundException.
class)@ResponseStatus(HttpStatus.NOT_FOUND)StringemployeeNo
tFoundHandler(EmployeeNotFoundException
ex){returnex.getMessage();
}
}
```

- @ResponseBodysignalsthatthisadviceisrenderedstraightintotheresponse body.
- @ExceptionHandlerconfigurestheadvicetoonlyrespondifan EmployeeNotFoundException isthrown.
- @ResponseStatussaystoissuean HttpStatus.NOT_FOUND,i.e.an**HTTP404**.
- The body of the advice generates the content. In this case, it gives the message of theexception.

Tolaunchtheapplication,eitherright-clickthepublicstaticvoid mainin PayRollApplicationandselect**Run**from yourIDE, or:

SpringInitializrusesmavenwrappersotypethis:

```
$./mvnwcleanspring-boot:run
```

Alternativelyusingyour installedmavenversiontypethis:

```
$mvnclean spring-boot:run
```

Whentheappstarts,wecanimmediatelyinterrogate it.

```
$curl-vlocalhost:8080/employees
```

Thiswill yield:

```
*   Trying::1...
* TCP_NODELAYset
* Connectedto localhost(::1)port8080(#0)
> GET/employeesHTTP/1.1
> Host:localhost:8080
> User-Agent:curl/7.54.0
> Accept:*/*
>
<HTTP/1.1200
<Content-Type:application/json;charset=UTF-8
```

```
<Transfer-Encoding:chunked
<Date:Thu,09Aug2018 17:58:00 GMT
<
* Connection#0 tohostlocalhostleftintact
[{"id":1,"name":"BilboBaggins","role":"burglar"},{"id":2,"name":"FrodoBaggins","role":"thief"}]
```

Here you can see the pre-loaded data, in a compacted

format.Ifyou try and query auser that doesn't exist…

```
$curl-vlocalhost:8080/employees/99
```

Youget…

```
*   Trying::1...
* TCP_NODELAYset
* Connectedto localhost(::1)port8080(#0)
> GET/employees/99HTTP/1.1
> Host:localhost:8080
> User-Agent:curl/7.54.0
> Accept:*/*
>
<HTTP/1.1404
<Content-Type:text/plain;charset=UTF-8
<Content-Length:26
<Date:Thu,09 Aug2018 18:00:56 GMT
<
* Connection #0 to host localhost left
intactCould notfindemployee99
```

This message nicely shows an **HTTP 404** error with the custom message **Could not findemployee99**.

It'snothardtoshowthe currentlycodedinteractions…

If you are using Windows Command Prompt to issue cURL commands, chances are thebelow command won't work properly. You must either pick a terminal that support singlequotedarguments, oruse double quotesand then escapethe onesinside theJSON.

Tocreate anewEmployeerecordweusethe following commandin aterminal—the$at thebeginningsignifies that what follows it is aterminal command:

```
$curl-XPOSTlocalhost:8080/employees-H'Content-type:application/json'-d'{"name":"SamwiseGamgee","role":
"gardener"}'
```

Thenit storesnewlycreated employeeandsendsit backto us:

```
{"id":3,"name":"SamwiseGamgee","role":"gardener"}
```

Youcanupdatetheuser. Let'schangehisrole.

```
$ curl -X PUT localhost:8080/employees/3 -H 'Content-type:application/json' -d '{"name": "Samwise
Gamgee","role":"ringbearer"}'
```

Andwecan seethechangereflected in the output.

{"id":3,"name":"SamwiseGamgee","role":"ringbearer"}

The way you construct your service can have significant impacts. In this situation, we said **update**,but **replace** is a better description. For example, if the name was NOT provided, it would instead getnulled out.

Finally,you can deleteusers like this:

$ curl -X DELETE

localhost:8080/employees/3# Now if

welookagain, it'sgone
$ curl
localhost:8080/employees/3Could
notfindemployee3

This is all well and good, but do we have a RESTful service yet? (If you didn't catch the hint,theanswer is no.)

What'smissing?

WhatmakessomethingRESTful?

So far, you have a web-based service that handles the core operations involving employeedata.But that'snot enough to makethings "RESTful".

- PrettyURLslike/employees/3aren'tREST.
- MerelyusingGET,POST,etc. isn'tREST.
- HavingalltheCRUDoperationslaidout isn'tREST.

In fact, what we have built so far is better described as **RPC** (**Remote Procedure Call**).That's because there is no way to know how to interact with this service. If you published thistoday, you'd also have to write a document or host a developer's portal somewhere with allthedetails.

ThisstatementofRoyFielding'smay furtherlendacluetothe differencebetween **REST** and**RPC**:

I am getting frustrated by the number of people calling any HTTP-based interface a RESTAPI.Today'sexampleistheSocialSiteRESTAPI.ThatisRPC.ItscreamsRPC.Thereissomuchcoupling on display that it should begivenan X rating.

What needs to be done to make the REST architectural style clear on the notion that hypertextis a constraint? In other words, if the engine of application state (and hence the API) is notbeing driven by hypertext, then it cannot be RESTful and cannot be a REST API. Period. Istheresomebroken manual somewherethat needstobe fixed?

—Roy Fielding

https://roy.gbiv.com/untangled/2008/rest-apis-must-be-hypertext-driven

The side effect of NOT including hypermedia in our representations is that clients MUSThard code URIs to navigate the API. This leads to the same brittle nature that predated theriseofe-commerceontheweb.It'sasignalthatourJSONoutputneedsalittlehelp.

Introducing Spring HATEOAS, a Spring project aimed at helping you write hypermedia-drivenoutputs. To upgradeyourserviceto beingRESTful, add thisto your build:

AddingSpringHATEOAStodependenciessectionofpom.xml

```
<dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-hateoas</artifactId>
</dependency>
```

This tiny library will give us the constructs to define a RESTful service and then render it inanacceptableformat forclient consumption.

A critical ingredient to any RESTful service is adding linksto relevant operations. To makeyourcontroller moreRESTful, add links like this:

Gettingasingleitemresource

```
@GetMapping("/employees/{id}")EntityModel<Empl
oyee>one(@PathVariableLongid){

Employeeemployee=repository.findById(id)//
.orElseThrow(()->newEmployeeNotFoundException(id));

returnEntityModel.of(employee,//linkTo(methodOn(EmployeeController.class).one(id)).withSel
    fRel(),linkTo(methodOn(EmployeeController.class).all()).withRel("employees"));
}
```

This tutorial is based on Spring MVC and uses the static helper methods fromWebMvcLinkBuilder to build these links. If you are using Spring WebFlux in your project, youmustinstead useWebFluxLinkBuilder.

Thisis verysimilarto whatwehad before,but afew things havechanged:

- Thereturntype ofthemethod haschangedfromEmployeetoEntityModel<Employee>.EntityModel<T>isagenericcontainer fromSpring HATEOASthatincludes notonlythedata but acollection oflinks.
- linkTo(methodOn(EmployeeController.class).one(id)).withSelfRel() asks that Spring HATEOASbuildalinkto theEmployeeController'sone()method,and flagit asaselflink.
- linkTo(methodOn(EmployeeController.class).all()).withRel("employees") asks Spring HATEOAStobuild a linkto the aggregate root,all(), andcall it"employees".

What do we mean by "build a link"? One of Spring HATEOAS's core types is Link. Itincludes a **URI** and a **rel** (relation). Links are what empower the web. Before the World WideWeb, other document systems would render information or links, but it was the linking ofdocumentsWITHthiskind ofrelationshipmetadata thatstitched the webtogether.

RoyFieldingencourages buildingAPIs withthesametechniquesthatmadetheweb

successful,andlinksare oneofthem.

If you restart the application and query the employee record of *Bilbo*, you'll get a slightlydifferentresponse thanearlier:

Curlingprettier

When your curl output gets more complex it can become hard to read. Use this or other tipstoprettify thejson returned by curl:

```
# Theindicated partpipestheoutputtojson_pp andasksittomakeyourJSONpretty.(Oruse whatever toolyou like!)
#                          v ----------------v
curl-vlocalhost:8080/employees/1|json_pp
```

RESTfulrepresentationofasingleemployee

```
{"id":
1,
"name":"Bilbo
Baggins","role":"burglar
","_links":{
"self":{"href":"http://localhost:8080/employ
ees/1"
},
"employees":{"href":"http://localhost:8080/employees
"
}
}
}
```

This decompressed output shows not only the data elements you saw earlier (id, name androle), but also a _links entry containing two URIs. This entire document is formatted usingHAL.

HAL is a lightweight mediatypethat allows encoding not just data but also hypermediacontrols, alerting consumers to other parts of the API they can navigate toward. In this case,thereis a "self"link (kind of likeathisstatement incode) alongwith alink back to the**aggregateroot**.

To make the aggregate root ALSO more RESTful, you want to include top level links whileALSOincluding any RESTful components within.

Soweturn this

Gettinganaggregateroot

```
@GetMapping("/employees")
List<Employee>all(){returnre
pository.findAll();
}
```

intothis

Gettinganaggregateroot**resource**

```
@GetMapping("/employees")CollectionModel<E
ntityModel<Employee>>all(){

List<EntityModel<Employee>>employees=repository.findAll().stream()
.map(employee -
        >EntityModel.of(employee,linkTo(methodOn(EmployeeController.class).one(employee.getId())).withSelfRel(),l
        inkTo(methodOn(EmployeeController.class).all()).withRel("employees")))
.collect(Collectors.toList());

returnCollectionModel.of(employees,linkTo(methodOn(EmployeeController.class).all()).withSelfRel());
}
```

Wow! That method, which used to just be repository.findAll(), is all grown up! Not to worry.Let'sunpack it.

CollectionModel<>isanotherSpringHATEOAScontainer;it'saimedaten

BuildinganapplicationusingMaven

Mavenis one of the open-source Java build toolsdeveloped by Apache Software Foundation.Itcan compile, test, and packageajavaprograminto.jaror.warformat.

Mavenmakesuseofthepom.xml filetobuildjavaprojects.

Project Object Model (POM) is an XML file that contains the java project details,configurations,and settingsrequired for maventobuild theproject.

The **pom.xml** file is present in the root of the java project directory. Primarily it contains theprojectdependencies.

For example, when a developer wants to implement a PostgreSQLdatabase connectivityfunctionality, he will make use of the PostgreSQL JDBC Driverdependency from the mavenrepositoryby adding it to the pom.xml file.

So when you build the code with maven, it reads the pom.xml file and downloads all thedependencies from the maven repository. Dependencies could be third-party libraries fromthe public Maven Repository or common libraries hosted within an organization's privatemavenrepository. Youcan compare itwith Python pip,Nodejs npm,or Ruby gems

CommonlyorganizationsuseSonatyopenexusasa privatehostedmavenrepository.

By default, maven uses the public repository but if you have in-house private mavenrepositories, you configure custom maven repository URLs in settings.xml maven configurationpresentinthemaveninstallationdirectory.for example,/opt/apache-maven-3.8.6/conf/settings.xml

MavenPrerequisites

Formaven toworkyou needthe followinginstalled onyoursystem

1. JavaJDK
2. Maven

ToinstallandconfigureJDKandmaven,followthe **maveninstallationguide.**

BuildJava ApplicationUsingMaven

For this example, we will be using the open-source **java spring boot application** named pet-clinic.

First,clonethe applicationtoyourdevelopmentmachineorserver.

```
gitclonehttps://github.com/spring-projects/spring-petclinic.git
```

The code base has the following important folders and files. It is common in real-time projectcodeas well.

1. /**srcfolder:** Thisfoldercontainsthesourcecodebasedonthejavaspringframework.
2. **/src/testsfolder:**Thisfolder containstheunittests&integrationtestsofthecodeunderthe testsfolder.
3. **pom.xml file:** It contains all the dependencies required for the pet-clinic applications. As it isanopen-sourceapplication,allthedependenciesarefrom thepublicmavenrepository.

To build the project, cd into the project root directory. In my case its spring-petclinic. It shouldcontain thepom.xmlfile

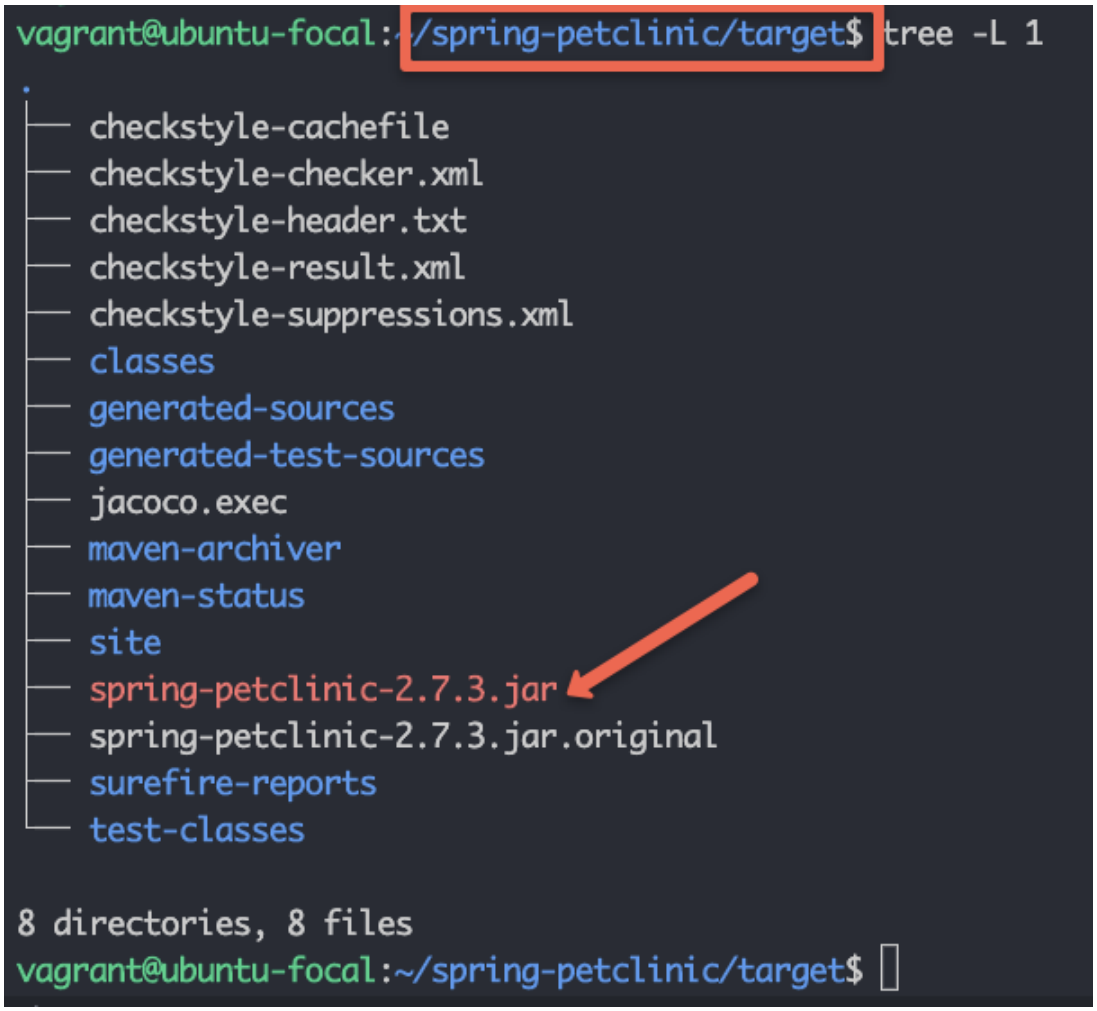
```
cdspring-petclinic
```

From a CI perspective, we just have to **build, test, and package** the project to create adeployableartifact(jar file)

So commonly in the CI process, we build and package the java projects using the followingmaven command. It compiles the code, tests it, package it as a jar file in the target folder, andwillalso install(copy)the jar packageinthelocal.m2repository.

