## CONTENTS

## ASSEMBLING AND EXECUTING THE PROGRAM

### Writing an ALP

Assembly level programs generally abbreviated as ALP are written in text editor EDIT.

Type *EDIT* in front of the command prompt to open an untitled text file.

*EDIT<file name>*

After typing the program save the file with appropriate file name with an extension *.ASM*

Ex:

Add.ASM

### Assembling an ALP

To assumble an ALP we needed executable file calledMASM.EXE. Only if this file is in current working directory we can assemble the program. The command is

*MASM<filename.ASM>*

If the program is free from all syntactical errors, this command will give the **OBJEC**T file.In case of errors it list out the number of errors, warnings and kind of error.

Note:No object file is created until all errors are rectified.

### Linking

After successful assembling of the program we have to link it to get **Executable file.**

The command is

*LINK<File name.OBJ>*

This command results in *<Filename.exe>* which can be executed in front of the command prompt.

### Executing the Program

Open the program in debugger by the command(note only exe files can be open)by the command.

*CV <Filename.exe>*

This will open the program in debugger screen where in you can view the assemble code with the CS and IP values at the left most side and the machine code. Register content ,memory content also be viewed using **VIEW** option of the debugger.

**Execute** option in the menu in the menu can be used to execute the program either in single steps(F7) or burst execution(F5).

**1. Program involving Data transfer instructions**

**i)Byte and word data transfer in different addressing modes**

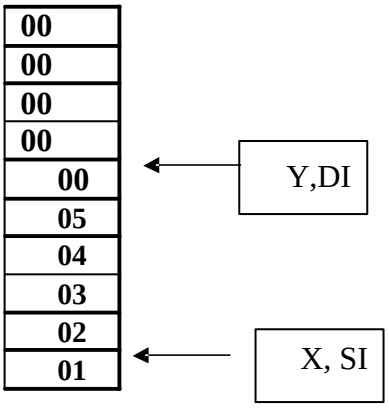
```
 DATA SEGMENT
   DATA1 DB 23H
   DATA2 DW 1234H
   DATA3 DB 0H
   DATA4 DW 0H
   DATA5 DW 2345H,6789H
DATA ENDS
CODE SEGMENT
        ASSUME CS:CODE,DS:DATA
START:  MOV AX,DATA            ;Initialize  DS to point to start of the memory
            MOV DS,AX          ;set aside for storing of data
            MOV AL,25X         ;copy 25H into  8 bit AL register
            MOV AX,2345H       ;copy 2345H into  16 bit AX register
            MOV BX,AX          ;copy the content of AX into BX register(16 bit)
            MOV  CL,AL         ;copy the content of AL into CL register
            MOV  AL,DATA1      ;copies the byte contents of data segment memory
                               ;location   DATA1 into 8 bit AL
           MOV  AX,DATA2       ;copies the word contents of data segment memory
                               ;location  DATA2 into 16 bit AX
           MOV  DATA3,AL       ;copies the AL content  into the byte contents of data
                               ;segment  memory location DATA3
           MOV  DATA4,AX       ;copies the AX content  into the word contents of
                               ;data   segment  memory location DATA4
           MOV BX,OFFSET DATA5 ;The 16 bit offset address of DS memeory location
                               ; DATA5 is copied into BX
              MOV AX,[BX]      ; copies the word content  of  data  segment
                               ;memory location addressed by BX  into
                               ;AX(register indirect addressing)
              MOV  DI,02H      ;address element
              MOV AX,[BX+DI}   ; copies the word content  of  data  segment
                               ;memory location addressed by BX+DI  into
                               ;AX(base plus indirect addressing)
             MOV AX,[BX+0002H] ; copies the word content  of  data  segment

                               ;(16 bit)
             MOV  AL,[DI+2]    ;register relative addressing
             MOV AX,[BX+DI+0002H]  ;copies the word content  of  data  segment
                               ;memory location addressed by BX+DI+0002H
                               ;into   AX(16 bit)
              MOV  AH,4CH      ; Exit to DOS with function call 4CH
              INT 21H
   CODE ENDS                   ; Assembler stop reading
   END START
```

