
# MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

**(Autonomous Institution – UGC, Govt. of India)**

**(Affiliated to JNTUH, Hyderabad, Approved by AICTE- Accredited by NBA & NAAC 'A' Grade – ISO 9001:2015 Certified)**

## Certificate

*Department of* ***Electronics and Communication Engineering*** *Certified that in the bonafide Record of the work done by Mr./Miss.* _____ *Reg.No*_____*of B.Tech* ***ECE***_____*year*_____*semester for the Academic year 20*____*to 20*_____*in* _____*Laboratory.*

*Date:* *Staff Incharge* *HOD*

*Internal Examiner* *External Examiner*

# MICROPROCESSORS & MICROCONTROLLERS

# LAB MANUAL

## B.TECH
## IV YEAR – I SEM

## 2024-2025

**(R20A0487)**

**Prepared by:**

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**Department of Electronics and Communication Engineering**


## MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

**(Autonomous Institution – UGC, Govt. of India)**

Recognized under 2(f) and 12 (B) of UGC ACT 1956
(Affiliated to JNTUH, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – 'A' Grade - ISO 9001:2015 Certified) Maisammaguda, Dhulapally (Post Via. Kompally), Secunderabad – 500100, Telangana State, India

# ELECTRONICS & COMMUNICATION ENGINEERING

## VISION

**To evolve into a center of excellence in Engineering Technology through creative and innovative practices in teaching-learning, promoting academic achievement & research excellence to produce internationally accepted competitive and world class professionals.**

## MISSION

**To provide high quality academic programmes, training activities, research facilities and opportunities supported by continuous industry institute interaction aimed at employability, entrepreneurship, leadership and research aptitude among students.**

## QUALITY POLICY

- **Impart up-to-date knowledge to the students in Electronics & Communication area to make them quality engineers.**
- **Make the students experience the applications on quality equipment andtools.**
- **Provide systems, resources and training opportunities to achieve continuous improvement.**
- **Maintain global standards in education, training and services.**

## PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

### PEO1: PROFESSIONALISM & CITIZENSHIP

**To create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with due consideration for ethical, ecological and economic issues.**

### PEO2: TECHNICAL ACCOMPLISHMENTS

**To provide knowledge based services to satisfy the needs of society and the industry by providing hands on experience in various technologies in core field.**

### PEO3: INVENTION, INNOVATION AND CREATIVITY

**To make the students to design, experiment, analyze, interpret in the core field with the help of other multi disciplinary concepts wherever applicable.**

### PEO4: PROFESSIONAL DEVELOPMENT

**To educate the students to disseminate research findings with good soft skills and become a successful entrepreneur.**

### PEO5: HUMAN RESOURCE DEVELOPMENT

**To graduate the students in building national capabilities in technology, education and research.**

## PROGRAMME SPECIFIC OBJECTIVES (PSOs)

### PSO1

**To develop a student community who acquire knowledge by ethical learning and fulfill the societal and industry needs in various technologies of core field.**

### PSO2

**To nurture the students in designing, analyzing and interpreting required in research and development with exposure in multi disciplinary technologies in order to mould them as successful industry ready engineers/entrepreneurs**

### PSO3

**To empower students with all round capabilities who will be useful in making nation strong in technology, education and research domains.**

## PROGRAM OUTCOMES (POs)

### Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design / development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments.
12. **Life- long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Course Objectives:

- To develop and execute variety of assembly language programs of Intel 8086 including arithmetic and logical, sorting, searching, and string manipulation operations.
- To develop and execute the assembly language programs for interfacing Intel 8086 with peripheral devices.
- To develop and execute simple programs on 8051 micro controller.

## *Course Outcomes:*

**After going through this course the student will be able to**

- The student will learn the internal organization of popular 8086/8051 microprocessors/microcontrollers.
- The student will learn hardware and software interaction and integration.
- To apply the concepts in the design of microprocessor/microcontroller based systems in real time applications

## LABORATORY RULES

### General Rules of Conduct in Laboratories:

1. You are expected to arrive on time and not depart before the end of a laboratory.
2. You must not enter a lab unless you have permission from a technician or lecturer.
3. You are expected to comply with instructions, written or oral, that the laboratory Instructor gives you during the laboratory session.
4. You should behave in an orderly fashion always in the lab.
5. You must not stand on the stools or benches in the laboratory.
6. Keep the workbench tidy and do not place coats and bags on the benches.
7. You must ensure that at the end of the laboratory session all equipment used is stored away where you found it.
8. You must put all rubbish such as paper outside in the corridor bins. Broken components should be returned to the lab technician for safe disposal.
9. You must not remove test equipment, test leads or power cables from any lab without permission.
10. Eating, smoking and drinking in the laboratories are forbidden.
11. The use of mobile phones during laboratory sessions is forbidden.
12. The use of email or messaging software for personal communications during laboratory sessions is forbidden.
13. Playing computer games in laboratories is forbidden.

### Specific Safety Rules for Laboratories:

1. You must not damage or tamper with the equipment or leads.
2. You should inspect laboratory equipment for visible damage before using it. If there is a problem with a piece of equipment, report it to the technician or lecturer. DONOT return equipment to a storage area
3. You should not work on circuits where the supply voltage exceeds 40 volts without very specific approval from your lab supervisor. If you need to work on such circuits, you should contact your supervisor for approval and instruction on how to do this safely before commencing the work.
4. Always use an appropriate stand for holding your soldering iron.
5. Turn off your soldering iron if it is unlikely to be used for more than 10 minutes.
6. Never leave a hot soldering iron unattended.
7. Never touch a soldering iron element or bit unless the iron has been disconnected from the mains and has had adequate time to cool down.
8. Never strip insulation from a wire with your teeth or a knife, always use an appropriate wire stripping tool.
9. Shield wire with your hands when cutting it with a pliers to prevent bits of wire flying about the bench.

# INDEX

## PART-A



## PART-B

# INDEX

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# PART-A

# 1. INTRODUCTION TO MASM

## EDITOR

An editor is a program, which allows you to create a file containing the assembly language statements for your program. As you type in your program, the editor stores the ASCII codes for the letters and numbers in successive RAM locations. When you have typed in all of your programs, you then save the file on a floppy of hard disk. This file is called source file. The next step is to process the source file with an assembler. In the MASM /TASM assembler, you should give your source file name the extension, .ASM

## ASSEMBLER

An assembler program is used to translate the assembly language mnemonics for instructions to the corresponding binary codes. When you run the assembler, it reads the source file of your program from the disk, where you saved it after editing on the first pass through the source program the assembler determines the displacement of named data items, the offset of labels and pails this information in a symbol table. On the second pass through the source program, the assembler produces the binary code for each instruction and inserts the offset etc that is calculated during the first pass. The assembler generates two files on floppy or hard disk. The first file called the object file is given the extension. OBJ. The object file contains the binary codes for the instructions and information about the addresses of the instructions. The second file generated by the assembler is called assembler list file. The list file contains your assembly language statements, the binary codes for each instructions and the offset for each instruction. In MASM/TASM assembler, MASM/TASM source file name ASM is used to assemble the file. Edit source file name LST is used to view the list file, which is generated, when you assemble the file.

## LINKER

A linker is a program used to join several object files into one large object file and convert to an **exe** file. The linker produces a link file, which contains the binary codes for all the combined modules. The linker however doesn't assign absolute addresses to the program, it assigns is said to

be reloadable because it can be put anywhere in memory to be run. In MASM/TASM, LINK/TLIN8K source filename is used to link the file.

## DEBUGGER

A debugger is a program which allows you to load your object code program into system memory, execute the program and troubleshoot are debug it the debugger allows you to look at the contents of registers and memory locations after your program runs. It allows you to change the contents of register and memory locations after your program runs. It allows you to change the contents of register and memory locations and return the program. A debugger also allows you to set a break point at any point in the program. If you inset a breakpoint the debugger will run the program up to the instruction where the breakpoint is set and stop execution. You can then examine register and memory contents to see whether the results are correct at that point. In MASM/TASM, td filename is issued to debug the file.

## DEBUGGER FUNCTIONS:

1. Debugger allows looking at the contents of registers and memory locations.
2. We can extend 8-bit register to 16-bit register which the help of extended registeroption.
3. Debugger allows setting breakpoints at any point with the program.
4. The debugger will run the program up to the instruction where the breakpoint is set and then stop execution of program. At this point, we can examine registry and memory contents at that point.
5. With the help of dump we can view register contents.
6. We can trace the program step by step with the help of F7.
7. We can execute the program completely at a time using F8

## The DOS -Debugger:

The DOS “Debug” program is an example of simple debugger that comes with MS-DOS. Hence it is available on any PC .it was initially designed to give the user the capability to trace logical errors in executable file.

**Below, are summarized the basic DOS - Debugger commands**

| COMMAND | SYNTAX |
|---|---|
| Assemble | A [address] |
| Compare | C range address |
| Dump | D [range] |
| Enter | E address [list] |
| Fill | F range list |
| Go | G [=address] [addresses] |
| Hex | H value1 value2 |
| Input | I port |
| Load | L[address] [drive][first sector][number] |
| Move | M range address |
| Name | N[pathname][argument list] |
| Output | O port byte |
| Proceed | P [=address][number] |
| Quit | Q |
| Register | R[register] |
| Search | S range list |
| Trace | T [=address][value] |
| Unassembled | u [range] |
| Write | W[address][drive][first sector][number] |

## MS-MASM:

Microsoft's Macro Assembler (MASM) is an integrated software package Written by Microsoft Corporation for professional software developers. It consists of an editor, an assembler, a linker and a debugger (Code View). The programmer's workbench combines these four parts into a user-friendly programming environment with built in on line help. The following are the steps used if you are to run MASM from DOS

## MICROPROCESSOR LAB EXECUTION PROCEDURE

### STEP1: Opening the DOS prompt

Click **start** menu button and click on **Run** and then type *cmd at* command prompt immediately DOS window will be appeared

### STEP2: Checking the masm installation

To know MASAM is installed or not simply type **masm** at the command prompt upon that it replies masm version vendor (Microsoft), etc... If you get any error there is no masm in that PC

### STEP3: Directory changing (create a folder with your branch and no in D drive)

Change the current directory to your won directory suppose your folder in **D** drive type the following commands to change the directory at command prompt type ***D:*** hit enter now you are in ***D* drive** type **cd folder name** hit the enter

**Example: D cd ece10**

Now we are in folder cse10

### STEP4: writing the program

At the command prompt type the **edit programname.asm**

**Example. Edit add.asm**

Immediately editor window will open and there you have to write the program. Type the program in that window after completion save the Program, to save the program Go to file opt in the menu bar and select save opt now your code is ready to Assemble.

### STEP5: Assembling, Linking and executing the program

Go to *file* opt click *exit* opt now DOS prompt will be displayed to assemble the program type the following commands at the DOS prompt

**Masm Program Name, Program Name, Program Name, Program Name** hit the enter

**Example: Masm add, add, add, add enter**

**OR**

**Example: Masm add.asm**

If there are any errors in the program assembler reports all of them at the command prompt with line no's, if there are now bugs your ready to link the program. To link the program type the following line at command prompt Link program name**,,,,,** (5 commas)

**Example: Link add,,,,,**

**OR**

**Example: link add.obj**

After linking you are ready to execute the program. To execute the program type the following command

**Debug program name.exe** hit the enter

**Example: Debug add.exe**

Now you entered into the execution part of the program here you have to execute the program instruction by instruction (debugging) first of all press the ***r*** key(register) hit the enter key it'll displays all the registers and their initial values in HEXDECIMAL note down the values of all the register which are used in the program. To execute the next instruction press **t** key (TRACE) hit the enter it'll execute that instruction and displays the contents of all the register. You have to do this until you reach the last instruction of the program. After execution you have to observe the results (in memory or registers based on what you have written in the program).

## STEP6: Copying list file (common for all programs):

A list file contains your code starting address and end address along with your program .For every program assembler generates a list file at your folder, programname.lst (ex. Add.lst) you should copy this to your lab observation Opening a list file

**Edit programname.lst**

**Example. Edit add.lst**

## EXPERIMENT NO.2

## 16 BIT ARITHMETIC OPERATIONS

**AIM**: Write an ALP to 8086 to perform 16-bit arithmetic operations in various Addressing Modes

**TOOLS:** PC installed with MASM

**ALGORITHM:**

**Step I** : Initialize the Data segment memory.

**Step II** : Initialize the Extra segment memory.

**Step III** : Load the first number into AX register.

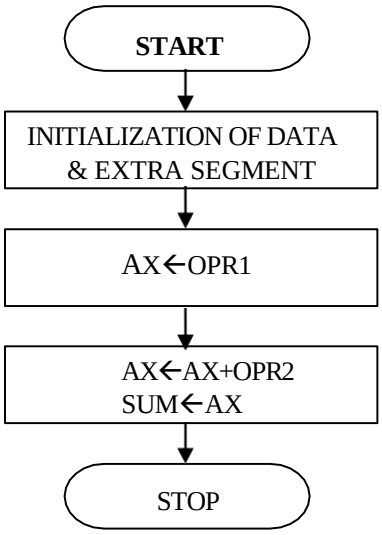
**Step IV** : Add two numbers.

**Step V** : Store the result in Extra segment.

**Step VI** : Terminate the program

**Step VII** : Stop.

## FLOW CHART:



## PROGRAM:

### (A) 16-bit addition using different addressing modes

```
ASSUME CS: CODE, DS: DATA, ES: EXTRA
DATA SEGMENT
        OPR1 DW 5169H
        OPR2 DW 1000H
DATA ENDS

EXTRA SEGMENT
        SUM DW ?
EXTRA ENDS
CODE SEGMENT
START: MOV AX, DATA
        MOV DS, AX          ; REGISTER ADDRESING MODE
        MOV AX, OPR1        ; DIRECT ADDRESSING MODE
        ADD AX, OPR2        ; DIRECT ADDRESSING MODE
        MOV SUM, AX         ; DIRECT ADDRESSING MODE
        INT 03H
CODE ENDS
END START
END
```

### (B) 16-bit subtraction using different addressing modes

**ALGORITHM:**

**Step I** : Initialize the data & extra segment memory.

**Step II** : Load the first number into AX register.

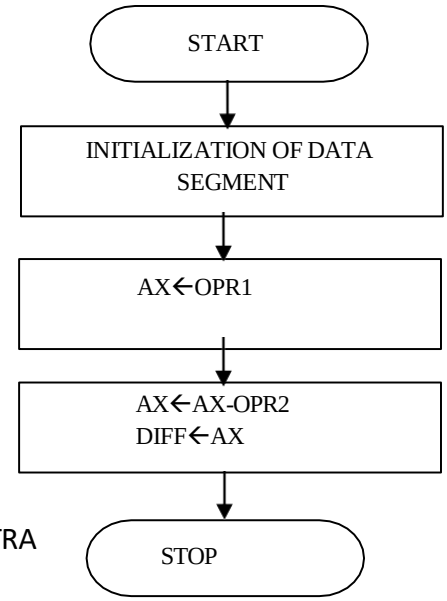
**Step IV** : Sub AX from OPR2.

**Step V** : Store result in extra segment

**Step VI** : verify the result.

**Step VII** : Stop.

**FLOW CHART:**




**PROGRAM:**

```
ASSUME CS:CODE, DS: DATA,ES:EXTRA
        DATA SEGMENT
            OPR1 DW 5169H
            OPR2 DW 1000H
        DATA ENDS
       EXTRA SEGMENT
            DIFF DW ?
        EXTRA ENDS
        CODE SEGMENT
        START: MOV AX, DATA
            MOV DS, AX                  ; REGISTER ADDRESIING MODE
            MOV AX, EXTRA
            MOV ES, AX                  ; REGISTER ADDRESIING MODE
            MOV BX, OFFSET OPR1         ; DIRECT ADDRESSING MODE
            MOV AX, [BX]                ; BASE ADDRESSING MODE/
            SUB AX, OPR2                ; DIRECT ADDRESSING MODE
            MOV DIFF, AX                ; DIRECT ADDRESSING MODE
            INT 03H
        CODE ENDS
        END  START
        END
```

**(C) 16-bit Multiplication using different addressing modes**

## ALGORITHM:

**Step I** : Initialize the data & extra segment memory.

**Step II** : Load the first number into AX register.

**Step III** : Load the second number into BX register.

**Step IV** : Multiply AX with BX.

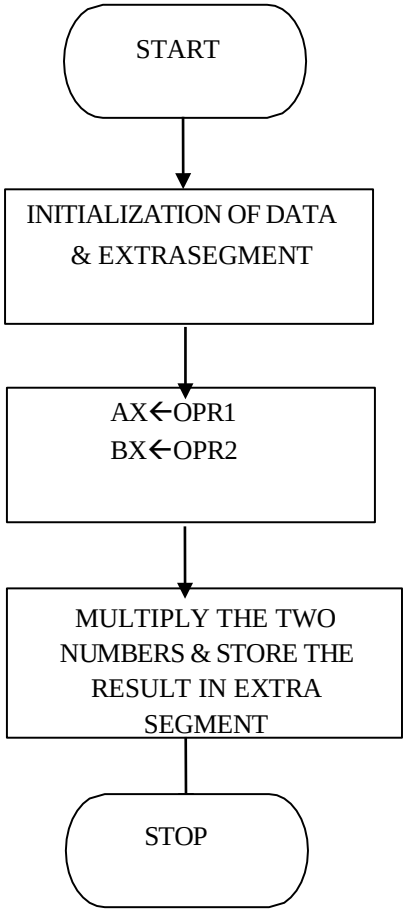
**Step V** : store lower word in accumulator into extra segment.