```
mvncleaninstall
```

After executing the above command, you will see a folder named **target** in the root directory.Inside the target directory, you will see the packaged jar file as shown below. We call it adeployableartifact.



Eventimeyourun**mvncleaninstall**,itdeletestargetdirectoryandpackagesfrom thelocal.**m2** repositoryandreplacesitwiththelatestbuildfilesandpackages.

If you want to skip the test during build, you can add the **-Dmaven.test.skip=true** parameter asshownbelow.

```
mvncleaninstall-Dmaven.test.skip=true
```

Now that you have understood how to build a java project using maven, let's look into themaven lifecycle. Few commands we don't have to use in the CI pipelines. However, it isgood to know about the maven lifecycle commands and you can use them depending on yourCIpipeline requirement.

MavenLifecycleExplained

Let's take a look at each maven lifecycle phase in order. Each phase executes all the phasesbeforeit.Forexample, if youexecutethethirdphase,one, two,andthreegetexecuted.

1. MavenValidate(mvn validate)

mvnvalidatevalidatesthemavenproject.Itdownloadsalltherequireddependenciestothe

local**.m2**repository.

2. MavenCompile(mvncompile)

mvncompilecompilesthejavaproject.Itrunsvalidatefirstandthencompilesthecode.

3. MavenTest(mvntest)

mvntestcommandruns theunittest thatis partofthe code.Youcantest classes individually,methodsindividually, oradd patternsto runtestson allmethods thatmatch thepattern.

4. MavenPackage(mvnpackage)

mvn package commands compile the code, test it and finally package it in the required format(jarorwar)

5. MavenVerify(mvnverify)

mvnverifycommandrunsallthephasesexplained beforeinorderandrunschecksonintegrationtests andcheckstylesif they aredefined in theproject.

6. MavenInstall(mvninstall)

mvninstallcommandinstallsthepackagedcodeinthe localmavenrepository.

7. MavenDeploy(mvndeploy)

mvn deploy command, deploys the package to the remote maven repository. When you rundeploy, it first runs validate, compile, test, package, verify, install, and then finally deploysthepackageto theremotemaven repository.

PossibleMavenBuildErrors

java.lang.IllegalStateException:Unabletoloadcacheitem

Ifmavendoesn’tsupport theJavaversion,youwillgettheaboveerror.

Torectifyit,install thelatestmaven versionthatsupportstheinstalledJava version.