**ii)Block move (with and with out overlapping)**

**Without overlapping**

```
DATA SEGMENT
   X DB 01H,02H,03H,04H,05H    ;Initialize Data Segments Memory Locations
   Y DB 05 DUP(0)
DATA ENDS
   CODE SEGMENT
      ASSUME CS:CODE,DS:DATA
   START:MOV AX,DATA           ; Initialize  DS to point to start of the memory
         MOV DS,AX             ; set aside for storing of data
         MOV CX,05H            ;  Load  counter
         LEA SI,X+04           ;  SI pointer pointed  to  top of the memory block
         LEA DI,X+04+03        ;  03 is displacement of over lapping, DI  pointed   to
                               ;the   top of the destination block
```

**Before execution**



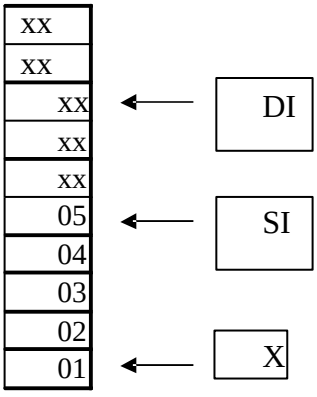

**After execution**

| |
|---|
| **05** |
| **04** |
| **03** |
| **02** |
| **01** |
| **05** |
| **04** |
| **03** |
| **02** |
| **01** |

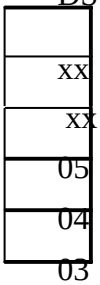
**With Overlapping**

```
DATA SEGMENT
   X DB 01H,02H,03H,04H,05H  ;  Initialize Data Segments Memory Locations
DATA ENDS
 CODE SEGMENT
      ASSUME CS:CODE,DS:DATA
   START:MOV AX,DATA          ; Initialize  DS to point to start of the memory
         MOV DS,AX            ; set aside for storing of data
         MOV CX,05H           ; Load  counter
         LEA SI,X+04          ;  SI pointer pointed  to  top of the memory block
         LEA DI,X+04+03       ;  03 is displacement of over lapping, DI  pointed   to
                              ;the   top of the destination block
    UP:  MOV BL,[SI]          ;  Move the SI content to BL register
         MOV [DI],BL          ; Move the BL register  to content of DI
         DEC SI               ; Update SI and DI
         DEC DI
         DEC CX               ; Decrement the counter till it becomes zero
         JNZ UP
         MOV AH,4CH
         INT 21H
CODE ENDS
END START
```

DS Before execution




DS After execution

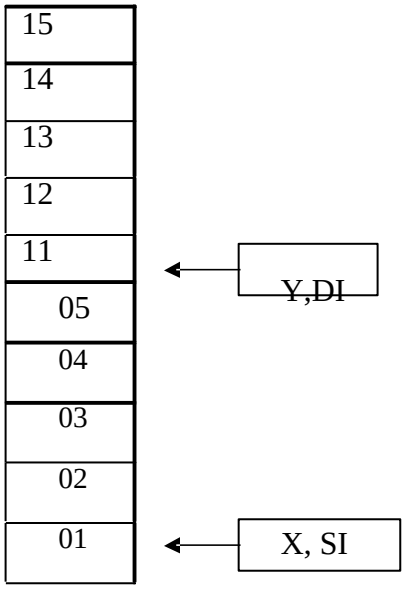


| |
|---|
| 02 |
| 01 |
| 03 |
| 02 |
| 01 |

**iii) Block Interchange**

```
DATA SEGMENT
 X DB 01H,02H,03H,04H,05H
 Y DB 11H,12H,13H,14H,15H
 DATA ENDS
 CODE SEGMENT
 ASSUME CS:CODE,DS:DATA
 START:MOV AX,DATA
        MOV DS,AX
          MOV CX,05H              ; Load the counter
        LEA SI,X                  ; SI pointed to the source location x
        LEA DI,Y                  ; DI pointed to the destination location y
   UP:   MOV BL,[SI]              ; Move the SI content to BL register
        MOV AL,[DI]               ; Move the DI content to AL register
        MOV [SI],AL               ; Move AL register content to content of SI
        MOV [DI],BL               ; Move BL register content to content of DI
          INC SI                  ; Update SI and DI
          INC DI
          DEC CX                  ; Decrement the counter till it becomes zero
          JNZ UP
          MOV AH,4CH
          INT 21H

CODE ENDS
END START
```