**Step VI** : Store Upper word in DX register into extra segment

**Step VII** : Verify the result.

**Step VIII** : Stop.

## FLOW CHART:



**PROGRAM:**

```
ASSUME CS: CODE, DS: DATA, ES: EXTRA
DATA SEGMENT
        OPR1 DW 5169H
        OPR2 DW 1000H
DATA ENDS
EXTRA SEGMENT
        RES DW 2 DUP(0)
        EXTRA ENDS
CODE SEGMENT
    START:MOV AX,DATA
        MOV DS,AX           ; REGISTER ADDRESIING MODE
        MOV AX,EXTRA
        MOV ES, AX          ; REGISTER ADDRESIING MODE
        MOV SI,OFFSET OPR1
        MOV AX,[SI]         ; INDEXED ADDRESSING MODE
        MOV BX,OPR2         ; DIRECT ADDRESSING MODE
        MUL BX              ; REGISTER ADDRESSING MODE
        MOV RES, AX         ; DIRECT ADDRESSING MODE
        MOV RES+2, DX       ; DIRECT ADDRESSING MODE
        INT 03H
        CODE ENDS
        END  START
        END
```

## (D) 16-bit Division using different addressing modes

### ALGORITHM:

**Step I** : Initialize the data & extra segment memory.

**Step II** : Load the first number into DX:AX registerpair.

**Step III** : Load the second number into BX register.

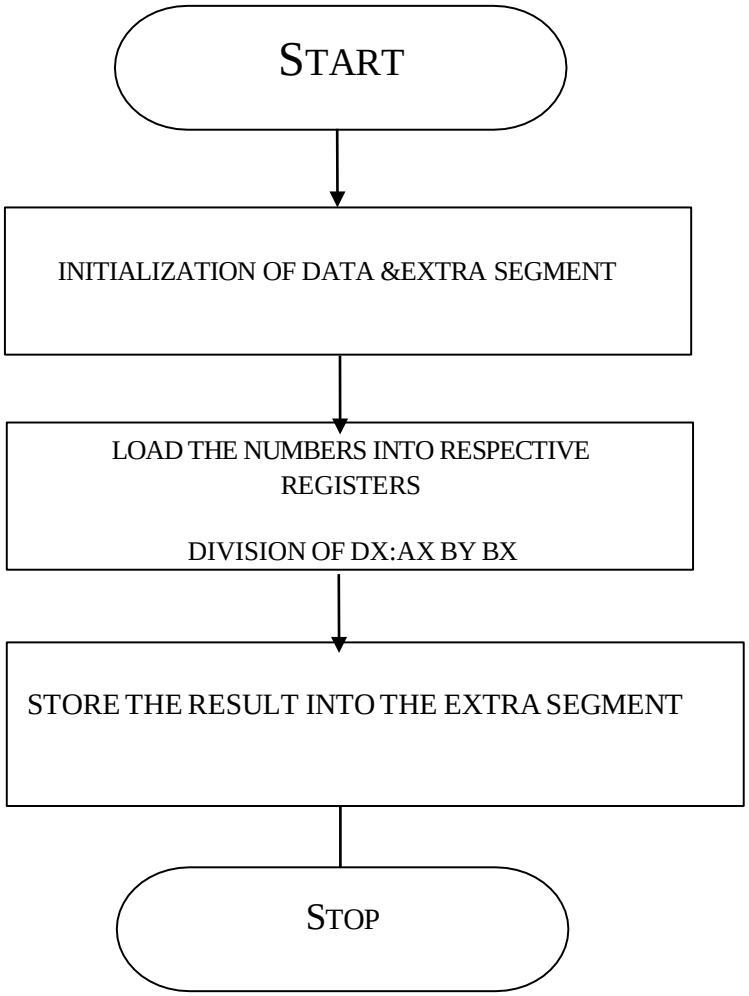
**Step IV** : Divide DX:AX pair by BX.

**Step V** : store the Quotient in AX register into extra segment. **Step VI** : Store the reminder in DX register into extra segment.

**Step VII** : Verify the result.

**Step VIII** : Stop.

### FLOW CHART:



**PROGRAM:**

```
ASSUME CS: CODE, DS:DATA, ES:EXTRA
DATA SEGMENT
        OPR1 DD 74105169H
        OPR2 DW 7875H
DATA ENDS
EXTRA SEGMENT
        DIVQ DW ?
        DIVR DW ?
EXTRA ENDS
CODE SEGMENT
        START:MOV AX, DATA
        MOV DS, AX          ; REGISTER ADDRESIING MODE
        MOV AX, EXTRA
        MOV ES, AX          ; REGISTER ADDRESIING MODE
        MOV SI, OFFSET OPR1
        MOV AX, [SI]        ; INDEXED ADDRESSING MODE/
        MOV DX, [SI+2]      ; INDEXED ADDRESSING MODE
        MOV BX, OPR2        ; DIRECT ADDRESSING MODE
        DIV BX              ; REGISTER ADDRESSING MODE
        MOV DIVQ , AX
        MOV DIVR , DX
        INT 03H
CODE ENDS
END  START
END
```

## Result:

**UNSIGNED NUMBERS**

**INPUT:** OPR1 =

OPR2 =

**OUTPUT:** ALL RESULTS ARE STORED IN EXTRA SEGMENT (ES)

SUM =

DIFF=

MUL=

MUL+2=

DIVQ=

DIVR=

## Exercise Questions:

1) Write an assembly language program for the expression ax+b
2) Write an assembly language program for the squaring of 16 bit Hexa Decimal number.
3) Write an assembly language program for the factorial of 8 bit Hexadecimal number.

## Viva Question:

1) What is meant by microprocessor?
2) What is meant by accumulator?
3) What is meant by assembler directive?
4) What are segment Registers?
5) What is the use of INT 03H instruction?

## OBSERVATION:

# EXPERIMENT NO.3

# SORTING AN ARRAY FOR 8086

**AIM:** Write and execute an ALP to 8086 processor to sort the given 16-bit numbers in Ascending and Descending order.

**TOOLS:** PC installed with MASM 6.11

## ALGORITHM:

**Step I**: Initialize the data segment memory.

**Step II :** Initialize the number of elements counter

**Step III** : Initialize the comparisons counter..

**Step IV**: Load the numbers into respective registers

**Step V:** Compare the elements. If first element < second element goto step **VII** Else go to next step.

**Step VI:** Swap the numbers in the memory..

**Step VII:** Increment memory pointer & Decrement the comparison counter.

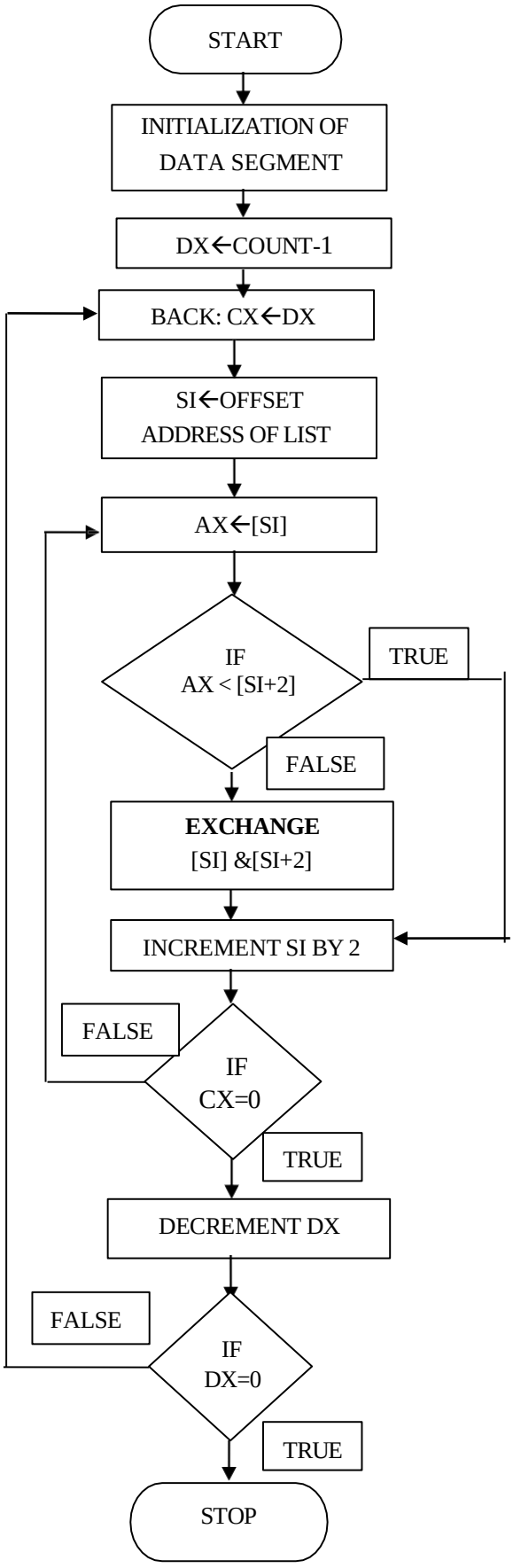
**Step VIII:** Is count = 0 ? if yes go to next step else go to **step IV**.

**Step IX:** decrement the element counter.

**Step X:** Is count not 0 ? go **Step III** else go to next step

**Step IX:** Stop & terminate the program**.**

**FLOW CHART:**


START
INITIALIZATION OF DATA SEGMENT
DX←COUNT-1
BACK: CX←DX
SI←OFFSET ADDRESS OF LIST
AX←[SI]
IF AX < [SI+2]
TRUE
FALSE
EXCHANGE [SI] &[SI+2]
INCREMENT SI BY 2
FALSE
IF CX=0
TRUE
DECREMENT DX
FALSE
IF DX=0
TRUE
STOP

**PROGRAM:**

## ASCENDING ORDER

```
ASSUME CS: CODE, DS: DATA
DATA SEGMENT
        LIST DW 0125H,0144H,3001H,0003H,0002H
        COUNT EQU 05H
DATA ENDS
CODE SEGMENT
START:MOV AX,DATA
        MOV DS,AX
        MOV DX,COUNT-1
BACK: MOV CX,DX
        MOV SI, OFFSET LIST
AGAIN: MOV AX,[SI]
        CMP AX,[SI+2]
        JC GO
        XCHG AX,[SI+2]
        XCHG AX,[SI]
   GO:INC SI
        INC SI
        LOOP AGAIN
        DEC DX
        JNZ BACK
        INT 03H
CODE ENDS
END  START
END
```

## Result:

**INPUT:** (DS: 0000H) = 25H,01H,44H,01H,01H,30H,03H,00H,02H,00H

**OUTPUT:** (DS: 0000H) =

## DESCENDING ORDER

## ALGORITHM:

**Step I**: Initialize the data segment memory.

**Step II :** Initialize the number of elements counter

**Step III** : Initialize the comparisons counter..

**Step IV**: Load the numbers into respective registers

**Step V:** Compare the elements. If first element > second element go to step **VII**

Else go to next step.

**Step VI:** Swap the numbers in the memory.

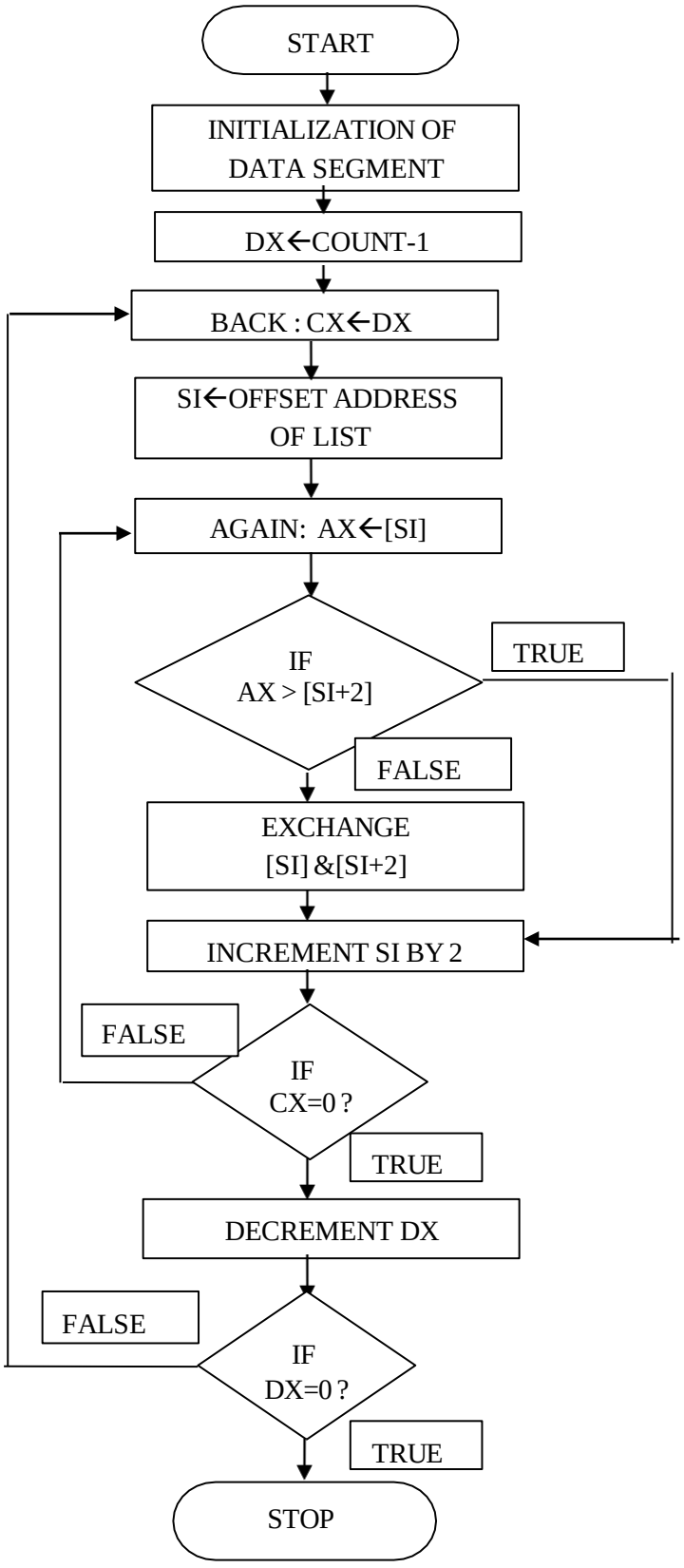
**Step VII:** Increment memory pointer & Decrement the comparison counter.

**Step VIII:** Is count = 0? If yes go to next step else go to **step IV**.

**Step IX:** decrement the element counter.

**Step X:** Is count not 0? go **Step III** else go to next step **Step IX:** Stop & terminate the program**.**

**FLOW CHART:**


START
INITIALIZATION OF DATA SEGMENT
DX←COUNT-1
BACK : CX←DX
SI←OFFSET ADDRESS OF LIST
AGAIN: AX←[SI]
IF AX > [SI+2]
TRUE
FALSE
EXCHANGE [SI] &[SI+2]
INCREMENT SI BY 2
FALSE
IF CX=0 ?
TRUE
DECREMENT DX
FALSE
IF DX=0 ?
TRUE
STOP

## DESCENDING ORDER

### PROGRAM:

```
ASSUME CS: CODE, DS:DATA
DATA SEGMENT
        LIST DW 0125H,0144H,3001H,0003H,0002H
        COUNT EQU 05H
DATA ENDS
CODE SEGMENT
        START:MOV AX,DATA
              MOV  DS,AX
              MOV DX,COUNT-1
        BACK:MOV CX,DX
             MOV SI,OFFSET LIST
       AGAIN:MOV AX,[SI]
             CMP AX,[SI+2]
             JAE GO
             XCHG AX,[SI+2]
             XCHG AX,[SI]
          GO:INC SI
             INC SI
             LOOP AGAIN
             DEC DX
              JNZ BACK
             INT 03H
CODE ENDS
END  START
END
```

## Result:

**INPUT:** (DS: 0000H) = 25H,01H,44H,01H,01H,30H,03H,00H,02H,00H

**OUTPUT:** (DS: 0000H) =

## Exercise Questions:

1) Write an assembly language program for finding the maximum number in array of five16 bit hexadecimal numbers?
2) Write an assembly language program for finding the minimum number in array of five 16 bit hexadecimal numbers?

## Viva Questions:

1) What is the use of SI Register?
2) What is the use of XCHG instruction?
3) What is the use of CX Register ?
4) What is the use of JNZ instruction?