```
vagrant@ubuntu-focal:~/spring-petclinic$ mvn dependency:resolve
[ERROR] Error executing Maven.
[ERROR] java.lang.IllegalStateException: Unable to load cache item
[ERROR] Caused by: Unable to load cache item
[ERROR] Caused by: Could not initialize class com.google.inject.internal.
vagrant@ubuntu-focal:~/spring-petclinic$
```

If you try to execute the maven command from the location where there is no **pom.xml**

file,youwill get thefollowing error.

Thegoalyou specified requiresaprojectto executebutthereisno POM in thisdirectory

Torectifythis,execute themavencommandfrom thefolderthat hasthe pom.xmlfile.

MavenBuild FAQs

Doesmvnpackageruntests?

Yes. By default, the mvn package command runs the test. However, you can add the flag -Dmaven.test.skipto skip thetests.

Whatdoes Maventest do?

mvntestruns alltheunit testsforthejavaproject.

Conclusion

As a Devops engineer,it is very important to understand the java build process if you areworkingon deploying javaprojects.

UNIT–V

Databases&Deployment

Functionaldependencydefinestherelationshipoftwoormoreattributes,typicallybetweenthe primary key and non-key attributes of another table. It is also defined by the relation ofoneattributeto anotherattributein DBMS.

empId→{empName,skill,dependent,contract,project},→Here,empIdcandetermineordefinest hevalues offieldsempName,dependent,contractandemployeeproject

UsernameTables:

userName → dateCreate here if we can know the userName like we have email account ifweknow the email Id of user then there is possibility to find the date when account wascreated.

MultivaluedDependency:

Multivalency Dependency occurs in such a condition or time when two or more attributes intableareindependenttoeach otherbut, both ofthem dependupon the third attributes.

EmployeeTable:

The attributes like empName, skill, dependent, contract, project all are independent of eachother means not depends on one another but depends upon empId example empName candetermine skill, or any other employee attribute because there can be or even more than oneemployeewith same nameor constraints.

empId->skillempId-> contractempId-> projectempId->

dependentThese all of the columns is the multivalued dependency on

the empIdUsernameTable:

We only have two attributes here, but there are no multiple attributes that are independent ofeachother but rely solelyon the third variable.

userName → dateCreate here dateCreate is an attribute that depends or relate

upontheuserNameonlydateCreate whenthereisnot sufficientto findanything.b)

Minimal key is the minimum no of attributes which can find out other attributes of a tablei.e.,aprimary key or thecandidatekey.**In the Context ofEmployeeTable:**

empId→{empName,skill,dependent,contract,project}

Inthe Context ofUsernameTable:

userName→dateCreate

IntheContextofSubjectTable:

ConsiderSubjecttablewhichhas sub_Code,subNamesub_Code->subName

IntheContextofEnrollmentTable:

Consideringtheenrollmenttablewhichhastheattributeslike:enrollmentId,Nameofemploy ee,field in whichemployeeenrolledanddate

c)

WehavethefollowingEmployeeandUsernameTables:

InContextofEmployee Table:

Employee table is not in normalize or the normal forms. Because the Attributes in it like:Skill,project,contractanddependentattributesmighthaveone ormorevalues.Accordingtothe 1NF principle every field must contain the atomic values if they don't have the atomicvalue.There is need to decompose the table since the table should have the 1 value in eachfield.

IntheContextof UsernameTable:

It is normalizing one Since it has two fields[UserName and dateCreate] in which both haveatomicvalues ordata, isfully functional dependent,no transition dependencyetc.

d)

Normalization,Decompositionprocesswillbedone.

Normalization is a process or technique of organizing or collecting the data in database. It ismainlydone fortwo purposes: Eliminatingtheredundancy oreven the uselessdata

In1stNF:

Every field must contain the single atomic value and the attribute like: skill, project, contractand dependent attribute has one or more than the decompose table so that the each and everyfield has atomic value which will increase the number of tuples in the table name"employee".

Inthe 2ndNF:

Each tableshouldbeat1stNF.

- There should not be any functional dependency. So, in this case, after it is in 1st NFtableis in 2ndNFSincethe empId can find out allthe attributes of theemployees.

In3rdNF:

- Table shouldbeat2ndNFForm.
- There should not be any transitive dependency in the table in which the non-primitiveattribute can find another non-primitive attribute i.e., empName, skill, dependent,project is the non-primitive attribute and they cannot find the each other but the mainprimeattributecan or ableto find all of them.

InBCNF:

- Table shouldbeat3rdNF.
- The LHS Side of attribute should have the candidate key or the super key. • So, In thiscaseempId→ { empName,skill,dependent,contract, project},The attributeempIdisa primary key andcanfind out all other attributes.

Inthe4thNF:

TableshouldbeatBCNFForm.

Thereshouldnotbeanymultivalued Dependency.

So,incurrentEmployeeTablecontext,EmployeemightcontainthemultivalueddependencyI.e.:skills,projects[0ormore],dependency[0ormore]andcontract[1ormore].So,thereislots of multivalued attributes or dependency on the empId which might increase the no ofentriesinthe tablewhichmightincreasethenoofentriesinthe tableaftermakingitto1stNF.

In the case of making the Employee table in 4th NF, it will decompose the employee tableintofollowingtables:empId →{empName,skill, dependent,contract, project}

EmployeeSkilse

mpId,

empName,skill

EmployeeDependencyempId,empName,dependent**EmployeeContract**empId,empName
,

contract

EmployeeProjectempId,empName,project

Thereis noneed tochangetheUsername Tablesinceit isalready on4th NF.

StructuredQueryLanguage

SQLTutorial

SQL tutorial provides basic and advanced concepts of SQL. Our SQL tutorial is designed forbothbeginners and professionals.

SQL(StructuredQuery Language)isusedtoperformoperationsontherecordsstoredinthedatabase, such as updating records, inserting records, deleting records, creating andmodifyingdatabasetables, views, etc.

SQLisnota databasesystem,but itisa querylanguage.

Suppose you want to perform the queries of SQL language on the stored data in the database.You are required to install any database management system in your systems, for example,Oracle,MySQL,MongoDB, PostgreSQL, SQLServer,DB2, etc.

Whatis SQL?

SQL is a short-form of the structured query language, and it is pronounced as S-Q-L orsometimesas See-Quell.

This database language is mainly designed for maintaining the data in relational databasemanagement systems. It is a special tool used by data professionals for handling structureddata (data which is stored in the form of tables). It is also designed for stream processing inRDSMS.

You can easily create and manipulate the database, access and modify the table rows andcolumns, etc. This query language became the standard of ANSI in the year of 1986 and ISOintheyear of 1987.

If you want to get a job in the field of data science, then it is the most important querylanguage to learn. Big enterprises like Facebook, Instagram, and LinkedIn, use SQL forstoringthedata in the back-end.