DS Before execution



DS After execution

| |
|---|
| 05 |
| 04 |
| 03 |
| 02 |
| 01 |
| 15 |
| 14 |
| 13 |
| 12 |
| 11 |

**2) Program involving Arithmetic and logic operations like addition and subtraction of multi precision numbers**

**i ) 16 Bit Addition**

```
DATA SEGMENT
  NUM DW 1234H, 0F234H
  SUM  DW 2 DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME CS: CODE, DS:DATA
START: MOV AX,DATA
       MOV DS,AX
       MOV AX,NUM          ; First number loaded into AX
       MOV BX,0H           ; For carry BX register is cleared
       ADD AX,NUM+2        ; Second number added with AX
       JNC DOWN            ; Check for carry
       INC BX              ; If carry generated increment the BX
DOWN: MOV SUM,AX           ; Storing the sum value
       MOV SUM+2,BX        ; Storing the carry value
       MOV AH,4CH
       INT 21H
CODE ENDS
END START
```

INPUT : 1234H, F234H

OUTPUT : 10468H

**ii) 32 Bit addition**

```
  DATA SEGMENT
    NUM1 DW 0FFFFH,0FFFFH
    NUM2 DW 1111H,1111H
    SUM  DW 4 DUP(0)
  dATA ENDS
  CODE SEGMENT
      ASSUME CS:CODE,DS:DATA
  START: MOV AX,DATA
           MOV DS,AX
           MOV AX,NUM1          ;Move LSB of  NUM1 to AX
           ADD AX,NUM2          ;Add  LSB of NUM2   to AX
           MOV SUM,AX           ;Store the LSB   in SUM
           MOV AX,NUM1+2        ; Move MSB of  NUM1 to AX
           ADC AX,NUM2+2        ; Add  MSB of NUM2   to AX

           JNC DOWN               ; Check for carry
           MOV SUM+4,01H        ; Store the carry in SUM+4
DOWN:  MOV SUM+2,AX             ; Store the MSB in SUM+2
          MOV AH,4CH
          INT 21H
  CODE ENDS
  END START
```

INPUT: 0FFFFFFFFH, 011111111H

OUTPUT: 0111111110H

**iii) 32 Bit addition using DD directive**

```
DATA SEGMENT
  NUM1 DW 12345678H
  NUM2 DW 12345678H
  SUM  DW 3 DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME CS:CODE,DS:DATA
START:MOV AX,DATA
        MOV DS,AX
        LEA SI,NUM1            ;  SI pointed to the of LSB of NUM1
        LEA DI,NUM2            ;  DI pointed to the of LSB of NUM2
        MOV AX,[SI]            ;  Move the content of SI to AX
          ADD AX,[DI]           ; Add DI content to AX
          MOV CX,[SI+2]         ; Move the SI to point MSB of NUM1 and move that

                                 ;content to CX
          ADC CX,[DI+2]          ; Move the DI to point MSB of NUM2 and  add
                                 ;with carry to CX
          JNC DOWN               ; Check for carry
          MOV SUM+4,01H         ; Store the carry in SUM+4
   DOWN:MOV SUM,AX              ; Store the LSB   in SUM

          MOV SUM+2,CX           ; Store the MSB   in SUM+2
          MOV AH,4CH
          INT 21H
   CODE ENDS
   END START

   INOUT:  12345678H,12345678H
   OUTPUT:2468ACF0H
```