## OBSERVATION:

## EXPERIMENT NO: 4

## SEARCH ING FOR CHARACTER IN A STRING

**AIM:** Write an ALP for searching for a number or character in a string for 8086.

**TOOLS:** PC installed with MASM 6.11

## ALGORITHM:

**Step I** **:** Initialize the Data segment (DS) & Extra segment(ES)

**Step II** **:** Load the offset address of the string into SI .

**Step III** **:** Load the number of elements in the string into CX register

**Step IV** **:** Move the character to be searched into the AL register

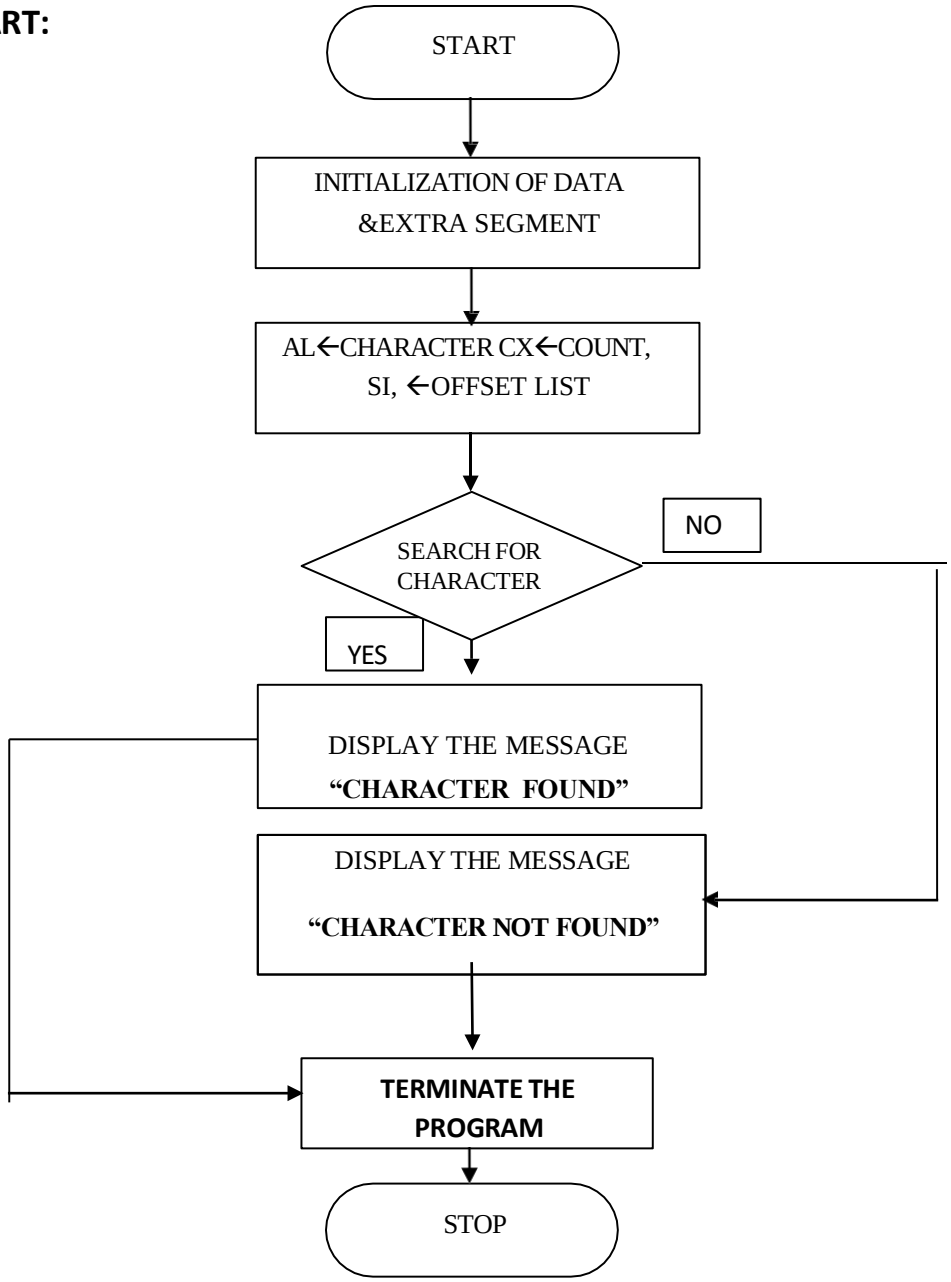
**Step V** **:** Scan for the character in ES. If the character is not found go to step **VII** else go to next step.

**Step VI** : Display the message that character found and go to step **VIII**

**Step VII** **:** Display the message that character not found

**Step VII** **:** Stop.& Terminate the program

**FLOW CHART:**


START
INITIALIZATION OF DATA &EXTRA SEGMENT
AL←CHARACTER CX←COUNT, SI, ←OFFSET LIST
SEARCH FOR CHARACTER
NO
YES
DISPLAY THE MESSAGE "CHARACTER FOUND"
DISPLAY THE MESSAGE "CHARACTER NOT FOUND"
TERMINATE THE PROGRAM
STOP

**Program:**

```
ASSUME CS: CODE, DS: DATA
        DATA SEGMENT
                STRING  DB  'MRCET$'
                SLEN EQU ($-STRING)
                CHAR DB 'E'
                MSG1  DB  'THE  CHARACTER  IS  FOUND$'
                MSG2 DB 'THE CHARACTER IS NOT FOUND$'
        DATA ENDS
        CODE SEGMENT
        START: MOV AX, DATA
                MOV DS, AX
                MOV ES, AX
                LEA SI, STRING
                MOV CX, LEN
                MOV AL, CHAR
                CLD
        REPNE SCASB
                JNZ EXIT
                LEA DX, MSG1
                MOV  AH,  09H
                INT 21H
                JMP GOTOEND
        EXIT: LEA DX, MSG2
                MOV AH, 09H
                 INT 21H
        GOTOEND: MOV AH, 4CH
                INT 21H
        CODE ENDS
        END START
        END
```

## Exercise Questions:

1) Write an assembly language program for the password verification?

## Viva Questions:

1) What is the use of SCASB Register?
2) What is the use of REPNE instruction?
3) What is the relation of CX Register with REPNE?

## OBSERVATION:

# EXPERIMENT NO.5

# STRING MANIPULATIONS FOR 8086

**AIM:** To write an assembly language program to move the block of data from a source BLOCK to the specified destination BLOCK.

**TOOLS:** PC installed with MASM 6.11

**A) BLOCK TRANSFER**

## ALGORITHM:

**Step I** **:** Initialize the Data segment (DS) & Extra segment (ES)

**Step II** **:** Load the offset address of source and destination the string into SI and DI.

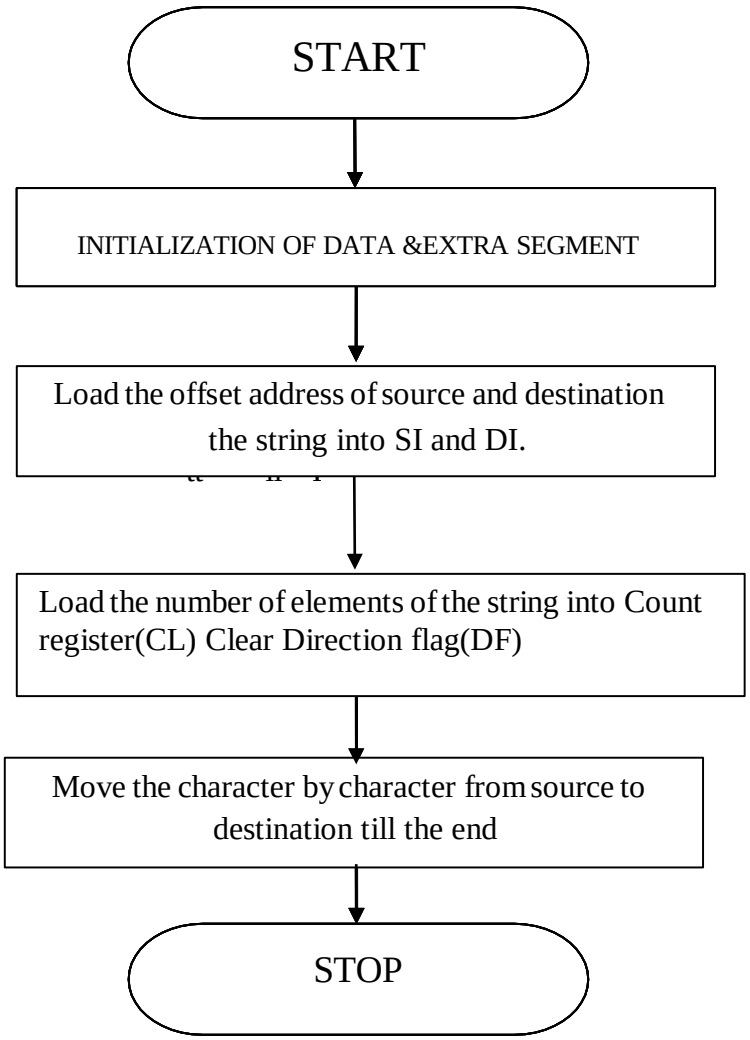
**Step III** **:** Load the number of elements of the string into Count register(CL)

**Step IV** **:** Clear Direction flag (DF) to make SI and DI into auto increment mode

**Step V** **:** move the character by character from source to destination till the end

**Step VI** **:** Stop & Terminate the program

**FLOW CHART:**




**PROGRAM:**

```
ASSUME CS: CODE, DS: DATA
DATA SEGMENT
        STRING DB 'MICROPROCESSOR$'
        COUNT EQU ($-STRING)
        ORG 0070H
DATA ENDS
EXTRA SEGMENT
        ORG 0010H
```

```
        STRING1 DB ?
EXTRA ENDS
CODE SEGMENT
START:
        MOV AX,DATA
        MOV DS,AX
        MOV AX, EXTRA
        MOV ES,AX
        MOV SI,OFFSET STRING
        MOV DI,OFFSET STRING1
        MOV CL,COUNT
        CLD
  REP MOVSB
      INT 03H
CODE ENDS
END START
END
```

**RESULT:**

INPUT: (DS: 0000H) = MICROPROCESSOR

OUTPUT: (ES: 0010H) = MICROPROCESSOR

## B) REVERSE STRING

**AIM:** To write an assembly language program to reverse the given string.

**TOOLS:** PC installed with MASM 6.11

## ALGORITHM:

**Step I** : Initialize the Data segment (DS) & Extra segment (ES)

**Step II** : Load the offset address of source and destination the string into SI and DI.

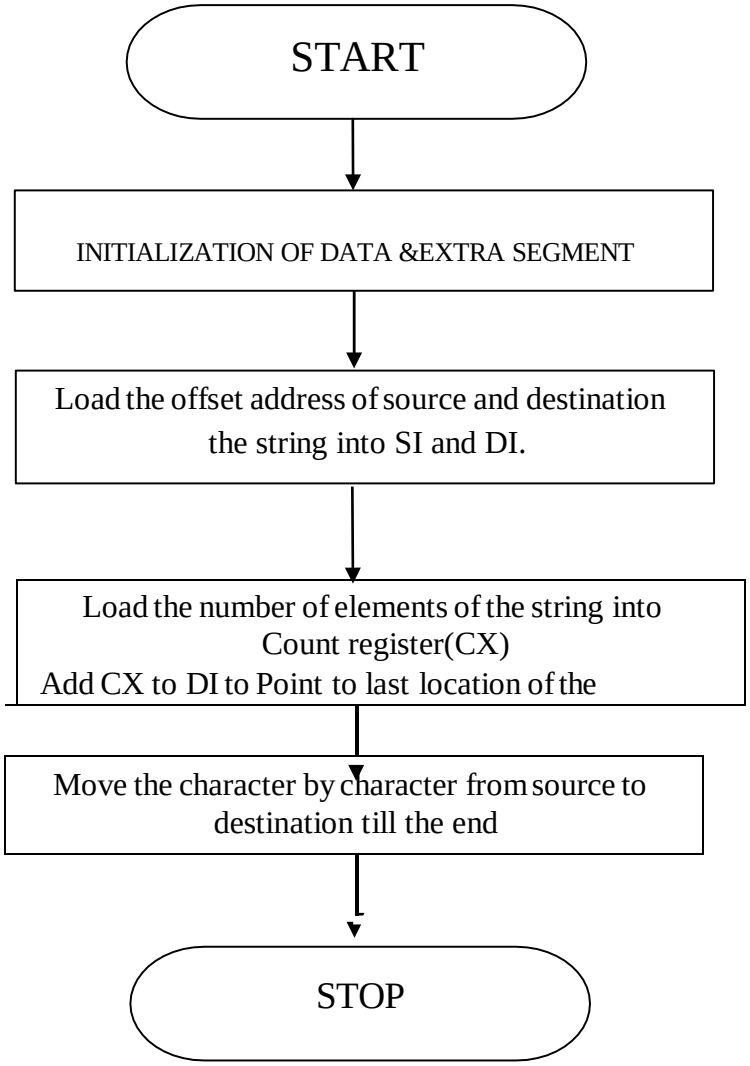
**Step III** : Load the number of elements of the string into Count Register (CX)

**Step IV** : Add CX to DI to Point to last location of the memory

**Step V** : move the character by character from source to destination till the end

**Step VI** : Stop & Terminate the program

## FLOW CHART:



**PROGRAM:**

```
ASSUME CS: CODE, DS: DATA ,ES:EXTRA
DATA SEGMENT
STRING1 DB 'MICROPROCESSOR$'
STRLEN EQU ($-STRING1)
DATA ENDS
 EXTRA SEGMENT
 STRING2 DB ?
 EXTRA ENDS
CODE SEGMENT
START: MOV AX, DATA
        MOV DS, AX
        MOV AX, EXTRA
        MOV ES, AX
        MOV SI, OFFSET STRING1
        MOV DI, OFFSET STRING2
        MOV CX, STRLEN-1
        ADD DI, CX
        MOV DL,'$'
       MOV ES:[DI],DL
AGAIN: DEC DI
        MOV AL,DS:[SI]
        MOV ES:[DI],AL
        INC SI
        DEC CX
        JNZ AGAIN
        INT 3H
```

**RESULT:**

INPUT: ' MICROPROCESSOR'
OUTPUT: 'ROSSECORPORCIM'

## C) LENGTH OF THE STRING

**AIM:** To write an assembly language program to find the length of the given string.

**TOOLS:** PC installed with MASM 6.11

### ALGORITHM:

**Step I** : Initialize the data segment (DS)

**Step II** : Initialize the counter CL with 0

**Step III** : Move stating address of the string to SI register

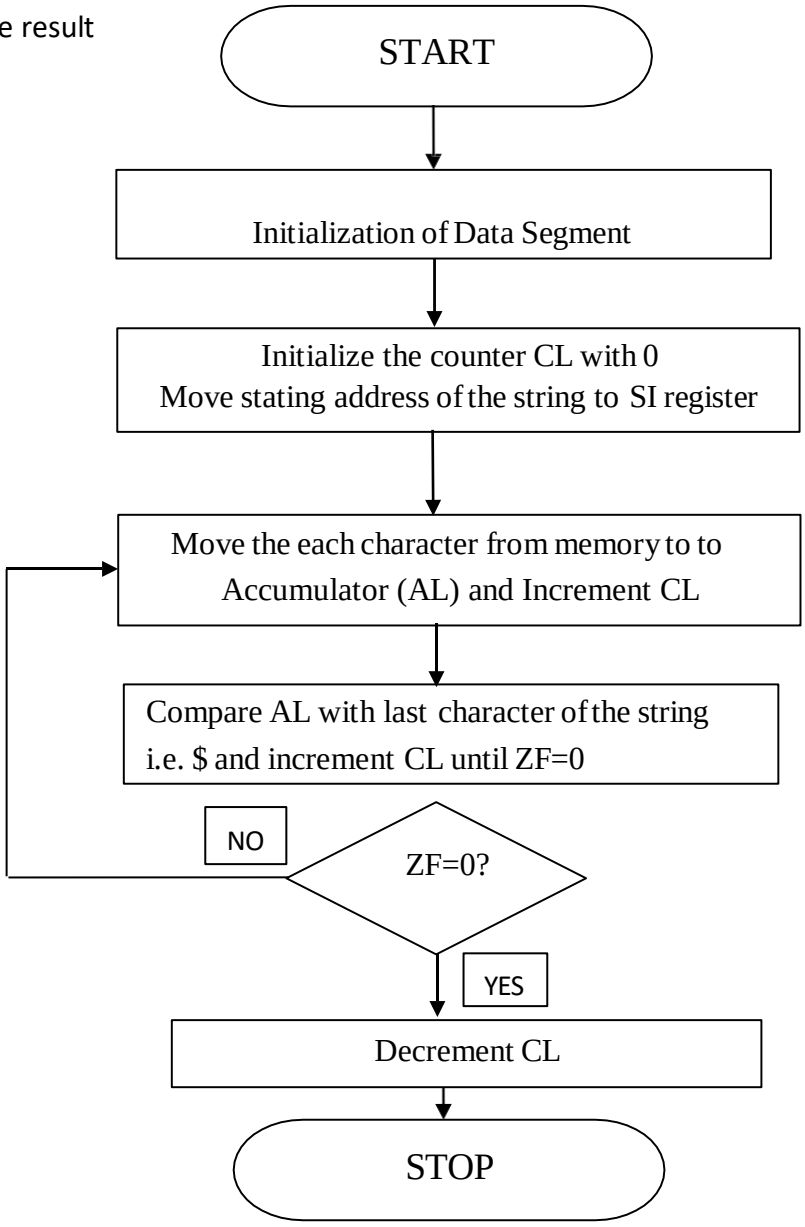
**Step IV** : Move the each character from memory to to Accumulator (AL)

**Step V** : Compare AL with last character of the string i.e $ and increment CL until ZF=0

**Step VII** : Store the result

**Step VIII** : Stop.

### FLOW CHART:



**Program:**

```
ASSUME CS:CODE, DS:DATA
DATA SEGMENT
        STRING1 DB 'MICROPROCESSOR AND INTERFACING LAB$'
        SLENGTH DB 0
DATA ENDS
CODE SEGMENT
START:  MOV AX, DATA
        MOV DS, AX
        SUB CL, CL
        MOV SI, OFFSET STRING1
        CLD
BACK: LODSB
        INC CL
        CMP AL,'$'
        JNZ BACK
        DEC CL
        MOV SLENGTH, CL
        INT 03H
CODE ENDS
END START
```