WhySQL?

Nowadays, SQL is widely used in data science and analytics. Following are the reasonswhichexplain why it is widely used:

- The basic use of SQL for data professionals and SQL users is to insert, update, and delete thedatafromtherelationaldatabase.
- SQL allows the data professionals and users to retrieve the data from the relational databasemanagement systems.
- Italsohelpsthem todescribethestructureddata.
- It allows SQLuserstocreate, drop,andmanipulatethedatabaseanditstables.
- Italsohelpsincreatingtheview,storedprocedure,andfunctionsintherelationaldatabase.
- It allows youto definethedataandmodifythat storeddataintherelational database.

- It also allows SQL users to set the permissions or constraints on table columns, views, andstored procedures.

HistoryofSQL

"A Relational Model of Data for Large Shared Data Banks" was a paper which was publishedbythe great computer scientist "E.F. Codd" in 1970.

The IBM researchers Raymond Boyce and Donald Chamberlin originally developed theSEQUEL (Structured English Query Language) after learning from the paper given by E.F.Codd. They both developed the SQL at the San Jose Research laboratory of IBM Corporationin 1970.

At the end of the 1970s, relational software Inc. developed their own first SQL using theconcepts of E.F. Codd, Raymond Boyce, and Donald Chamberlin. This SQL was totallybased on RDBMS. Relational Software Inc., which is now known as Oracle Corporation,introduced the Oracle V2 in June 1979, which is the first implementation of SQL language.ThisOracle V2 version operates on VAXcomputers.

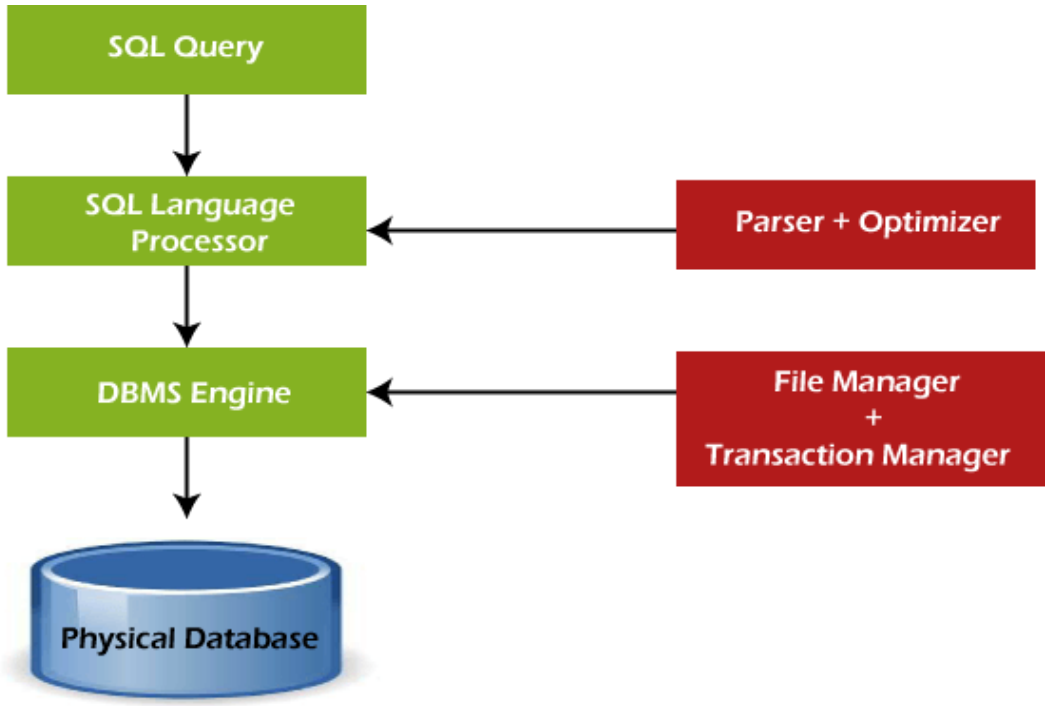
ProcessofSQL

When we are executing the command of SQL on any Relational database managementsystem,thenthesystemautomaticallyfindsthebestroutinetocarryoutour request,andtheSQLengine determines how tointerpret that particularcommand.

StructuredQueryLanguagecontainsthefollowingfourcomponentsinits process:

- QueryDispatcher
- OptimizationEngines
- ClassicQueryEngine
- SQLQuery Engine,etc.

A classic query engine allows data professionals and users to maintain non-SQL queries. Thearchitectureof SQL is shown in the following diagram:



SomeSQLCommands

The SQL commands help in creating and managing the database. The most common SQLcommandswhich arehighly used are mentioned below:

1. CREATE command
2. UPDATEcommand
3. DELETEcommand
4. SELECT command
5. DROPcommand
6. INSERTcommand

CREATECommand

This command helps in creating the new database, new table, table view, and other objects ofthedatabase.

UPDATECommand

This command helps in updating or changing the stored data in the

database.DELETECommand

Thiscommandhelpsinremovingorerasingthesavedrecordsfromthedatabasetables.Iterasessingle or multipletuplesfrom thetables of the database.

SELECTCommand

This command helps in accessing the single or multiple rows from one or multiple tables ofthedatabase.Wecanalso usethiscommand with theWHEREclause.

DROPCommand

This command helps in deleting the entire table, table view, and other objects from thedatabase.

INSERTCommand

This command helps in inserting the data or records into the database tables. We can easilyinserttherecords in single as wellas multiple rows of thetable.

SQLvs No-SQL

The following table describes the differences between the SQL and NoSQL, which arenecessaryto understand:

SQL	No-SQL
1. SQL is a relational database managementsystem.	1. While No-SQL is a non-relational or distributeddatabasemanagementsystem.
2. The query language used in this databasesystemisa structuredquerylanguage.	2. The query language used in the No-SQL databasesystemsisa non-declarativequery language.
3. The schema of SQL databases is predefined,fixed, andstatic.	3. The schema of No-SQL databases is a dynamicschemaforunstructured data.
4.Thesedatabasesareverticallyscalable.	4.Thesedatabasesarehorizontallyscalable.
5. The database type of SQL is in the form oftables,i.e.,intheform ofrows andcolumns.	5. The database type of No-SQL is in the form ofdocuments,key-value, andgraphs.
6.It followstheACIDmodel.	6.It followstheBASEmodel.

7. Complex queries are easily managed in theSQL database.	7.NoSQLdatabasescannothandlecomplexqueries.
8. This database is not the best choice forstoringhierarchicaldata.	8. While No-SQL database is a perfect option forstoringhierarchicaldata.
9. All SQL databases require object-relationalmapping.	9. Many No-SQL databases do not require object-relationalmapping.
10. Gauges, CircleCI, Hootsuite, etc., are thetop enterprises that are using this querylanguage.	10. Airbnb, Uber, and Kickstarter are the topenterprisesthatareusingthisquerylanguage.
11.SQLite,Ms-SQL,Oracle,PostgreSQL,and MySQL are examples of SQL databasesystems.	11.Redis, MongoDB,Hbase, BigTable,CouchDB, and Cassandra are examples of NoSQL databasesystems.

Advantagesof SQL

SQLprovidesvariousadvantageswhichmakeitmorepopularinthefieldofdatascience.Itis a perfect query language which allows data professionals and users to communicate withthedatabase.Followingarethebestadvantagesor benefitsof StructuredQueryLanguage:

1. Noprogrammingneeded

SQL does not require a large number of coding lines for managing the database systems. Wecan easily access and maintain the database by using simple SQL syntactical rules. Thesesimplerules makethe SQL user-friendly.

2. High-SpeedQueryProcessing

A large amount of data is accessed quickly and efficiently from the database by using SQLqueries.Insertion,deletion,andupdationoperationsondataarealsoperformedinless time.

3. StandardizedLanguage

SQL follows the long-established standards of ISO and ANSI, which offer a uniformplatformacross the globeto all its users.

4. Portability

The structured query language can be easily used in desktop computers, laptops, tablets, andeven smartphones. It can also be used with other applications according to the user'srequirements.

5. Interactivelanguage

We can easily learn and understand the SQL language. We can also use this language forcommunicatingwiththedatabasebecauseitis asimplequerylanguage. Thislanguageisalso

usedforreceivingthe answerstocomplexqueriesinafewseconds.

6. MorethanoneDataView

The SQL language also helps in making the multiple views of the database structure for thedifferentdatabaseusers.

Disadvantagesof SQL

WiththeadvantagesofSQL, italsohassomedisadvantages, whichareasfollows:

1. Cost

The operation cost of some SQL versions is high. That's why some programmers cannot usetheStructured Query Language.

2. InterfaceisComplex

Another big disadvantage is that the interface of Structured query language is difficult, whichmakesit difficult forSQLusers to useand manageit.

3. PartialDatabasecontrol

The business rules are hidden. So, the data professionals and users who are using this querylanguagecannot have full databasecontrol.

DatapersistenceusingSpring

I'm used to using Spring Roo to generate my entities and having it handle injecting theentityManageraswellasthepersistandothermethodsviaAspectJclasses.NowI'mtryingtouseSpring Boot to dosomething simple that willwritethings to the database...