**iv) 16 Bit Subtraction**

```
DATA SEGMENT
  NUM DW  4567H,2345H
  DIF DW 1  DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME
CS:CODE,DS:DATA
START:  MOV AX,DATA
        MOV DS,AX          ; Clearing Carry
        CLC

        LEA SI,NUM          ; SI pointed to the NUM
        MOV AX,[SI]         ; Move NUM1 to AX
        SBB AX,[SI+2]      ; Move the SI to Num2 and subtract with AX(Takes

                            ;care for both smaller as well  as larger
                            ;Number subtraction)
        MOV DIF,AX          ;Store the result
        MOV AH,4CH
        INT 21H
CODE ENDS
END START
```

INPUT: 4567H,2345H
OUTPUT:2222

**v) 32 Bit Subtraction**

```
DATA SEGMENT
  NUM1 DW 2345H,6762H
  NUM2 DW 1111H,1111H
  DIF  DW 2 DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME CS:CODE,DS:DATA
START:  MOV AX,DATA
        MOV DS,AX
        LEA SI,NUM1          ; SI pointed to the LSB of NUM1
        LEA DI,NUM2          ; DI pointed to the LSB of NUM2
        MOV AX,[SI]          ; Move the content of SI to AX
        MOV BX,[DI]          ; Move the content of DI to BX
        SUB AX,BX            ; Subtract from BX to AX
        MOV DIF,AX           ; Store the LSB result in DIF
          INC SI               ;Update SI to point the MSB of NUM1(if

                               ;ADD SI,02 instruction its affect carry flag)
        INC SI
        INC DI               ;Update DI to point the MSB of NUM2
        INC DI
        MOV AX,[SI]          ; Move the content of SI to AX
        MOV BX,[DI]          ; Move the content of DI to BX

        SBB AX,BX              ;  Subtract with borrow from BX to AX
        MOV DIF+2,AX         ;  Store the MSB result in DIF+2
        MOV AH,4CH
        INT 21H
CODE ENDS
END START


INPUT: 23456762,-11111111
OUTPUT:12345651

INPUT:11111111,-23451234
OUTPUT:EDCBFEDD
```

**Multiplication and Division of signed and unsigned Hexadecimal numbers**
**vi)16 Bit multiplication for unsigned numbers**

```
DATA SEGMENT
  NUM DW  1234H,1234H
  PROD DW 2  DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME CS:CODE,DS:DATA
START: MOV AX,DATA
        MOV DS,AX
        LEA SI,NUM          ; SI pointed to the Multiplicand
           MOV AX,[SI]          ; Multiplicand has to be in AX register

             MOV BX,[SI+2]      ; SI+2  pointed to the Multiplier and move it to BX
             MUL BX             ;Perform the multiplication

             MOV PROD,AX  ;32 bit product stored in DX-AX registers
             MOV PROD+2,DX
             MOV AH,4CH
             INT 21H
   CODE ENDS
   END START

   INPUT: Multiplicand- 1234H,
            Multiplier    -  1234H
   OUTPUT: DX-01 4B
              AX-54 90
```

**vii)16 Bit multiplication for signed numbers**

```
DATA SEGMENT
  NUM DW  -2,1
  PROD DW 2  DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME CS:CODE,DS:DATA
  START:  MOV AX,DATA
          MOV DS,AX
            LEA SI,NUM       ; SI pointed to the Multiplicand
            MOV AX,[SI]    ; Multiplicand has to be in AX register
            MOV BX,[SI+2]   ; SI+2  pointed to the Multiplier and move it to BX
            IMUL BX          ; Perform the sign multiplication using sign
                             ;Multiplication operator (IMUL)
            MOV PROD,AX    ; 32 bit product stored in DX-AX registers
            MOV PROD+2,DX
            MOV AH,4CH
           INT 21H
CODE ENDS
END START
```

INPUT: Multiplicand- -2,
Multiplier - 1
OUTPUT: DX – FF FF
AX – FF FE ; Result is in two complement form.