**RESULT:** INPUT: 'MICROPROCESSOR AND INTERFACING LAB

OUTPUT:

## D) STRING COMPARISON

**AIM:** Write an ALP to 8086 to compare the given strings.

**TOOLS:** PC installed with MASM 6.11

## ALGORITHM:

**Step I** : Initialize the data segment (DS) & extra Segment as per requirement

**Step II** : Load the offset address of source and destination of the string into SI and DI.

**Step III** : Initialize the counter register CX with length of source string

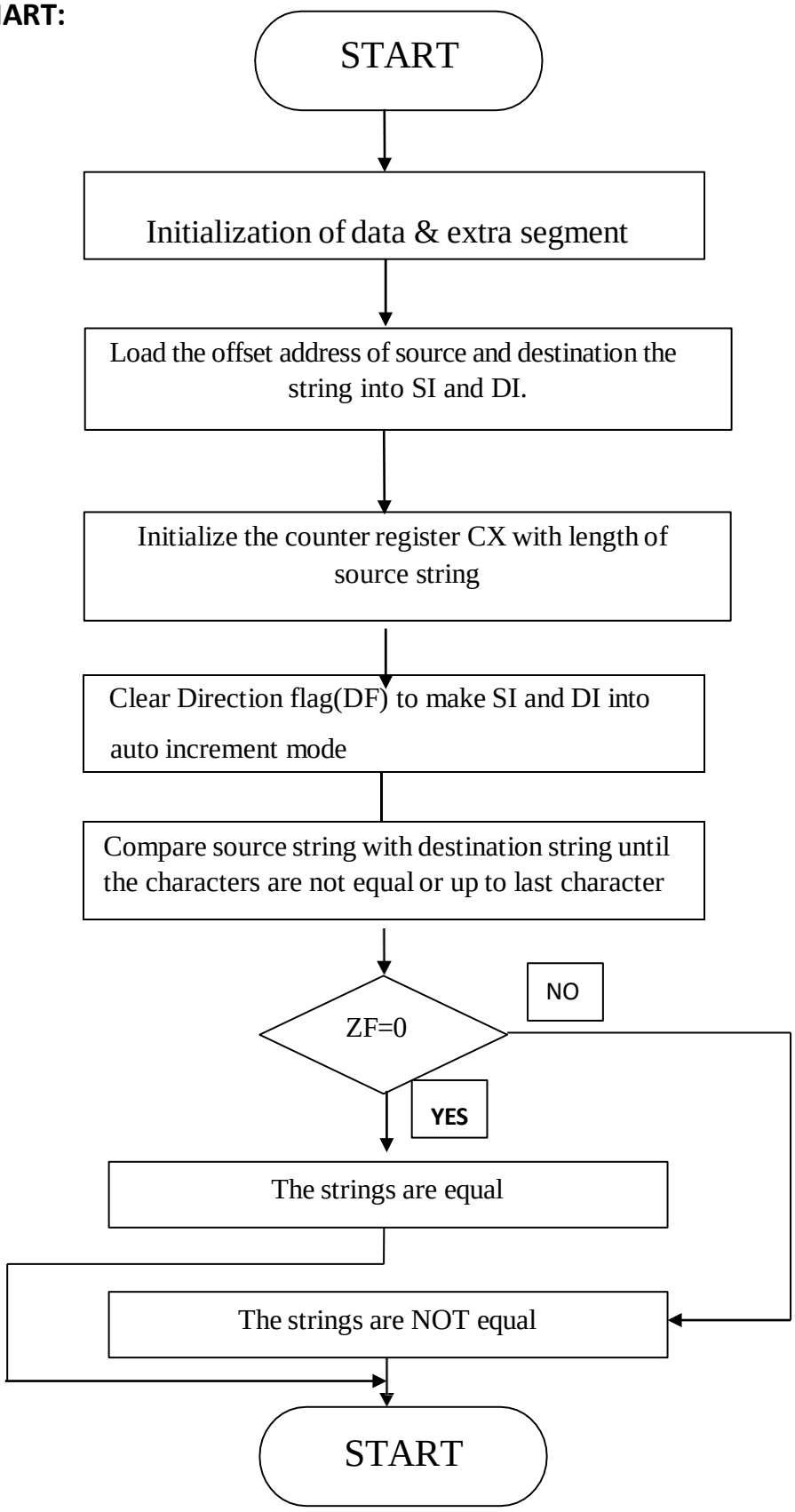
**Step IV** : Clear Direction flag (DF) to make SI and DI into auto increment mode

**Step V** : Compare source string with destination string until the characters are not equal or up to last last character

**Step VII** : If ZF=0 the strings are equal or otherwise the strings are not equal

**Step VIII :** Stop.

**FLOW CHART:**


START
Initialization of data & extra segment
Load the offset address of source and destination the string into SI and DI.
Initialize the counter register CX with length of source string
Clear Direction flag(DF) to make SI and DI into auto increment mode
Compare source string with destination string until the characters are not equal or up to last character
ZF=0
NO
YES
The strings are equal
The strings are NOT equal
START

**Program:**

```
ASSUME CS: CODE, DS:DATA, ES:EXTRA
DATA SEGMENT
        STRING1 DB 'MRCET'
        STRLEN EQU ($-STRING1)
        SNOTEQUAL DB 'STRINGS ARE UNEQUAL$'
        SEQUAL DB 'STRINGS ARE EQUAL$'
DATA ENDS
EXTRA SEGMENT
        STRING2 DB 'MRCET'
EXTRA ENDS
CODE SEGMENT
    START: MOV AX,DATA
           MOV DS,AX
           MOV AX,EXTRA
           MOV ES,AX
           MOV SI,OFFSET STRING1
           MOV DI,OFFSET STRING2
           CLD
           MOV CX,STRLEN
      REPZ CMPSB
           JZ FORW
           MOVAH, 09H
           MOV DX, OFFSET SNOTEQUAL
           INT 21H
           JMP EXITP
     FORW: MOV AH,09H
           MOV DX, OFFSET SEQUAL
           INT 21H
    EXITP: MOV AH, 4CH
           INT 03H
CODE ENDS
END START
```

**RESULT:** INPUT: OUTPUT:

## (E) STRING INSERTION

**AIM:** To Write and execute an Assembly language Program (ALP) to 8086 processor to insert or delete a character/ number from the given string.

**TOOLS:** PC installed with MASM 6.11

## ALGORITHM:

**Step I :**Initialize the data segment (DS) & extra segment (ES)

**Step II :**Load the offset address of source and destination of the string into SI and DI.

**Step III :**Initialize the counter register CX with length of first part of source string

**Step IV :** Copy the first part of STRING1 in to STRING3 of extra segment

**Step V :** Load the offset address of STRING2 in to SI

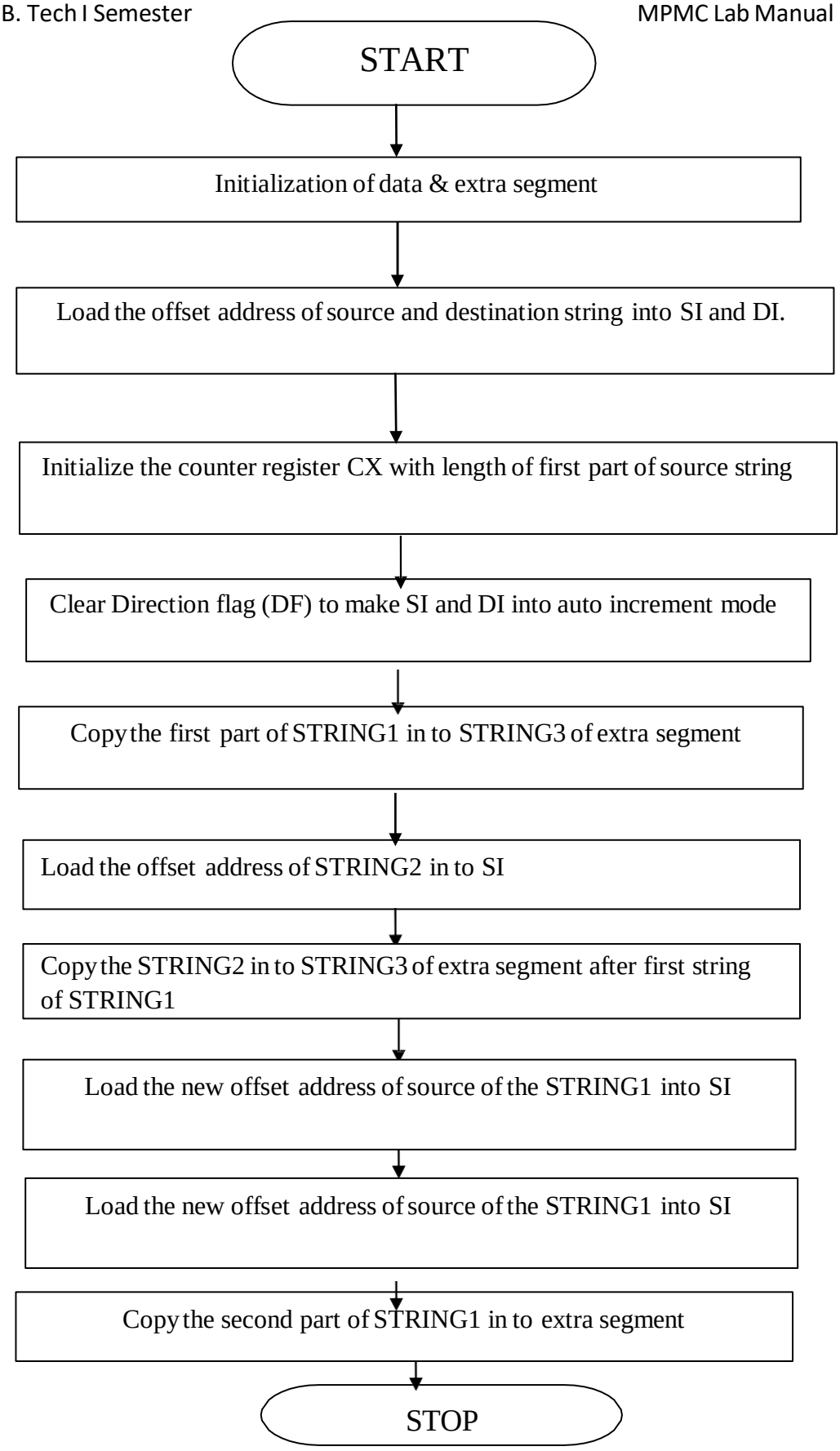
**Step VI :** Copy the STRING2 in to STRING3 of extra segment after first string of STRING1

**Step VII:** Load the new offset address of source of the STRING1 into SI

**Step VIII:** Copy the second part of STRING1 in to extra segment

**Step IX:** Stop

**FLOW CHART:**


START
Initialization of data & extra segment
Load the offset address of source and destination string into SI and DI.
Initialize the counter register CX with length of first part of source string
Clear Direction flag (DF) to make SI and DI into auto increment mode
Copy the first part of STRING1 in to STRING3 of extra segment
Load the offset address of STRING2 in to SI
Copy the STRING2 in to STRING3 of extra segment after first string of STRING1
Load the new offset address of source of the STRING1 into SI
Load the new offset address of source of the STRING1 into SI
Copy the second part of STRING1 in to extra segment
STOP

**Program:**

```
ASSUME CS:CODE,DS:DATA,ES:EXTRA
DATA SEGMENT
        STRING1 DB 'MICROPROCESSOR INTERFACING LAB$'
        STRING2 DB ‘AND ’
        STRLEN EQU ($-STRING1)
        ORG 0070H
DATA ENDS
EXTRA SEGMENT
        ORG 0010H
        STRING3 DB 38 DUP(0)
EXTRA ENDS
CODE SEGMENT
        START: MOV AX, DATA
                MOV DS, AX
                MOV AX, EXTRA
                MOV ES, AX
                MOV SI, OFFSET STRING1
                MOV DI, OFFSET STRING3
                CLD
                MOV CX, 15
               REP MOVSB
               CLD
                MOV SI, OFFSET STRING2
                MOV CX,4
             REP MOVSB
                MOV SI, OFFSET STRING1
                ADD SI,15
                MOV CX, 15
             REP MOVSB
                INT 3H
```

```
CODE ENDS
END START
```

**RESULT:**

INPUT: **STRING1:** 'MICROPROCESSOR INTERFACING LAB'

**STRING2:**'AND '

OUTPUT: **STRING3:** 'MICROPROCESSOR AND INTERFACING LAB'

## (F) STRING DELETION

```
ASSUME CS: CODE, DS:DATA, ES:EXTRA
  DATA SEGMENT
      STRING1 DB 'MICROPROCESSOR AND INTERFACING LAB$'
      ORG 0070
  DATA ENDS
EXTRA SEGMENT
      ORG 0010H
      STRING2 DB 40 DUP (0)
EXTRA ENDS
CODE SEGMENT
START:    MOV AX, DATA
          MOV DS, AX
          MOV AX, EXTRA
          MOV ES, AX
          MOV SI, OFFSET STRING1
          MOV DI, OFFSET STRING2
          CLD
          MOV CX, 15
          REP MOVSB
          CLD
         MOV SI, OFFSET STRING1
          ADD SI, 19
```

```
        MOV CX, 15
        REP MOVSB
        INT 03H
CODE ENDS
END START
```

**RESULT:**

INPUT: **STRING1:** MICROPROCESSOR AND INTERFACING LAB'

OUTPUT: **STRING2:** 'MICROPROCESSOR INTERFACING LAB'

## Exercise Questions:

1) Write an assembly language program for the palindrome of a given string?
2) Write an assembly language program for the display of given string?

## Viva Questions:

1) What are the string manipulation instructions?
2) What are the repeat instructions?
3) What is the use of DUP instruction?
4) What is the meaning of ORG assembler Directive?

## OBSERVATION:

## PART-B

## INTRODUCTION TO HARDWARE EXPERIMENTS

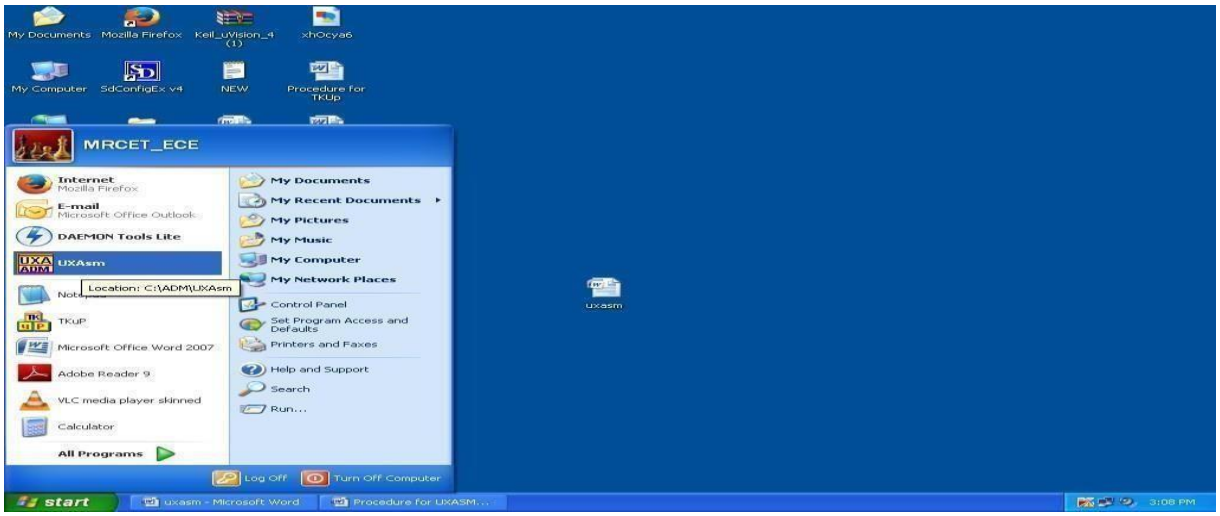
8086 Programs can also executed by using ADM TK_µP Trainer kits. The Assembly language programs (ALP) can be executed by the following steps

1. UxAsm
2. TKµP

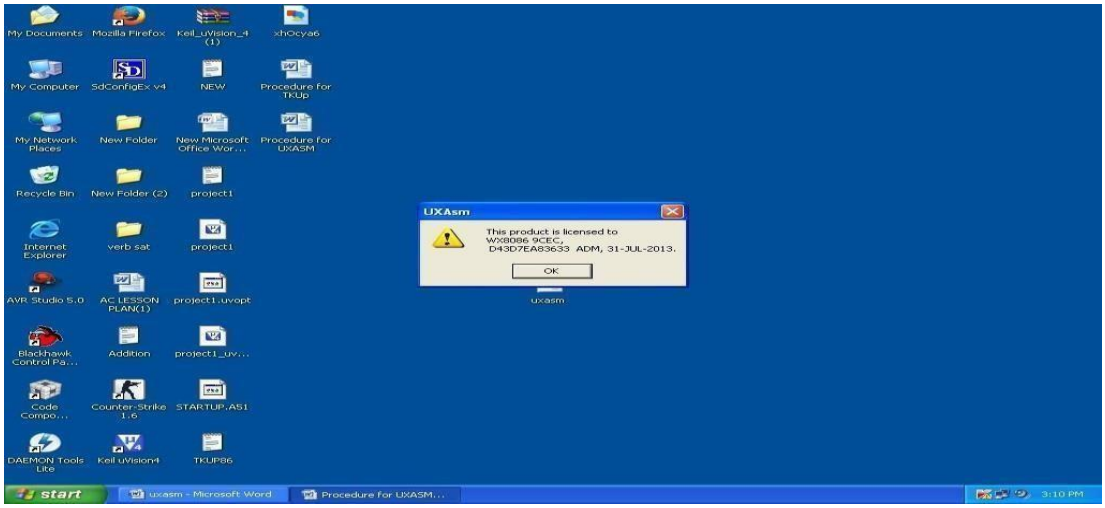
1. UxAsm: It is used to translate the Assembly language program in to Machine language (Hex File).The input file to the UxAsm is .asm and one of the output files is hex file