```
@Entity
@Table(name =
"account")publicclassAcco
unt {

transientEntityManagerentityManager;

@Id
@GeneratedValue
privateLong id;

@Column(name="username",
nullable=false,unique=true)private Stringusername;

@Column(name = "password", nullable =
false)private Stringpassword;

  ...gettersand setters

@Transactionalpubl
icvoidpersist(){
```

```
if (this.entityManager == null) this.entityManager =
entityManager();this.entityManager.persist(this);
  }

@Transactional
publicAccountmerge() {
if (this.entityManager == null) this.entityManager =
entityManager();Accountmerged=this.entityManager.merge(this);this
.entityManager.flush();
return merged;
  }
```

When I'mcallingpersistormerge,entityManagerisobviouslynull.

I'vealsotriedadding implementsCrudRepository<Account,Long>totheAccountclasstoseeit'llgive me that functionality via a Default Implementation, but what I'm getting is simply emptyclassesthat needs to befilled in.

I've had a look at the Spring Boot docs, they cover it very briefly omitting just enough detailtoso that it's not obviouswhatI'm missing.

IhaveanApplicationclass thatbootstrapstheapplication:

```
@Configuration@Compone
ntScan@EnableAutoConfig
urationpublicclassApplicati
on{

publicstaticvoidmain(String[] args)throws Exception
{SpringApplication.run(Application.class,args);
  }

}
```

Myproperties file looks like this:

```
spring.application.name:TestApplication

spring.datasource.url:
jdbc:mysql://localhost/testspring.datasource.username=root
spring.datasource.password=spring.datasource.driverClass
Name=com.mysql.jdbc.Driverspring.jpa.hibernate.ddl-
auto=update
```

Thisdatabaseisautomaticallybeingcreatedthankstothe ddl-auto=updateproperty

WhatisthecorrectwaytopersistentitiesinSpringBoot+JPAandifwhatI'vedoneiscorrectso far, how doI"autowire" orauto-create theentityManager?

JDBCAgiledevelopmentprinciples

WhataretheAgilePrinciples?

There are 12 agileprinciples outlined in The Agile Manifestoin addition to the 4 agilevalues. These 12 principles for agile software development help establish the tenets of theagile mindset. They are not a set of rules for practicing agile, but a handful of principles tohelpinstill agilethinking.

Below we will review each of the 12 agile principles and describe how they may bepracticed.

AgilePrinciple 1

"Our highest priority is to satisfy the customer through early and continuous delivery ofvaluablesoftware."

Thebestwaysto ensureyoumakecustomers happywhilecontinuouslydeliveringvaluablesoftwareareto shipearly, iterate frequently, andlisten to your marketcontinually.

Unlike traditional approaches to product development, which have notoriously longdevelopment cycles, agile principles encourage minimizing the time between ideation andlaunch. The idea is to get a working product in the hands of customers as soon as possible.Doing this successfully means product managers are able to quickly get a minimum viableproduct (MVP)out and into the world and use it to get feedback from real customers. Thisfeedback is then fed back into the product development process and used to inform futurereleases.

Howitlooks inpractice:

- Product teams use minimum viable products and rapid experimentation to test hypothesis andvalidateideas.
- Frequentreleaseshelpfuelacontinuousfeedbackcyclebetween customer andproduct.
- Shipped and done are not the same thing. Instead of releasing a "finished" product, iterationscontinue to make incremental improvements to product based on customer and marketfeedback.

AgilePrinciple 2

"Welcome changing requirements, even late in development. Agile processes harness changeforthe customer's competitiveadvantage."

In the world around us, change is the only constant. Agile principles and values supportresponding to these changes rather than moving forward in spite of them. Previousapproachestoproductdevelopmentwereoftenchangeadverse;detailed, well-

documented

plansweremadebefore developmentbeganandweresetinstoneregardlessofnewfindings.Agile principles support observing changing markets, customer needs, and competitivethreatsand changing coursewhen necessary.

Howitlooks inpractice:

- Product teams are guided by high-level strategic goals and perhaps eventhemesbelow thosegoals. The product department's success is measured against progress toward those strategicgoalsrather than bydelivery of apredefinedfeatureset.
- Product constantly has its ear to the ground monitoring the market, customer feedback, andother factors which could influence product direction. When actionable insight is uncovered,plansare adjustedto betterservecustomer andbusiness needs.
- Product strategy and tactical plans are reviewed, adjusted, and shared on a regular cadence toreflect changes and new findings. As such, product needs to manage the expectations ofexecutivestakeholdersappropriatelyandensuretheyunderstandthe*why*behindchanges.

AgilePrinciple 3

"Deliver working software frequently, from a couple of weeks to a couple of months, with apreferenceto theshortertimescale."

Agile philosophy favors breaking a product's development into smaller components and"shipping" those components frequently. Using an agile approach, therefore—and buildingin more frequent mini-releases of your product—can speed the product's overalldevelopment.

Thisagileapproach,withshort-termdevelopment cyclesofsmallerportionsoftheproduct,results in less time spent drafting and poring over the large amounts of documentation thatcharacterizes Waterfall product development. More importantly, this frequent-releaseapproach creates more opportunities for you and your teams to validate your product ideasandstrategies fromthe qualified constituencieswho seeeachnewrelease.

Howitlooks inpractice:

- Agile development cycles, often called "sprints" or "iterations" break down productinitiatives into smaller chunks that can be completed in a set timeframe. Often this timeframeis between 2 and 4 weeks which truly is a sprint if you consider the marathon-likedevelopment cycles waterfallteamsoften follow.
- Another popular alternative to agile sprints is continuous deployment. This method ofshipping software frequently works less in terms of predetermined time boxes and more intermsof simply deciding whatto doand doingit.

AgilePrinciple 4

"Businesspeopleanddevelopersmustworktogetherdailythroughoutthe project."

Communication is a critical component of any project or team's success, and agile principlesessentially mandate that it's a daily event. It takes a village to raise a child they say, and thatappliesto product as well.

Asuccessfulproductrequiresinsightfromthebusinessandtechnicalsidesofanorganizationwhich can only happen if these two teams work together consistently. Regularcommunication between business people and developers helps improve alignment across theorganizationby building trust and transparency.

Howitlooks inpractice:

- Cross-functional agile product development teams include product people. This means thatproduct is represented on the development team and bridges the gap between technical andbusinessaspects oftheproduct.
- Daily update meetings, or standups, are one technique many agile shops use to put thisprinciplein practice and keep everyoneconnected.

AgilePrinciple 5

"Build projects around motivated individuals. Give them the environment and support theyneed,and trust them to get thejob done."

A key part of the agile philosophy is empowering individuals and teams through trust andautonomy. The agile team needs to be carefully built to include the right people and skill setsto get the job done, and responsibilities need to be clearly defined before the beginning of aproject. Once the work has begun, however, there's no place in agile for micromanagementorhand holding.

Howitlooks inpractice:

- Product must clearly ensure engineering understands strategy and requirements beforedevelopment starts. This means not only sharing user stories with the cross-functional teambut alsothebiggerpictureoutlined intheproductroadmap.
- Product is not responsible for explaining "how" something should be built. They need toshare what and why, but it's the delivery team's job to determine the how. Furthermore,during sprints product does not micromanage outcome, instead they make themselvesavailableto answerquestions and providesupportas needed.

AgilePrinciple 6

"The most efficient and effective method of conveying information to and within adevelopmentteam is face-to-faceconversation."

With so many distributed or remote development teams these days, this principle gets a bit ofcritique. But at the root of it, effective communication with developers means getting theseconversations out of Slack and email and favoring more human interaction (even if done byvideo conference calls). The overall objective behind this principle is to encourage productpeopleanddeveloperso trulycommunicate inrealtimeabouttheproduct,requirements,andthehigh-level strategy driving thosethings.

Howitlooks inpractice:

- Dailystandupmeetings
- Collaborativebackloggroomingsessions
- Sprintplanningmeetings
- Frequent demos
- Pair-programming

AgilePrinciple 7

"Workingsoftwareistheprimarymeasureofprogress."

Proponents of the agile philosophy are quick to remind us that we're in the business ofbuilding software, and that's where our time should be spent. Perfect, detailed documentationis secondary to working software. This mentality pushes to get products to the market quicklyrather than let documentation or an "it's not done until it's perfect" mentality become abottleneck.Theultimatemeasurefor successis a workingproduct thatcustomers love.

Howitlooks inpractice:

- Designing and releasing "Minimum Viable Features" rather than fully-developed feature setsmeans thinking first and foremost about the smallest things we can ship to start gettingcustomerfeedbackand validateas wecontinue tobuild software.
- A fail fast mentality means moving forward even in times of uncertainty and testing ideasrapidly.
- Shipsoftwareoften: ausefulproduct nowisbetterthanaperfect onelater.

AgilePrinciple 8

"Agile processes promote sustainable development. The sponsors, developers, and usersshouldbeable to maintain a constant paceindefinitely."