**viii)8 Bit Division for Unsigned numbers**

```
DATA SEGMENT
  NUM1 DB  72H,
  NUM2 DB  02H
  QUO DB 1  DUP(0)
  REM DB 1  DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME CS:CODE,DS:DATA
START:  MOV AX,DATA
          MOV DS,AX
          MOV AL,NUM1    ;Move the Dividend  to AL
             MOV AH,0H      ; Zero extended for 16 bit/8 bit division
             DIV NUM2       ; Perform the Division operation

             MOV QUO,AL     ; Store the quotient to AL
             MOV REM,AH     ;Store the reminder to AH
             MOV AH,4CH
             INT 21H
  CODE ENDS
  END START
```

INPUT: Dividend - 72H,
Divisor - 02 H,
0UTPUT: AL - 39H (quotient);
AX - 00H (reminder);

INPUT: Dividend - 55H,
Divisor - 04 H,
0UTPUT: AL - 15H (quotient);
AX - 01H (reminder);

**ix)8 Bit Division for Signed numbers**

```
DATA SEGMENT
  NUM1 DB  -10
  NUM2 DB  02
  QUO DB 1  DUP(0)
  REM DB 1  DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME CS:CODE,DS:DATA
START:  MOV AX,DATA
          MOV DS,AX
          MOV AL,NUM1    ;Move the Dividend  to AL
          CBW
          IDIV NUM2        ; Perform the Sign Division operation using IDIV operator
          MOV QUO,AL     ; Store the quotient to AL
          MOV REM,AH     ;Store the reminder to AH
          MOV AH,4CH
          INT 21H
CODE ENDS
END START
```

INPUT: Dividend - -10
Divisor - 02
0UTPUT: AL – FBH (quotient) ; Result is in two complement form

INPUT: Dividend - -10
Divisor - 03
0UTPUT: AL – FDH (quotient);
AX – FF H (reminder) ; Result is in two complement form

**x)16 Bit Division for Unsigned numbers**

```
DATA SEGMENT
  NUM1 DW 4567H,2345H
  NUM2 DW  4111H
  QUO DW 2  DUP(0)
  REM DW 1  DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME CS:CODE,DS:DATA
START:  MOV AX,DATA
        MOV DS,AX
        MOV AX,NUM1          ;Move the lower bit of Dividend  to AX
          MOV DX,NUM1+2      ; Move the higher bit of Dividend  to DX
          DIV NUM2           ; Perform the Division operation
          MOV QUO,AX         ; Store the quotient to AX
          MOV REM,DX         ; Store the reminder to DX
          MOV AH,4CH
          INT 21H
   CODE ENDS
   END START
```

INPUT: Dividend - 23454567,
Divisor - 4111,
0UTPUT: AX – 8AC5H (quotient);
DX – 0952H (reminder);

**xi)16 Bit Division for Signed numbers**

```
DATA SEGMENT
  NUM1 DW 4567H,2345H
  NUM2 DW  4111H
  QUO DW 2  DUP(0)
  REM DW 1  DUP(0)
DATA ENDS
CODE SEGMENT
   ASSUME CS:CODE,DS:DATA
START:  MOV AX,DATA
        MOV DS,AX
        MOV AX,NUM1          ; Move the lower bit of Dividend  to AX
          MOV DX,NUM1+2      ; Move the higher bit of Dividend  to DX
          CWD
          IDIV NUM2          ; Perform the sign Division operation using IDIV
          MOV QUO,AX         ; Store the quotient to AX
          MOV REM,DX         ; Store the reminder to DX
          MOV AH,4CH
          INT 21H
  CODE ENDS
  END START
```

INPUT: Dividend - -44444444,
Divisor - 2222,
0UTPUT: AX – FE (quotient);
DX – FF (reminder) ; Result is in two complement form.

**3.Code Conversion**

**i)ASCII adjustment instructions**

```
CODE SEGMENT
        ASSUME CS:CODE
        START:  MOV AX,31H      ;Load ASCII 1
                ADD AX,39H      ;Load ASCII 9
                AAA             ;ASCII Adjust, AX=0100 UNPACKED BCD

                ADD AX,3030H    ;Answer in ASCII

                MOV BL,9        ;Load divisor

                MOV AX,0702H    ;Load dividend, AAD instruction requires
                                 Ax register to contain a two digit unpacked
                                 ;BCD number before executing
                AAD             ;AAD appears before division
                DIV BL          ;Contents of adjusted AX register is devised
                                 ;by an unpacked BCD number to generate
                                 ;a single digit result in AL with any
                                 ;remainder in AH

                MOV AL,5        ;Load multiplicand
                MOV CL,5        ;Load multiplier
                MUL CL          ;AX=0019H
                AAM             ;AX=0205(Unpacked BCD)
                ADD AX,3030H    ;AX=3235H

                MOV AX,38H      ;Load ASCII 8
                SUB AX,31H      ;Load ASCII 1
                AAS             ;AX=0007
                AX,3030H        ;AX=3037H

                MOV AH,4CH
                INT 21H

    CODE ENDS
    END START
```