Procedure for UXASM:

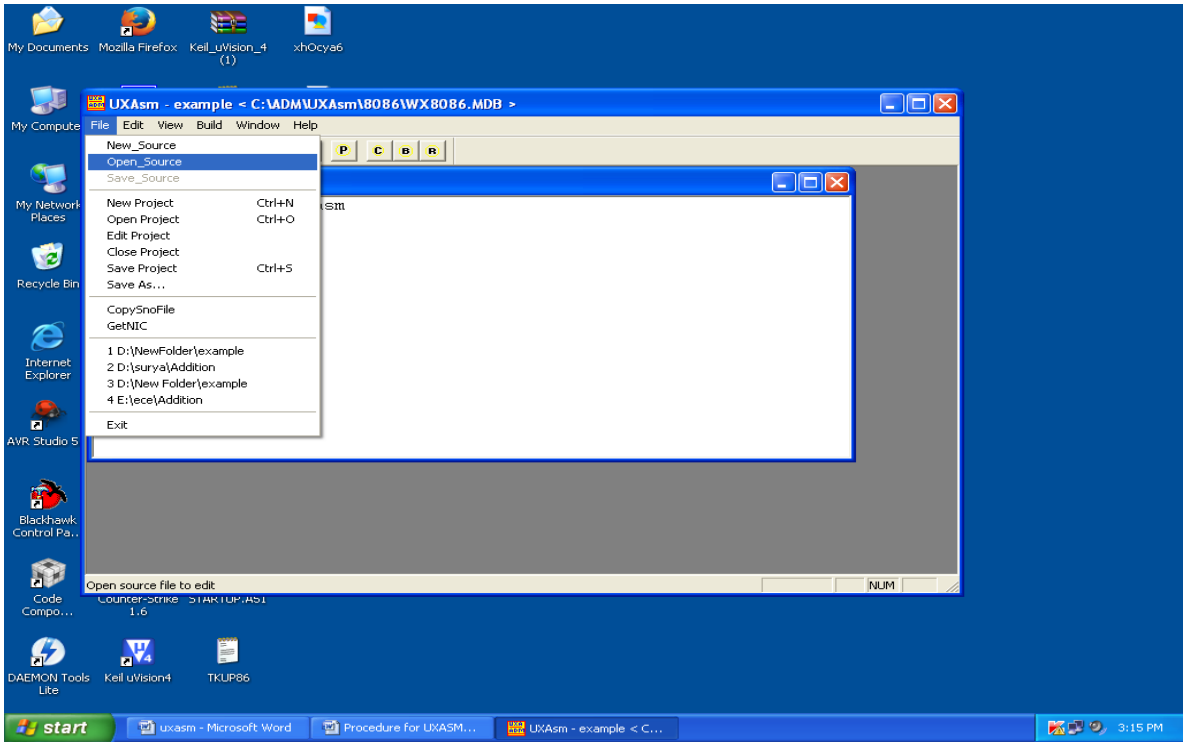
**1. Go to start and select UXAsm**



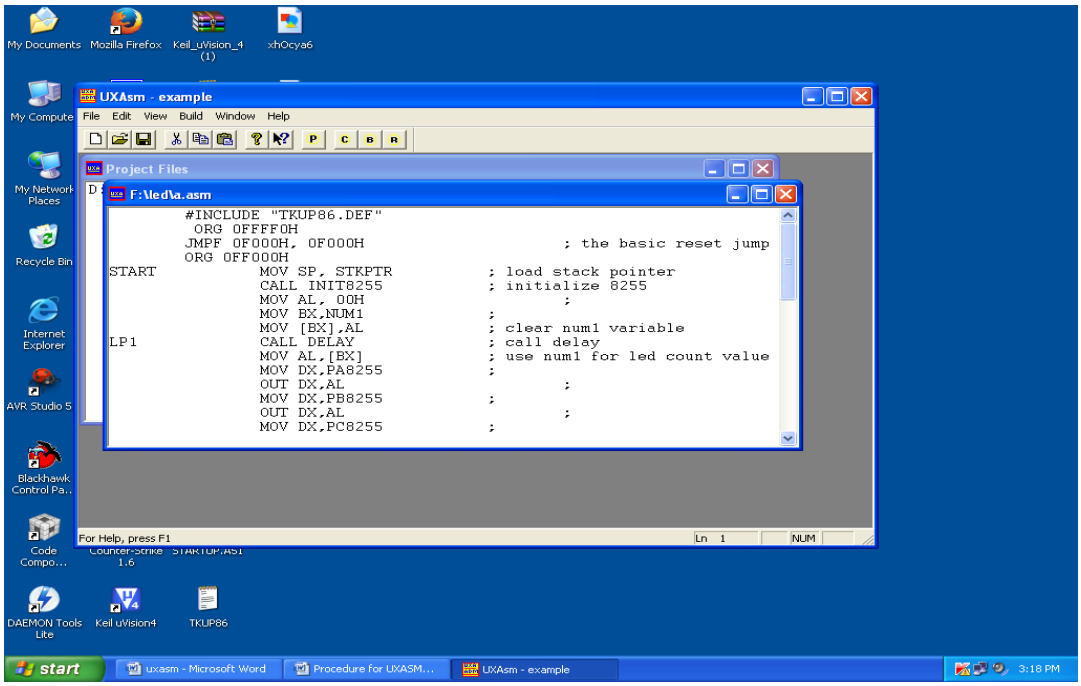

**2. Verify the license by observing the following window and click "OK"**



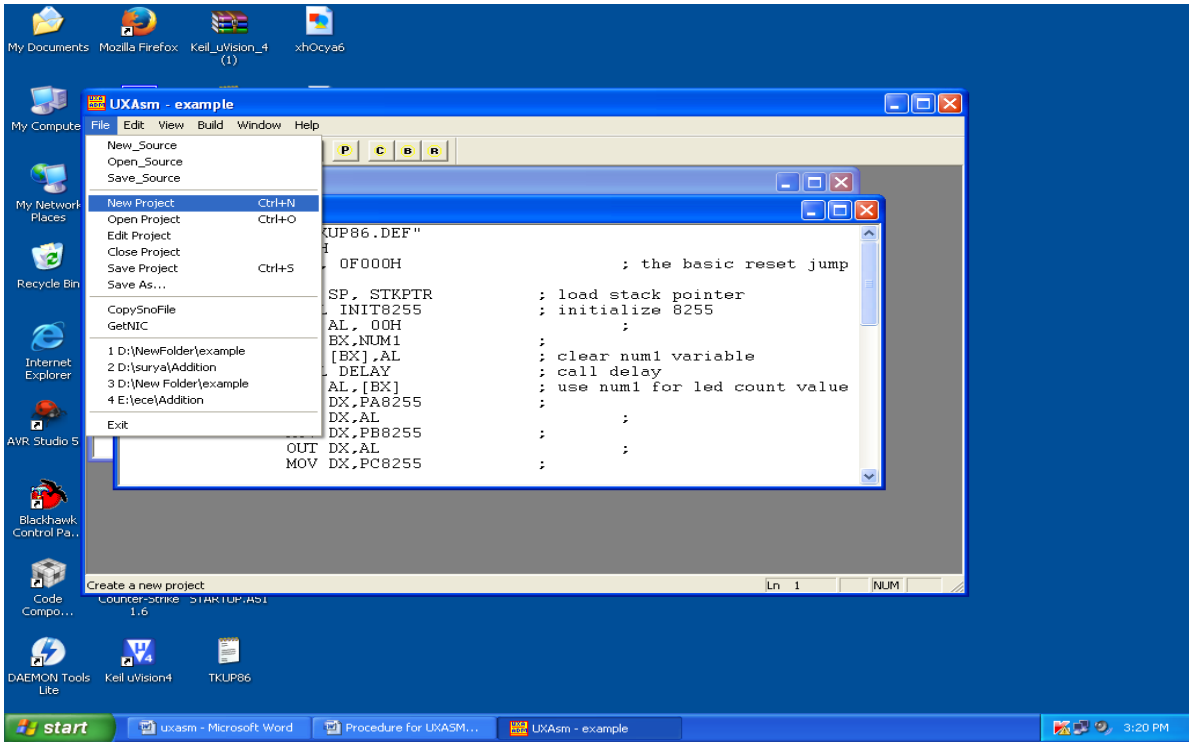
**3. Go to file and select "open source" and browse the source file(.ASM file)**



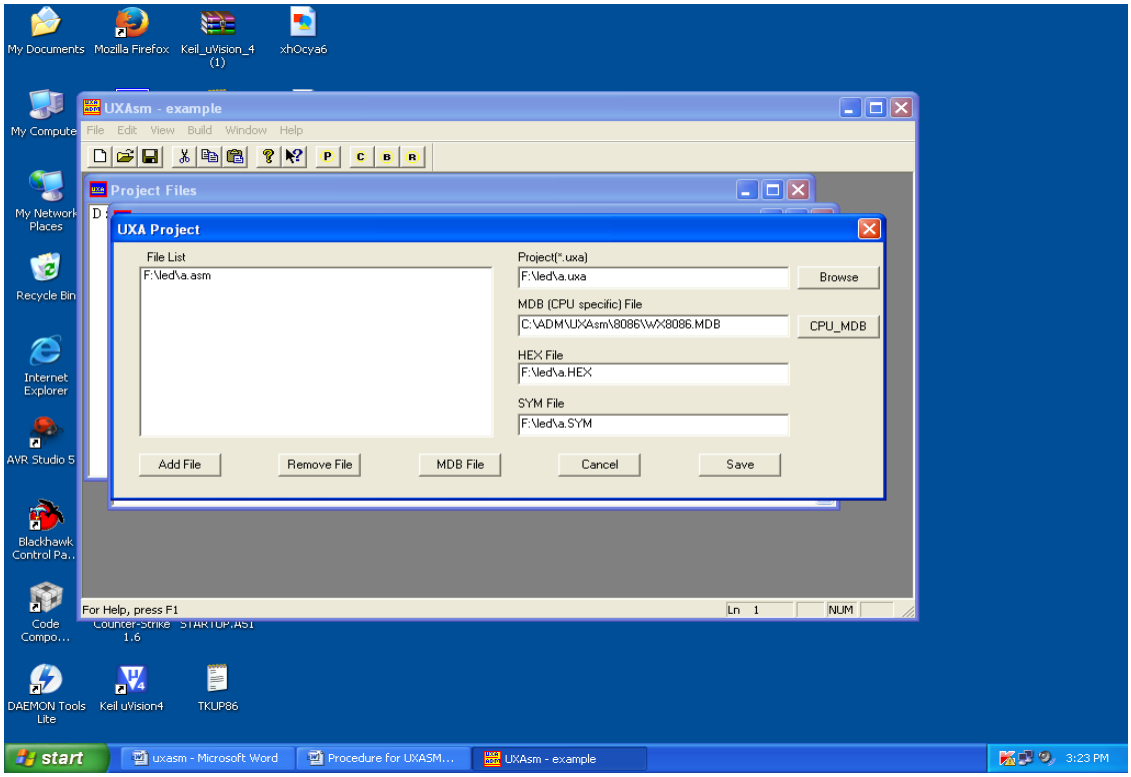

**4. Observe the following window which shows the source code.**



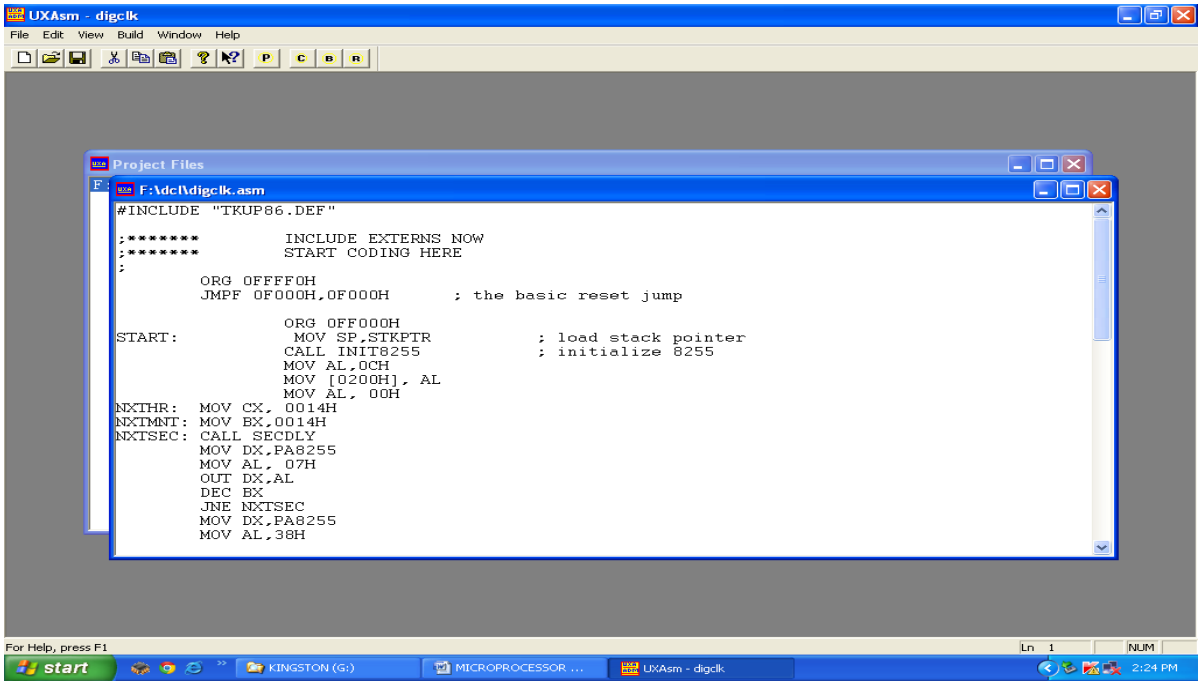
**5. Again go to file select "New Project"**



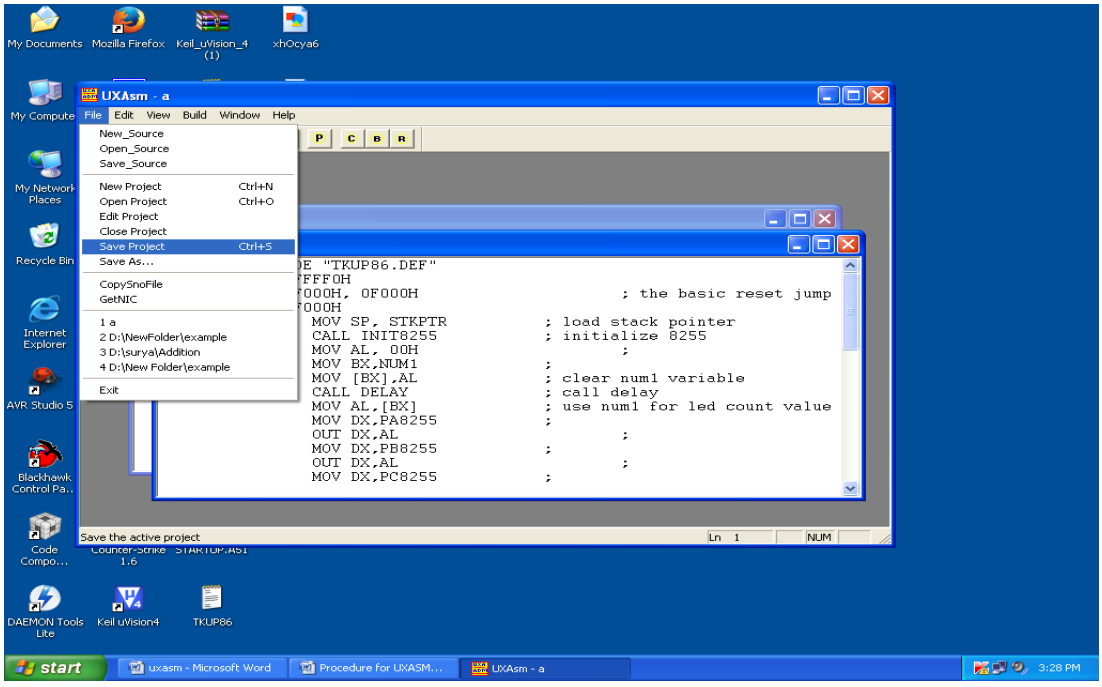

**6. To add source file click on "Add File" and browse the source file and provide the source file path with .Uxa extension in the Project and press Tab and Press "Save" and click on "OK"**