Keeping up with a demanding, rapid release schedule can be taxing on a team. Especially ifexpectations are set too high. Agile principles encourage us to be mindful of this and setrealistic, clear expectations. The idea is to keep morale high and improve work-life balance topreventburnout and turnover amongmembers of cross functionalteams.

Howitlooksinpractice:

- Before every sprint, careful consideration of the amount of work that can be committed to ismade. Development teams don't over promise on what they can and cannot deliver. Effortestimationsareacommonpracticein settingoutputexpectationsfordevelopmentteams.
- Everyone agrees on what will get done during a sprint. Once a sprint has begun, no additionaltasksare to beaddedexceptinrare cases.
- Product managers should act as gatekeepers to reduce the noise from other stakeholders andtoavoidsqueezinginadditionalunplannedwork duringan ongoingsprint.
- Product people should do their part in promoting a sense of psychological safety across thecross-functionalteamthatencouragesopencommunicationandfreelyflowingfeedback.

AgilePrinciple 9

"Continuousattentiontotechnicalexcellenceand gooddesignenhancesagility."

While the agile philosophy encourages shorter cycles and frequent releases, it also putsemphasis on the importance of keeping things neat and tidy so they don't cause problems inthe future. Product managers often forget about this aspect of development because theymostly don't spend their days wading through their products' codebases, but it is still of theutmostimportanceto them.

Howitlooks inpractice:

- The team needs to be cognizant oftechnical debtand the technical debt implications of anynew features or initiatives added to the backlog. Developers and product need to worktogethertounderstandifand whentechnicaldebtis acceptable.
- On a regular basis, product will need to allocate development resources to refactoring efforts.Refactoringcannotbe anafterthought,itneeds tobe anongoingconsideration.

AgilePrinciple 10

"Simplicity—theartofmaximizing theamountofwork notdone—isessential."

You've probably heard of the 80/20 rule—the concept that you can usually get 80% of yourintended results with just 20% of the work. Agile principles encourage thinking this way;doing the things that can have the most impact. In a product management context this meanshaving a laser sharp focus on organizational objectives and making some cutthroatprioritization decisions. Agile principles discourage building merely for the sake of buildingbyemphasizing the importanceof beingstrategicand building with purpose.

Howitlooks inpractice:

- Product managers need to make very focused product decisions and closely align productstrategy with organizational goals while being extremely picky about what user stories andfeaturesactuallymakethecut.Usingprioritizationtechniquestoprioritizeinitiativesbyeffortand predicted impact is one way product teams can apply this agile principle to productdevelopment.
- The short sprints that agile is characterized by present many opportunities for rapid testingand experimentation which can help reduce uncertainty around whether initiatives will trulyhave the predicted impact. Using experiments to validate ideas before building them up tospecis agreatway toweedoutbad ideasandidentifygood ones.

AgilePrinciple 11

"Thebestarchitectures,requirements,anddesignsemergefrom self-organizingteams."

In traditional software development methodologies, you'll often see pyramid shaped teamswhere management makes key decisions for contributors. Agile principles suggest the use ofself-organizing teams which work with a more "flat" management style where decisions aremade asagroupratherthanbyasingularmanagerormanagementteam.Theconcepttiesinto agile's value of teams and interactions over processes and tools, and the intent behind theconceptis to empower teams to work togetheras they need to.

Howitlooks inpractice:

- Self-organizing teams are autonomous groups within the organization who take control andresponsibility over their respective projects and have ownership of those areas. Differentorganizations practice this principle differently. Spotify, for example uses “product squads” topracticethis.

Learnmoreaboutmanagingcomplexrequirementsin anagileworldinthe webinarbelow.

deployingapplicationinCloud

AboutDeploying OracleAgile PLMonCloud

If your organization wants to develop, deploy, and/or update parts of an Agile ProductLifecycle Management (PLM) application in a faster, more agile way, instead of investing inbuildingon-premiseimplementations, thendeployAgile PLM onOracle CloudInfrastructure.

By using Agile PLM on Oracle Cloud, replication from on-premise to cloud and cloud-to-cloudplatforms can easily be established and managed. You can also gain the benefits of fasterinfrastructure updates, easier scaling up (and down), lower capital expenditure, and fewer personneldedicatedto basicinfrastructuremaintenance.

KeyWorkloadRequirements

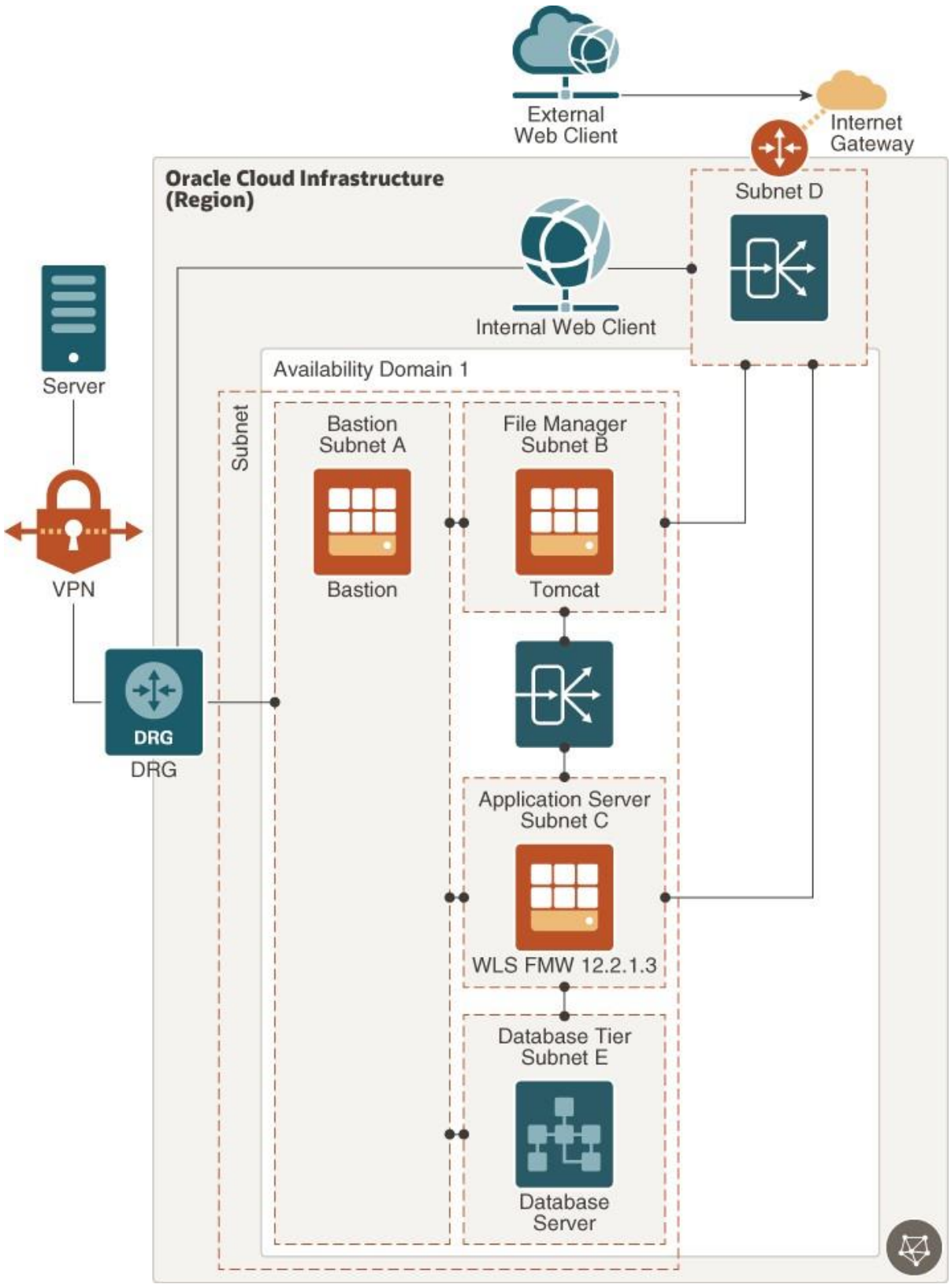
ThearchitecturesthatOracleprovideshelpyouaddresstheserequirements:

- Designingforhighavailabilityanddisasterrecovery
- Deployingasecurearchitecture.
- Matchingyourhigh-performanceandhighlyisolatednetworkmodel.
- Deployingyourapplicationanddatabaseenvironmentsintothecloud.
- Maintainingvisibilityovercostsandusage.
- Monitoringinfrastructurehealthandperformance.

Architecturefor Deploying AgilePLM on Cloud

You can deploy Agile PLM in a single availability domain while ensuring high availability.Usethisarchitecturewhenyouwanttoensurethatyourapplicationisavailableevenwhenanapplication instance goes down. The other available application instances in the availabilitydomaincontinueto process therequests.

Oracle Agile PLM can be deployed on cloud in a multi-tiered architecture. The architectureconsists of a virtual cloud network (VCN) with the bastion host, load balancer tier,application tier, and database tier. The tiers are placed in separate subnets of the VCN in asingleavailability domain.



[Descriptionoftheillustrationagile_plm_reference_architecture_high_availability.png]

TheAgilePLMapplicationserver canbesetupinastandaloneorclusteredconfiguration.Inthe image shown, a standalone server is considered, which has only one Oracle WebLogicServerinstance.Allclientserversandusersconnecttotheapplicationservereitherdirectl y

or indirectly. To permit traffic to the web server from the internet, you can create loadbalancers in the public subnet. You can access Oracle Cloud instances in the private subnetfromyourdata centersbyconnectingthroughthe dynamicroutinggateway (DRG).TheDRGis the gateway that connects your on premise network to your cloud network and you canenable communication between the two using VPN. You'll also have to update the route tabletoenable traffic to andfrom theDRG.

The load balancer receives requests from users, and then routes these requests to theapplication tier. You can allow for redundancy (and scalability) by configuring multipleinstances of the WebLogic server for the core application, Tomcat for File Manager, andRAC for database. You can augment redundancy through the use of fault domains so that youcan continue accessing the application even if an instance goes down. All instances are activeandreceive trafficfrom theload balancer.

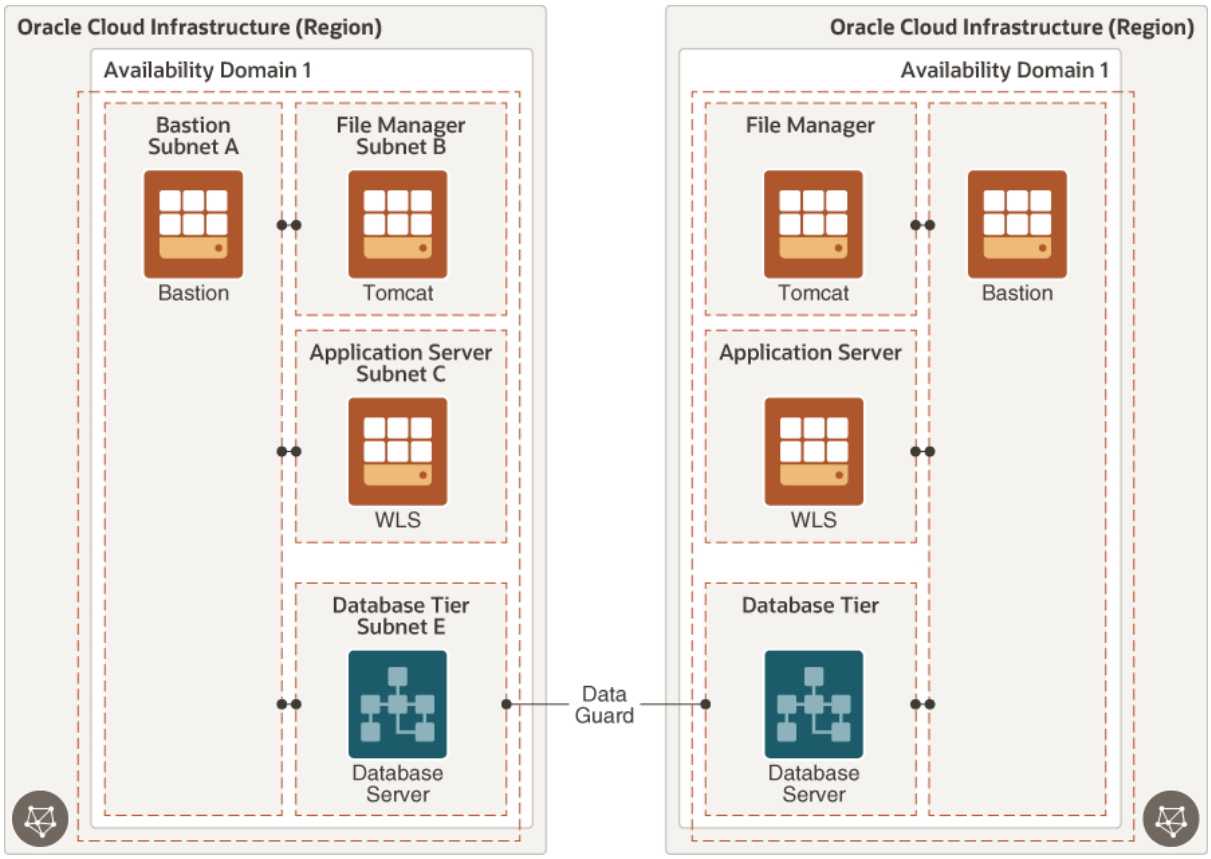
There's a private Load Balancer between File Manager and Application Server to distributetraffic to your application instances within a VCN. This service provides a primary and astandby instance of the load balancer to ensure that if the primary load balancer becomesunavailable, the standby load balancer forwards the requests. The load balancer ensures thatrequests are routed to the healthy application instances. If there's a problem with anapplicationinstance,then theloadbalancerremovesthatinstanceandstartsroutingrequeststotheremaining healthyapplication instances.

The database server stores all product content and system settings and is placed in the privatesubnet. This database is accessed only by the application server. For performance and highavailability requirements, Oracle recommends that you use two-node Oracle Real ApplicationClusters(OracleRAC) databasesystems in OracleCloudInfrastructure.

ArchitectureofAgilePLMDisasterRecovery

Oracle Cloud provides Agile PLM implementations that ensure you can build disasterrecovery (DR) into your deployment in unforeseen events that would require you to failoverandstill keep Agile PLM up and running.

The following image illustrates the reference architecture for deploying Agile PLM inmultipleregions with highavailability and disasterrecovery.



Description of the illustrationagile_plm_reference_architecture_high_availability_and_dr.png

OracleDataGuardprotectsyourdatabasetierby replicatingdata acrossavailabilitydomains.