**ii)Binary to BCD code conversion**

```
DATA SEGMENT
      BIN DW 01A9H
      BCD DB 2 DUP(0)
DATA ENDS

CODE SEGMENT
      ASSUME CS:CODE,DS:DATA
    START: MOV AX,DATA          ;Load the Data to AX.
           MOV DS,AX            ;Move the Data AX to DS.
           MOV AX,BIN           ;Move the Binary Data to AX.
          MOV CL,64H            ;100 in decimal
           DIV CL               ;Perform the division by 100.
          MOV BCD+1,AL          ;Store the quotient in BCD+1.
           MOV AL,AH            ;Move the Reminder value to AL.
           MOV AH,00H           ;Initialize the AH.
           MOV CL,0AH           ;10 in decimal.
           DIV CL               ;Perform the division by 10.
           MOV CL,04
           ROR AL,CL            ;Perform the Right side rotation 4 times.
           ADD AL,AH            ;Adding the Reminder in LSB.
           MOV AH,4CH
           INT 21H
   CODE ENDS
   END START

   Input:  binary--------01A9
   Output: bcd-----------425
```

**iii)BCD to Binary code conversion**

```
DATA SEGMENT
  BCD DW 27H
  BIN DW ?
DATA ENDS

CODE SEGMENT
 ASSUME CS:CODE,DS:DATA
 START:  MOV AX,DATA        ;Load the Data to AX.
       MOV DS,AX            ;Move the Data AX to DS.
       MOV AX,BCD           ;Move the BCD Data to AX.
       AND AX,07H           ;Perform the AND operation between
                            ;07H and input BCD
       MOV BX,AX            ;Move data AX to BX
       MOV AX,BCD           ;Move the BCD Data to AX.
       AND AX,0F0H          ;Perform the AND with 0F0H for shifting operation.
       MOV CX,0AH           ;10 in decimal.
       MUL CX               ;Perform the multiplication by 10.
       ADD AX,BX            ;Perform the addition operation to get the LSB.
       MOV BIN,AX           ;Move the result to binary.

       MOV AH,4CH
       INT 21H

CODE ENDS
END START
```

Input: BCD----------27
Output:----------1B

**4. Arithmetic programs to find square, cube, LCM, GCD and factorial**

**i) Program to find square and cube of a number**

```
DATA SEGMENT
  X DW 04H
  SQUARE DW ?
  CUBE DW ?
DATA ENDS

CODE SEGMENT
  ASSUME CS:CODE,DS:DATA

    START: MOV AX,DATA      ;Load the Data to AX.
           MOV DS,AX        ;Move the Data AX to DS.
           MOV AX,X         ;Move the X number Data to AX.
           MOV BX,X         ;Move the X number Data to BX.
           MUL BX           ;Perform the multiplication by BX.
           MOV SQUARE,AX    ;Store value in SQUARE.
           MUL BX           ;Perform the multiplication by BX.
           MOV CUBE,AX      ;Store value in CUBE.
           MOV AH,4CH
           INT 21H

  CODE ENDS
  END START
```