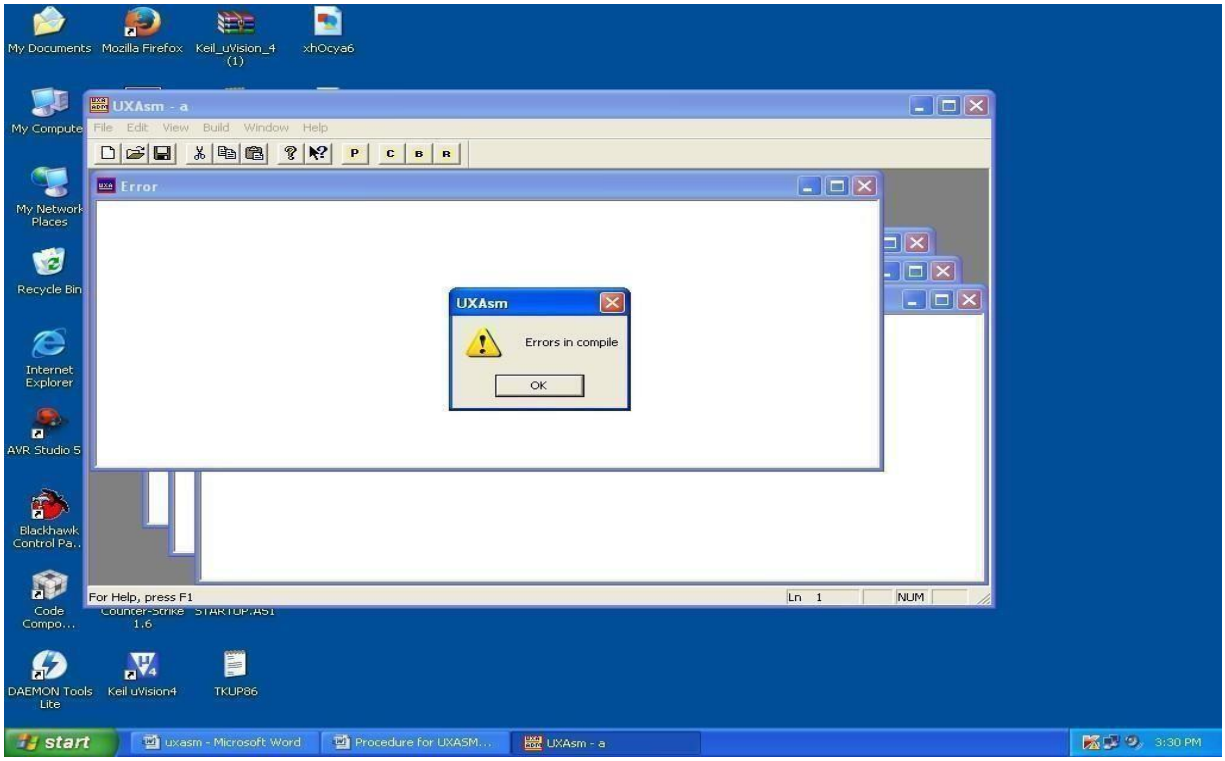
**7. Observe the following window and double click on path of the File to view theprogram**



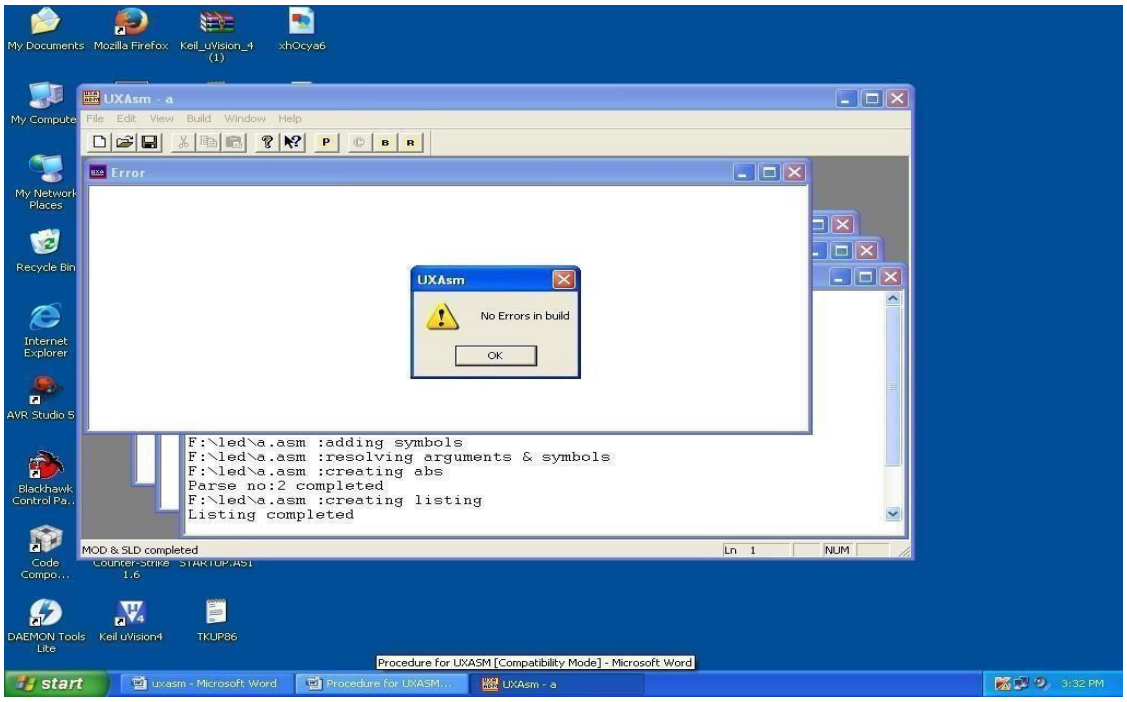

**8. To save the project go to File select "save project"**



**9. To compile the program, click on "C" and observe the following window**




**10. If any errors, Fix the errors, click on "OK" and click on "B" to build the program**



**TKµP**

## INTRODUCTION:

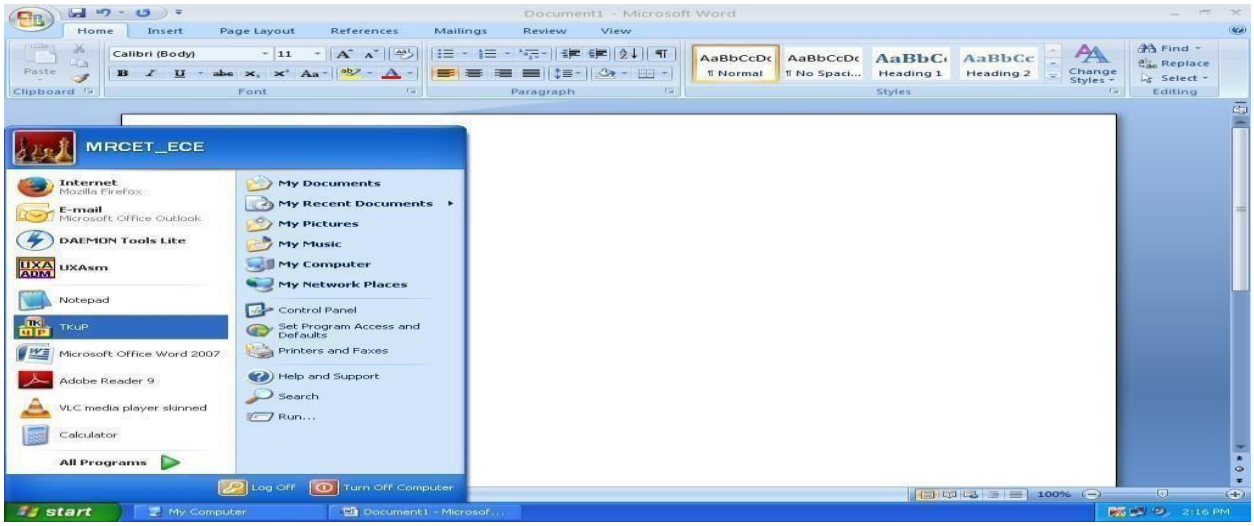
TKµP is an ideal trainer cum development boards for Microprocessors like Z80, 8032, 8085, 8088 and 8086. All interface is provided through 10 pin polarized Box Headers. TKµP user interface software communicates with the TKµP hardware through PC parallel port LPT1 and provides fast download of hex files. The PC user interface can open multiple windows for memory Dump and List. Multiple dump windows is also useful to study memory move operations and programs.

TKµP is made up of three sections:

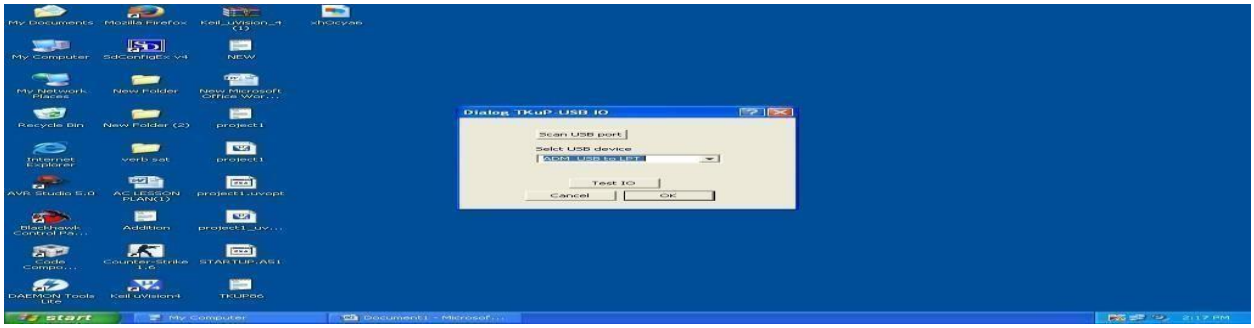
1. **CPU specific daughter board.**
2. **Base board section:** It has following features
   - Four sockets for memory which can accommodate maximum 4x128KB.
   - 8279 key board display controller.
   - 8255 IO expander.
   - 8155 IO expander with timer counter.
   - 8251 Asynchronous serial Transmitter and Receiver.
3. **User interface section:** It has following features
   - Hex keypad.
   - 8-Leds indicator.
   - Four multiplexed 7-Segment displays.
   - LCD 16 characters x 2 lines.
   - I2C NVRAM 24C1024.
   - I2C RTC PCF8583.
   - I2C ADC/DAC PCF8591.
   - Serial port interface through MAX232.

## Procedure for TKµP

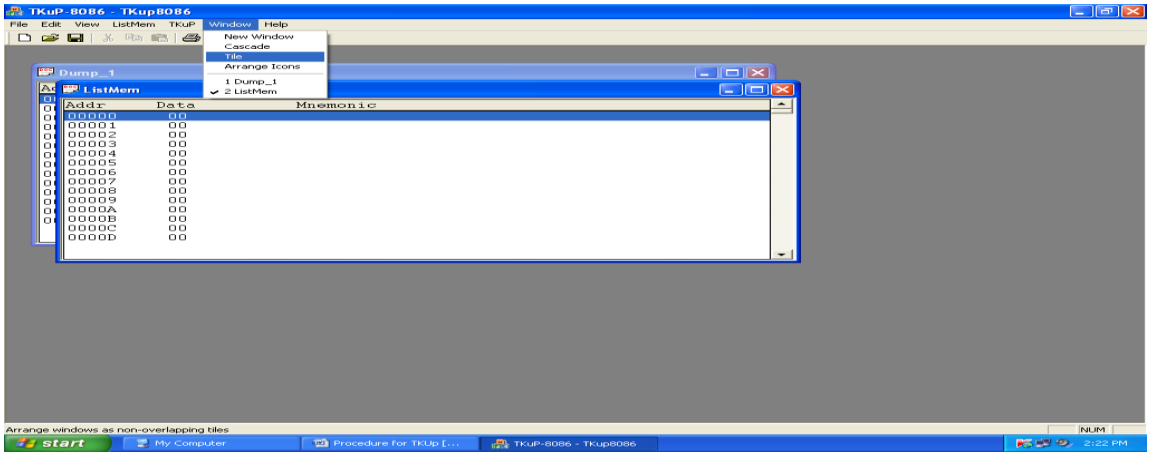
### 1. Go to start and select TKµP



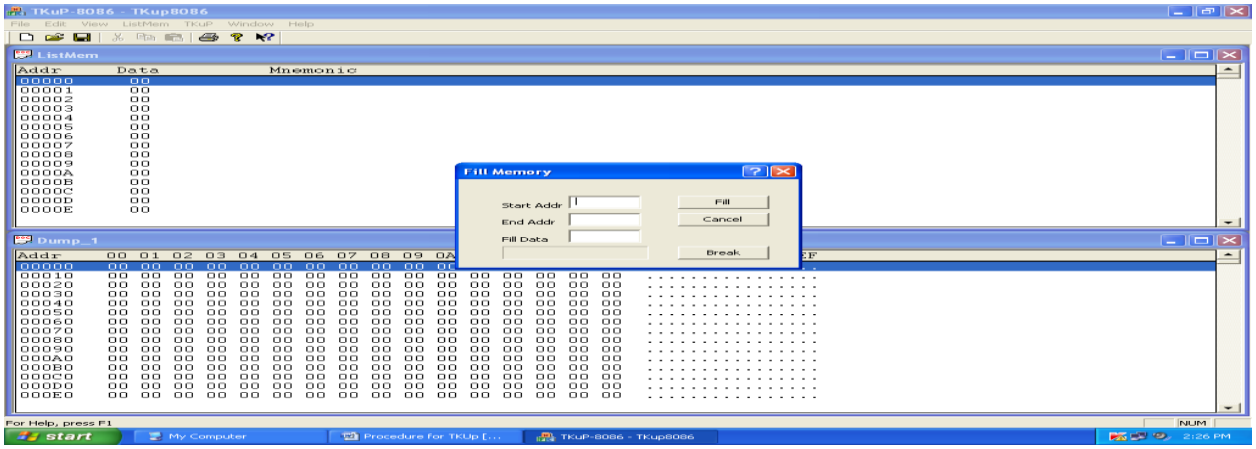

### 2. To Test the I/O connection clicks on Test I/O and click on OK



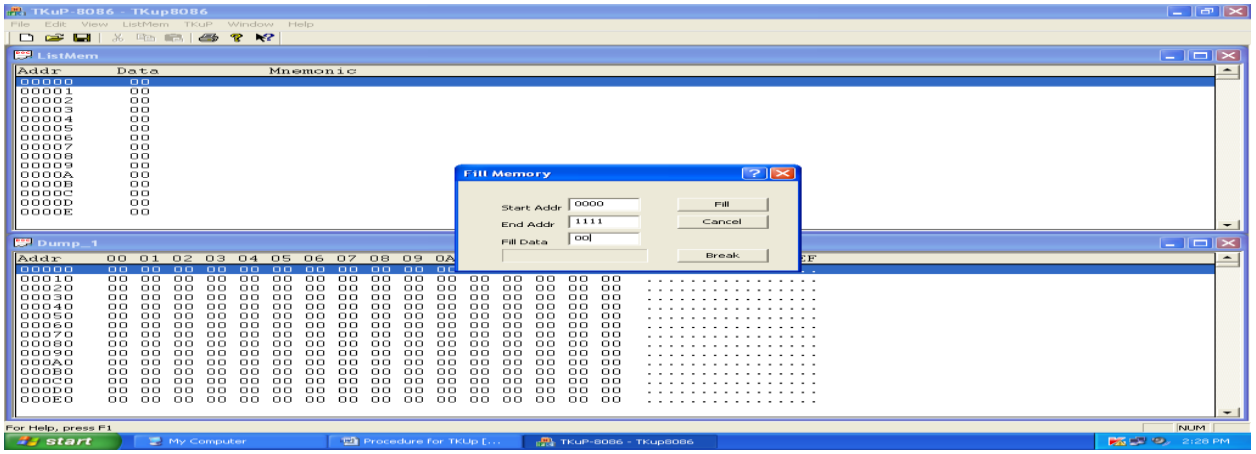

### 3. The following window will be displayed and go to window, select tile to avoid the overlap of windows



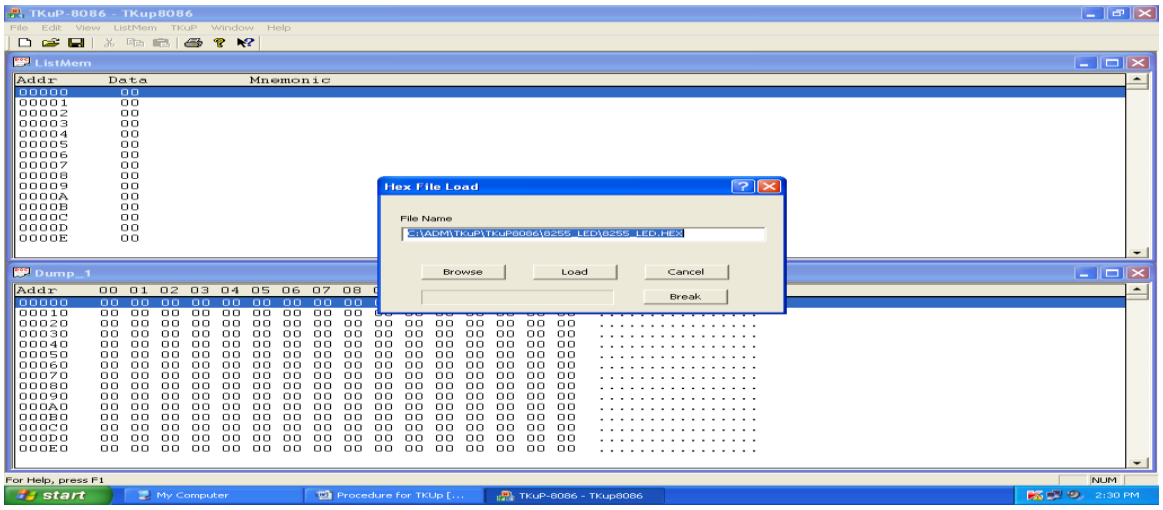
**4 .To clear the garbage data from dump window, go to Listmem and select fillmem**



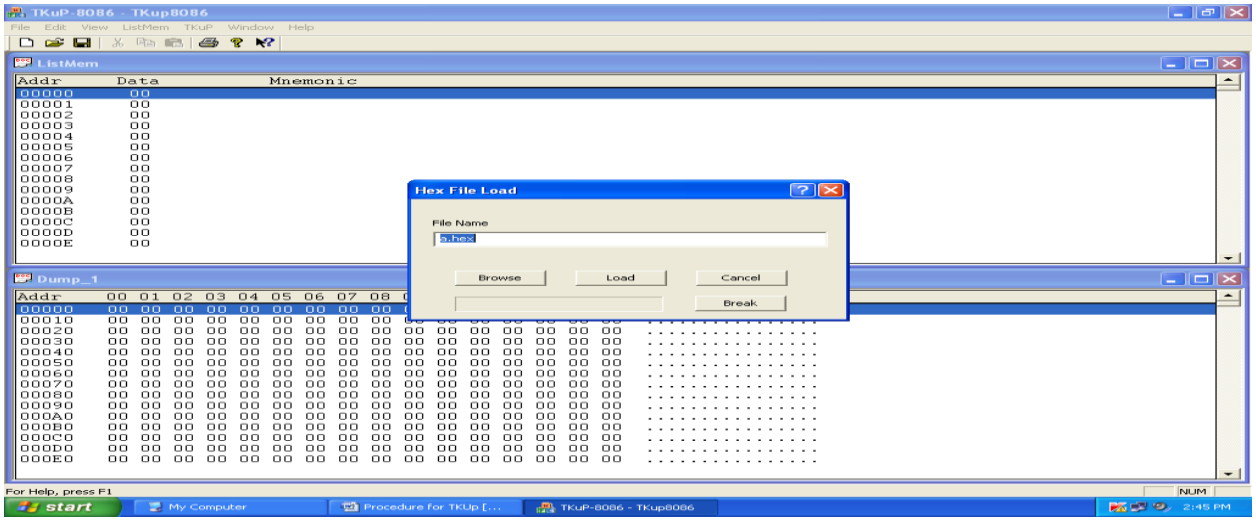

**5. To clear the data from dump window, enter start and, end address and fill the data with 00**



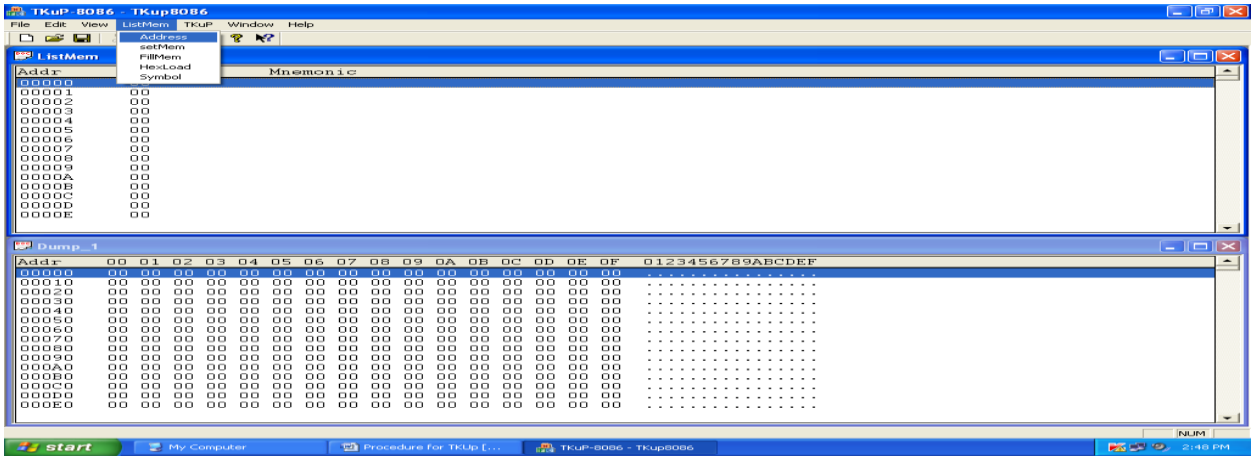

**6. To load the hex file ,go to "Listmem" and select "HexLoad"**



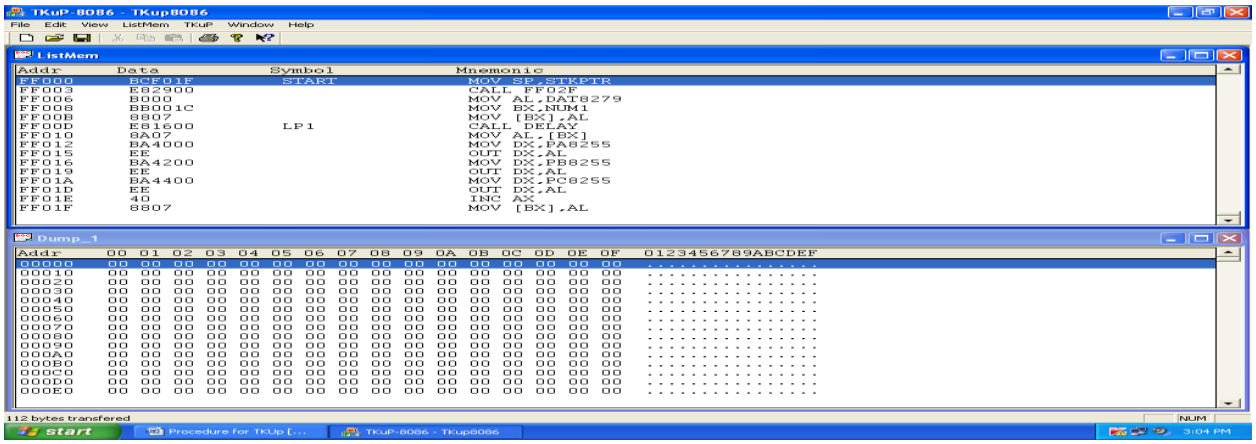
**7. Browse the hex file from the source and click on "Load"**




**8. To view the program on the window, go to "Listmem" and selectaddress**




**9. Enter the starting address of the program click "OK"**




**10. To verify the output, change the "SW-PP PROGRAM" switch to execution mode and verify output**

## EXPERIMENT NO: 6

## DIGITAL CLOCK DESIGN USING 8086

**AIM:** Write an ALP for digital clock design using 8086

**TOOLS:**

i. UXASM
ii. TKUP
iii. TKUP86 KIT
iv. FRC CABLE

**PROGRAM:**

; **CONNECT BH4 (PORT A) TO CNLED**

```
#INCLUDE "TKUP86.DEF"
;*******        INCLUDE EXTERNS NOW
;*******        START CODING HERE
          ORG 0FFFF0H
          JMPF 0F000H,0F000H ; the basic reset jump
                    ORG 0FF000H
START:              MOV SP,STKPTR                ; load stack pointer
                    CALL INIT8255          ; initialize 825
                    MOV AL,0CH
                    MOV [0200H], AL
                    MOV AL, 00H
NXTHR:              MOV CX, 003CH
NXTMNT:     MOV     BX,003CH
NXTSEC:             CALL SECDLY
                    MOV DX,PA8255
                    MOV AL, 07H
                    OUT DX,AL
                    DEC BX
                    JNE NXTSEC
```

```
                MOV DX,PA8255
                MOV AL,38H
                OUT DX,AL
                DEC CX
                JNE NXTMNT
                MOV DX, PA8255
                MOV AL, 0C0H
                OUT DX,  AL
                MOV AX,[0200H]
                DEC AX
                MOV [0200H], AX
                JNE NXTHR
SECDLY:         PUSH  AX
                PUSH  BX
                PUSH  CX
                PUSH DX
                MOV CX, 1234H
DLY:            NOP
                NOP
                LOOP DLY
                POP DX
                POP CX
                POP BX
                POP AX
                RET
;*******  initialize     8255
 INIT8255
                MOV AL,080H
                MOV DX, CMD8255
                OUT DX,AL
```

```
MOV AL,00H
OUT DX,AL
MOV DX,PB8255
OUT  DX,AL
MOV DX,PC8255
OUT DX,AL
RET
```

**RESULT:** INPUT:

OUTPUT:

## Exercise Questions:

1) Write an assembly language program for the different clock rates to display the clock on the LCD.

## Viva Questions:

1) What is the use of IN and OUT instructions?
2) What is meant by procedure?
3) What is meant by PPI?
4) What are the modes of 8255?

## OBSERVATION:

## EXPERIMENT NO: 7

## PROGRAM FOR INTERFACING ADC&DAC TO 8086

**AIM:** Write an ALP for interfacing ADC to 8086

**TOOLS:**

i. UXASM
ii. TKUP
iii. TKUP86 KIT
iv. FRC CABLE
v. ADC KIT

## PROGRAM:

```
; CONNECT BH4 (PORT A) TO DAC BH1A
; CONNECT BH5 (PORTB) TO DAC BH2B
; CONNECT CRO PROBES TO CND1_1 OF DAC

#INCLUDE "TKUP86.DEF"
DATA SEGMENT
        PORTA EQU 9000H
        PORTC EQU 9004H
        CNTLPRT EQU 9006H
        MEM DW 2000H
DATA ENDS
CODE SEGMENT
ASSUME CS: CODE, DS: DATA
START: MOV AX, DATA
                MOV DS, AX
                MOV DX, CNTLPRT
                MOV AL, 98H
                OUT DX, AL
                MOV AL, 01H
                OUT DX, AL
```

```
                MOV AL, 00
                OUT DX, AL
                MOV DX, PORTC
CHK:            IN AL, DX
                AND AL, 80H
                JZ CHK
                MOVDX, PORTA
                IN AL, DX
                MOV MEM, AL
                INT 03H
CODE ENDS
END START
```

**RESULT:** INPUT :

OUTPUT :

# INTERFACING DAC TO 8086

**AIM:** Write an ALP for interfacing DAC to 8086

**TOOLS:**

i. UXASM
ii. TKUP
iii. TKUP86 KIT
iv. FRC CABLE

## PROGRAM:

```
; CONNECT BH4 (PORT A) TO DAC BH1A
; CONNECT BH5 (PORTB) TO DAC BH2B
; CONNECT CRO PROBES TO CND1_1 OF DAC

#INCLUDE "TKUP86.DEF"
        ORG 0FFFF0H
        JMPF 0F000H,0F000H
        ORG 0FF000H
        MOV AL,080H
        MOVDX,CMD8255
        OUT DX,AL
        MOV AL,00H
        MOV DX,PA8255
        OUT  DX,AL
        MOV DX,PB8255
        OUT  DX,AL
        MOV DX,PC8255
        OUT DX,AL
RPT:    MOV AL,00H
        MOV AL,0FFH
AGAIN:  MOV DX, PA8255
        OUT  DX,  AL
        CALL DELAY
        CALL DELAY
        CALL DELAY
        CALL DELAY
        CALL DELAY
        CALL DELAY
        INC AX
        JNE AGAIN
```

```
        JMP RPT
DELAY:  MOV CX, 0FF00H
NXT2:   MOV BX, 1234H
NXT:    NOP
        NOP
        NOP
        NOP
        NOP
        DEC BX
        JNE NXT
        RET
```

**RESULT:** INPUT :

OUTPUT :

## Exercise Questions:

1) Write an assembly language program to convert a saw tooth wave into digital.
2) Write an assembly language program for the generation of triangularwave

## Viva Questions:

1) What is the function of INC Instruction?
2) What is the function of NOP Instruction?
3) What is the size of the ports of 8255?
4) What is the function of the control word register of 8255?

## OBSERVATION:

# EXPERIMENT NO: 8

# PARALLEL COMMUNICATION BETWEEN TWO MICROPROCESSORS USING 8255

**AIM:** Write an ALP for parallel communication between two microprocessors using 8255

**TOOLS:**

i. UXASM
ii. TKUP
iii. TKUP86 KIT
iv. FRC CABLE

**PROGRAM: FOR DATA IN KIT**

```
#INCLUDE "TKUP86.DEF"
        ORG 0FFFF0H
        JMPF 0F000H,0F000H
        ORG 0FF000H
        MOV AL,080H
        MOVDX,CMD8255
        OUT DX,AL
        MOV AL,00H
        MOV DX,PA8255
        OUT  DX,AL
        MOV DX,PB8255
        OUT  DX,AL
        MOV DX,PC8255
        OUT DX,AL
RPT:    MOV AL,47H
        MOV DX,PA8255
        OUT  DX,AL
        MOV DX,PB8255
        OUT  DX,AL
        MOV DX,PC8255
        OUT DX,AL
        JMP RPT
```

**PROGRAM: FOR DATA OUT KIT**

```
        #INCLUDE "TKUP86.DEF
         ORG 0FFFF0H
        JMPF 0F000H,0F000H
        ORG 0FF000H
        MOV AL,090H
        MOVDX,CMD8255
        OUT DX,AL
        MOV AL,00H
        MOV DX,PA8255
        OUT  DX,AL
        MOV DX,PB8255
        OUT  DX,AL
        MOV DX,PC8255
        OUT DX,AL
RPT:    MOV DX,PA8255
        IN AL,DX
        MOV [0200H],AL
        MOV DX,PB8255
        OUT DX,AL
        MOV DX,PC8255
        OUT DX,AL
`       JMP RPT
```

**RESULT:**

## Exercise Questions:

1) Write an assembly language program to transfer MRCET string in between two 8255 kits.

## Viva Questions:

1) What is the function of IN Instruction?
2) What is the function of OUT Instruction?
3) What is the size of the ports of 8255?
4) What is the function of the control word register of 8255?

## OBSERVATION:

# EXPERIMENT NO: 9

# PROGRAM FOR INTERFACING STEPPER TO 8086

## (A) ROTATE THE STEPPER MOTOR IN ANTICLOCKWISE DIRECTION

; Connect 8255 Ports A to CNLED

```
;**** INCLUDE DEFINATION FILES NOW
#INCLUDE "TKUP86.DEF"

;****START CODING HERE

        ORG 0FFFF0H
        JMPF 0F000H,0F000H ; the basic reset jump
        ORG 0FF000H
START   MOV SP,STKPTR       ; load stack pointer
        CALL INIT8255       ; initialize 8255
LP1     MOV AL,01H          ; use num1 for led count value
        MOV DX,PA8255
        OUT DX,AL           ;
        CALL DELAY          ; call delay
        MOV AL,02H          ; use num1 for led count value
        MOV DX,PA8255
        OUT DX,AL
        CALL DELAY          ; call delay
        MOV AL,04H          ; use num1 for led count value
        MOV DX,PA8255
        OUT DX,AL
        CALL DELAY          ; call delay
        MOV AL,08H          ; use num1 for led count value
        MOV DX,PA8255
        OUT DX,AL
        CALL DELAY          ; call delay
        JMP START           ; restart again

;*******      Delay module

DELAY   NOP                 ;
        MOV CX,03500H               ; load Delay count = 0x3500
        NOP                 ;
DLY1    NOP                 ;
        LOOP DLY1           ;
        RET                 ; end of delay

;*******      initialize 8255
```

```
INIT8255
        MOV AL,080H         ; make all ports output
        MOV DX, CMD8255
        OUT DX,AL           ; write to command register
        MOV AL,00H          ; clear all ports
        MOV DX,PA8255
        OUT DX,AL           ;
        MOV DX,PB8255
        OUT DX,AL           ;
        MOV DX,PC8255
        OUT DX,AL           ;
        RET                 ;
```

**(B) ROTATE THE STEPPER MOTOR IN CLOCKWISE DIRECTION**

```
;***** START CODING HERE

        ORG 0FFFF0H
        JMPF 0F000H,0F000H ; the basic reset jump

            ORG 0FF000H
START  MOV SP,STKPTR        ; load stack pointer
            CALL INIT8255   ; initialize 8255
    LP1     MOV AL,08H      ; use num1 for led count value
            MOV DX,PA8255
            OUT DX,AL
            CALL DELAY      ; call delay
            MOV AL,04H      ; use num1 for led count value
            MOV DX,PA8255
            OUT DX,AL
            CALL DELAY      ; call delay
            MOV AL,02H      ; use num1 for led count value
            MOV DX,PA8255           ;
            OUT DX,AL
            CALL DELAY      ; call delay
            MOV AL,01H      ; use num1 for led count value
            MOV DX,PA8255
            OUT DX,AL
            CALL DELAY      ; call delay
            JMP START       ; restart again

        ;*******     Delay module

        DELAY  NOP
```

```
        MOV CX,03500H      ; load Delay count = 0x3500
        NOP
DLY1    NOP
        LOOP DLY1
        RET                ; end of delay

;*******    initialize 8255
INIT8255
        MOV AL,080H        ; make all ports output
        MOV DX, CMD8255
        OUT DX,AL          ; write to command register
        MOV AL,00H         ; clear all ports
        MOV DX,PA8255
        OUT DX,AL
        MOV DX,PB8255
        OUT  DX,AL
        MOV DX,PC8255
        OUT DX,AL
        RET
```

**RESULT:** INPUT:

OUTPUT:

## Exercise Questions:

1) Write an assembly language program to rotate a stepper motor for 20steps in clockwise direction?

## Viva Questions:

1. Explain the principle of stepper motor.
2. How to calculate step angle?
3. What are the applications of stepper motor.

## OBSERVATION:

## EXPERIMENT NO: 10

## ARITHMETIC, LOGICAL AND BIT MANIPULATION INSTRUCTIONS OF 8051

**AIM:** Write an ALP for Arithmetic, logical and bit manipulation operations in 8051

**TOOLS:**

i. UXASM
ii. TKUP
iii. TKUP86 KIT
iv. FRC CABLE

**A) PROGRAM: FOR ARITHMETIC INSTRUCTIONS OF 8051**

**;Connect P1 to CNLED1**

```
#INCLUDE "TKUP52.DEF"
        ORG 0000H
START: LJMP MAIN
        ORG 0150H
MAIN MOV SP,#50H
        MOV R0,#20H
        MOV R1,#07H
        MOV A,R0
        ADD A,R1
        MOV P1,A
        LCALL DELAY
        MOV A,R0
        SUBB A,R1
        MOV P1,A
        LCALL DELAY
        MOV A,R0
        MOV 0F0H,R1
        MUL AB
        MOV P1,A
```

```
        LCALL DELAY
        MOV P1,0F0H
        LCALL DELAY
        MOV A,R0
        MOV 0F0H,R1
        DIV AB
        MOV P1,A
        LCALL DELAY
        MOV P1,0F0H
        LCALL DELAY
        LJMP MAIN
DELAY   NOP
        MOV R4,#020H
DLY3    MOV   R3,#0FFH
DLY2    MOV R2,#0FFH
        NOP
DLY1    NOP
        NOP
        NOP
        DJNZ R2,DLY1
        DJNZ R3,DLY2
        DJNZ R4,DLY3
        RET             ;
```

**B) PROGRAM: FOR LOGICAL INSTRUCTIONS OF 8051**

i) **;Connect P1 to CNLED1**

```
        #INCLUDE "TKUP52.DEF"
        ORG 0000H
START:  LJMP MAIN
        ORG 0150H
MAIN    MOV SP,#50H
```

```
        MOV A,#35H
        ANL A,#0FH
        MOV P1,A
        ACALL DLY
        MOV A,#04H
        ORL A,#30H
        MOV P1,A
        ACALL DLY
        MOV A,#54H
        XRL A,#78H
        MOV P1,A
        ACALL DLY
        MOV A,#55H
        CPL A
        MOV P1,A
        ACALL DLY
DLY     NOP
        NOP
        MOV R4,#020H
DLY3    MOV   R3,#0FFH
DLY2 MOV R2,#0FFH
        NOP
DLY1    NOP
        NOP
        NOP
        NOP
        DJNZ R2,DLY1
        DJNZ R3,DLY2
        DJNZ R4,DLY3
        RET
```

**ii) ;Connect P1 to CNLED1**

```
#INCLUDE "TKUP52.DEF"
        ORG 0000H
START:  LJMP MAIN
        ORG 0150H
MAIN:   MOV SP,#060H
        MOV A,#0A5H
        MOV P1,A
        LCALL SFTDL
        RR A
        MOV P1,A
        LCALL SFTDL
        SWAP A
        MOV P1,A
        LCALL SFTDL
        RL A
        MOV P1,A
        LCALL SFTDL
        SETB C
        RLC A
        MOVP1,A
        LCALL SFTDL
        RRC A
        MOV P1,A
        LCALL SFTDL
        LJMP MAIN
SFTDL MOV R4,#50H
DL3     MOV R5,#0FFH
DL2     MOV R6,#0FFH
DL1     DJNZ R6,DL1
        DJNZ R5,DL2
```

```
        DJNZ R4,DL3
        RET
```

**C) PROGRAM: FOR BIT MANIPULATION INSTRUCTIONS OF 8051**
**; Connect P1 to CNLED1**

```
#INCLUDE "TKUP52.DEF"
        ORG 0000H
START: LJMP MAIN
        ORG 0150H
MAIN MOV SP,#50H
        MOV P1,#00H
        MOV C,00H
        SETB C
        MOV P1_7,C
        LCALL  SFTDL
        CLR C
        ANL C,00H
        MOV P1_7,C
        LCALL SFTDL
        CPL C
        MOV P1_3,C
        LCALL SFTDL
        ORL C,00H
        MOV P1_7,C
        LCALL SFTDL
        LJMP MAIN
SFTDL MOV R4,#50H
DL3     MOV R5,#0FFH
DL2     MOV R6,#0FFH
DL1     DJNZ R6,DL1
```

```
        DJNZ R5,DL2
        DJNZ R4,DL3

        RET
```

**RESULT:** INPUT:

OUTPUT:

## Exercise Questions:

1) Write an assembly language program for the addition of 012H and 376H in 8051?

## Viva Questions:

1) What are the ports of 8051?
2) What is the use of DJNZ instruction?
3) What are the bit manipulation instructions of 8051?
4) What are the flags of 8051?

## OBSERVATION:

## EXPERIMENT NO: 11

## TIMER/COUNTERS IN 8051

**AIM:** Write an ALP to verify timer/counter operation in 8051

**TOOLS:** i) UXASM

Ii) TKUP

Iii) TKUP86 KIT

IV) FRC CABLE

**PROGRAM:**

**; Connect P1 to CNLED1**

```
#INCLUDE "TKUP52.DEF"
        ORG 0000H
START:  LJMP MAIN
        ORG 0150H
MAIN:   MOV SP,#060H
        MOV TMOD,#01H
BACK:   MOV TL0,#075H
        MOV TH0,#0B8H
        MOV P1,#0AAH
        LCALL SFTDL
        ACALL DELAY
        MOV TL0,#00H
        MOV TH0,#00H
        MOV P1,#055H
        ACALL DELAY
        LCALL SFTDL
        SJMP BACK
        ORG 300H
DELAY:  SETB TCON4
AGAIN:  JNB TCON5,AGAIN
```

```
        CLR TCON4
        CLR TCON5
        RET
SFTDL   MOV R4,#10H
DL3     MOV R5,#0FFH
DL2     MOV R6,#0FFH
DL1     DJNZ R6,DL1
        DJNZ R5,DL2
        DJNZ R4,DL3
        RET
```

**RESULT:** INPUT:

OUTPUT:

## Exercise Questions:

1) Write a assembly language program for counting number of 1's and 0's in 34H?

## Viva Questions:

1) What are timer/counter registers in 8051?
2) What is the size of timer/Counter?
3) When timer overflow occurs?
4) What are special functions registers of 8051?

## OBSERVATION:

## EXPERIMENT NO: 12

## INTERRUPT HANDLING IN 8051

**AIM:** Write an ALP to verify the interrupt handling in 8051

**TOOLS** i) UXASM

ii)TKUP

iii) TKUP86 KIT

iv) FRC CABLE

**PROGRAM:**

```
#INCLUDE "TKUP52.DEF"
        ORG 0000H
START: LJMP MAIN
        ORG 0150H
MAIN    MOV SP,#50H
        MOV IE,#85H
HERE    MOV P1,#7EH
        SJMP HERE
        ORG 0003H       ; INT0 ISR
        MOV P1,#0AAH
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        RETI
        ORG 0013H       ; INT1 ISR
        MOV  P1,#0A5H
        LCALL DELAY
        LCALL DELAY
        RETI
DELAY NOP
```

```
        MOV R4,#020H
DLY3    MOV R3,#0FFH
DLY2    MOV R2,#0FFH
DLY1    NOP
        NOP
        DJNZ R2,DLY1
        DJNZ R3,DLY2
        DJNZ R4,DLY3
        RET
```

**RESULT:** INPUT:

OUTPUT:

## Exercise Questions:

1) Write the program for interrupt handing of 8051 using PORT 0?

## Viva Questions:

1) What are the interrupts of 8051?
2) What is the Priority among 8051 interrupts?
3) What are the interrupt registers of 8051?
4) What is the size of the interrupt registers of 8051?

## OBSERVATION:

## EXPERIMENT NO: 13

## UART OPERATION IN 8051

**AIM:** To observe the UART operation in 8051

**TOOLS:** i) UXASM

ii) TKUP

iii) TKUP86 KIT

iv) FRC CABLE

**PROGRAM:**

```
; CONNECT THE RS232 FROM PC TO TKUP51 KIT
; CONNECT THE Tx PIN OF 8051 TO Rx OF MAX232 AND VICE VERSA
; CONNECT PORT1 TO CNLED

#INCLUDE "TKUP52.DEF"
        ORG 0000H
START: LJMP MAIN
        ORG 0150H
MAIN:   MOV SP,#060H
        MOV IE,#85H
        MOV TMOD,#20H
        MOV TH1,#0FAH
        MOV SCON,#50H
        SETB TCON6
RPT:    MOV SBUF,#'Y'
HERE:   JNB SCON1,HERE
        CLR SCON1
        MOV A,#'A'
        MOV P1,A
        SJMP RPT
```

**RESULT:** INPUT:

OUTPUT:

## Exercise Questions:

**1)** Where do we prefer the serial communication & Why?

## Viva Questions:

1) What is the full form of UART?
2) What is meant by Synchronous and Asynchronous communication?
3) What is the serial communication registers in 8051?
4) Which data communication method is supported by 8051?

## OBSERVATION:

## EXPERIMENT NO: 14

## INTERFACING LCD TO 8051

**AIM:** Write an ALP for interfacing LCD to 8051

**TOOLS:**

I) UXASM

II) TKUP

III) TKUP86 KIT

IV) FRC CABLE

## PROGRAM:

```
;CONNECT BH4 TO CNLCDC
;CONNECT BH6 TO CNLCDD

#INCLUDE "TKUP52.DEF"
      ORG 0000H
 START: LJMP MAIN
         ORG 0150H
         MAIN MOV SP,#060H
         LCALL INIT8255
LOOP MOV DPTR,#CMDTBL
         LCALL INIT_LCD
         MOV DPTR,#STRTBL
LP1      MOV A,#0
         MOVC A,@A+DPTR
         CJNE A,#00,LP2
         LCALL  DELAY
         LCALL  DELAY
         LCALL DELAY
         LJMP MAIN
LP2 LCALL WR_DAT
```

```
        INC DPTR
        LCALL SDELAY
        LJMP LP1
;*******LCD init module
INIT_LCD
        MOV A,#0
        MOVC A,@A+DPTR
        CJNE  A,#00,IL2
        RET
IL2     LCALL WR_CMD
        INC DPTR
        LJMP INIT_LCD
;*******     LCD Write CMD module
WR_CMDPUSH DPH
        PUSH DPL
        MOVDPTR,#PB8255
        LCALL WRPORT
        LCALL SDELAY
        MOV A,#04
        MOV DPTR,#PA8255
        LCALL WRPORT
        LCALL SDELAY
        MOV A, #00
        MOV DPTR,#PA8255
        LCALL WRPORT
        LCALL SDELAY
        POP   DPL
        POP  DPH
        RET
;*******     LCD Write Data module
WR_DAT      PUSH DPH
```

```
        PUSH DPL
        MOV DPTR,#PB8255
        LCALL WRPORT
        LCALL SDELAY
        MOV A,#05H
        MOV DPTR,#PA8255
        LCALL WRPORT
        LCALL SDELAY
        MOV A,#01H
        MOV DPTR,#PA8255
        LCALL WRPORT
        LCALL SDELAY
        POP  DPL
        POP  DPH
        RET

;******Write Port
WRPORT      CLR P1_7
        MOVX @DPTR,A
        SETB P1_7
        RET
;******                Read Port
RDPORT      CLR P1_7
        MOVX A,@DPTR
        SETB P1_7
        RET
;*******   Delay   module
SDELAYNOP
        MOV  R0,#0FFH
        MOV  R1,#01H
        LJMP DLY1
```

```
        NOP
DELAY NOP
        MOV  R0,#0FFH
        MOV R1,#055H
        NOP
DLY1 DJNZ R0,DLY1
        MOV R0,#0FFH
        DJNZ R1,DLY1
        RET
;*******        initialize 8255
INIT8255
        MOV A,#080H
        MOVDPTR,#CMD8255
        LCALL WRPORT
        RET
        ORG 0500H
;*******        initialize seven segment table
CMDTBL HEX 38,0E,02,01,00
STRTBL ASCII "HELLO ADM - TKUP"
ENDTBL HEX    00,00
```

**RESULT:** INPUT :
OUTPUT :

## Viva Questions:

1) What are the special function register of 8051?
2) What is the function of accumulator register?
3) What is the function of CJNE instruction?
4) What is the function of MOVX instruction?

## OBSERVATION:

## EXPERIMENT NO: 15

## INTERFACING MATRIX/KEYBOARD TO 8051

**AIM:** Write an ALP for interfacing Matrix/keyboard to 8051

TOOLS: i) UXASM

ii) TKUP

iii) TKUP86 KIT

iv) FRC CABLE

**PROGRAM:**

```
;*******        8255_KBD
*******         INCLUDE DEFINATION FILES NOW
;          1. Connect 8255 PA0-7 to CNMUX of L1C peripheral board
;          2. Connect 8255 PC0-7 to CNKEY of L1C peripheral board
;          3. Connect 8255 PB0-7 to CNSEG of L1C peripheral board
;          4. Motor one segment showing 0000->0001->....->000F->0000 (key press)

#INCLUDE "TKUP52.DEF"
          ORG 0000H
START: LJMP MAIN
          ORG 0150H
MAIN MOV SP,#060H
          LCALL INIT8255
          MOV DPTR,#NUM1
          LCALL CLRMEM
          MOV DPTR,#NUM2
          LCALL CLRMEM
          MOV DPTR,#NUM3
          LCALL CLRMEM
          NOP
```

```
LOOP LCALL SCANKBD
        MOV DPTR,#NUM3
        MOVX A,@DPTR
        MOV DPTR,#SEGTBL
        MOVC A,@A+DPTR
        MOV DPTR,#PB8255
        LCALL WRPORT
        MOV A,#070H
        MOV DPTR,#PA8255
        LCALL WRPORT
        LJMP LOOP

;*******   MATRIX KBD SCAN module
;*******   Output either E0,D0,B0,70 for Row 1,2,3,4
;*******   Read PC port ended with 0x0F, expect 0F,0E,0D,0B,07

SCANKBD   MOV A,#00H
SKLOOP    MOVDPTR,#NUM1
        MOVX @DPTR,A
        MOV DPTR,#KBDTBL
        MOVC A,@A+DPTR
        CJNE A,#00,SKL1
        RET
SKL1    MOV DPTR,#PC8255
        LCALL WRPORT
        MOV DPTR,#PC8255
        LCALL RDPORT
        ANL A,#0FH
        CJNE A,#0FH,SKL2
        MOV DPTR,#NUM1
        MOVX A,@DPTR
```

```
        INC A
        LJMP SKLOOP
SKL2    LJMP GETKEY
;*******    GETKEY module
GETKEY      MOVDPTR,#NUM2
        MOVX @DPTR,A
        MOV DPTR,#RETTBL
        MOVC A,@A+DPTR
        MOV R0,A
        MOV DPTR,#NUM1
        MOVX A,@DPTR
        MOV DPTR,#ROWTBL
        MOVC A,@A+DPTR
        ADD A,R0
        MOV DPTR,#NUM3
        MOVX @DPTR,A
        RET
;******          Clear memory location
CLRMEM      MOV A,#0
        MOVX @DPTR,A
        RET
WRPORT CLR P1_7
        MOVX @DPTR,A
        SETB P1_7
        RET
;******          Read Port
RDPORT      CLR P1_7
        MOVX A,@DPTR
        SETB P1_7
        RET
```

```
;*******     Delay module
SDELAYNOP
        MOV R0,#0FFH
        MOV R1,#01H
        LJMP DLY1
        NOP
DELAY NOP
        MOV R0,#0FFH            ; load lsb of delay=0x34FF
        MOV R1,#055H            ;load msb
        NOP
DLY1    DJNZ R0,DLY1
        MOV R0,#0FFH            ; decrement msb count
        DJNZ R1,DLY1
        RET                     ; end of delay

;*******     initialize 8255
INIT8255
        MOV A,#081H         ; make all ports output
        MOV DPTR,#CMD8255       ; write to command register
        LCALL WRPORT
        RET
        ORG 0500H
;*******     initialize seven segment table
SEGTBL      HEX   3F,06,5B,4F,66,6D,7D,07,7F,6F,77,7C,39,5E,79,71,00
KBDTBL      HEX   E0,D0,B0,70,00
RETTBLHEX   00,00,00,00,00,00,00,03,00,00,00,02,00,01,00,00,00
ROWTBL      HEX   00, 04, 08, 0C, 00
```

**RESULT:** INPUT:

OUTPUT:

## Exercise Question:

1) Write an assembly language program for the display of MRCET string on LCDby using 8051

## Viva Questions:

1) What are the special function register of 8051?
2) What is the function of accumulator register?
3) How many no. of pins available for 8051?
4) What is the function of SP register

**OBSERVATION:**