Input: x ---------- 4h

Output: Square ---------10h

Cube ----------40h

**ii)Program to find LCM of a given number**

```
DATA SEGMENT
   NUM DW 05,04
   LCM DW 2 DUP(0)
DATA ENDS

CODE SEGMENT
  ASSUME CS:CODE,DS:DATA
     START:  MOV AX,DATA      ;Load the Data to AX.
          MOV DS,AX           ;Move the Data AX to DS.
          MOV DX,0H           ;Initialize the DX.
          MOV AX,NUM          ;Move the first number to AX.
          MOV BX,NUM+2        ;Move the second number to BX.
      UP: PUSH AX             ;Store the  quotient/first number in AX.
          PUSH DX             ;Store the remainder value in DX.
          DIV BX              ;Divide the first number by second number.
          CMP DX,0            ;Compare the remainder.
          JE EXIT             ;If remainder is zero, go to EXIT label.
                              ;If remainder is non-zero,
          POP DX              ;Retrieve the remainder.
          POP AX              ;Retrieve the quotient.
          ADD AX,NUM          ;Add first number with AX.
          JNC DOWN            ;If no carry jump to DOWN label.
          INC DX              ;Increment DX.
       DOWN: JMP UP           ;Jump to Up label.
       EXIT: POP LCM+2        ;If remainder is zero, store the value at LCM+2.
          POP LCM

          MOV AH,4CH
          INT 21H

   CODE ENDS
   END START
```

Input: 0A, 04
Output: 02

**iii)Program to find GCD of two numbers**

```
DATA SEGMENT
    NUM1 DW 000AH
    NUM2 DW 0004H
    GCD DW ?
DATA ENDS

CODE SEGMENT
  ASSUME CS:CODE,DS:DATA
     START: MOV AX,DATA      ;Load the Data to AX.
          MOV DS,AX          ;Move the Data AX to DS.
          MOV AX,NUM1        ;Move the first number to AX.
          MOV BX,NUM2        ;Move the second number to BX.
     UP: CMP AX,BX           ;Compare the two numbers.
          JE EXIT            ;If equal, go to EXIT label.
          JB EXCG            ;If first number is below than second,
                             ;go to EXCG label.
     UP1:MOV DX,0H           ;Initialize the DX.
          DIV BX             ;Divide the first number by second number.
          CMP DX,0           ;Compare remainder is zero or not.
          JE EXIT            ;If zero, jump to EXIT label.
          MOV AX,DX          ;If non-zero, move remainder to AX.
          JMP UP             ;Jump to UP label.
     EXCG:XCHG AX,BX         ;Exchange the remainder and quotient.
          JMP UP1            ;Jump to UP1.
     EXIT:MOV GCD,BX         ;Store the result in GCD.
          MOV AH,4CH
          INT 21H

    CODE ENDS
    END START

    Input: 0A,04
    Output: 02
```

**iv)Program to find factorial of a given number**

```
DATA SEGMENT
      X DW 06H
      FACT DW ?
DATA ENDS

CODE SEGMENT
  ASSUME CS:CODE,DS:DATA
  START: MOV AX,DATA
       MOV DS,AX
          MOV AX,01H          ;Set the value of AX as 01H.
          MOV CX,X            ;Move the i/p number to CX.
     UP: MUL CX               ;Perform the Loop multiplication operation.
          LOOP UP
          MOV FACT,AX         ;Store the FACT value.
          MOV AH,4CH
          INT 21H

   CODE ENDS
   END START
```

Input: 06
Output: 2D0H

**5.Program involving bit manipulation instruction**

**i)If given data is positive or negative**

```
DATA SEGMENT
  NUM DB 12H
  MES1 DB 10,13,'DATA IS POSITIVE $'
  MES2 DB 10,13,'DATA IS NEGATIVE $'
DATA ENDS

CODE SEGMENT
  ASSUME CS:CODE,DS:DATA
  START: MOV AX,DATA
       MOV DS,AX
          MOV AL,NUM              ;Move the Number to AL.
          ROL AL,1                ;Perform the rotate left side for 1 bit position.
          JC NEGA                 ;Check for the negative number.

          MOV DX,OFFSET MES1      ;Declare it positive.
          JMP EXIT                ;Exit program.

     NEGA:  MOV DX,OFFSET MES2;Declare it negative.
     EXIT:  MOV AH,09H
          INT 21H
          MOV AH,4CH
          INT 21H

  CODE ENDS
  END START
```

Output: Data is positive
Positive Numbers: 00-7F
Negative numbers: 80-FF

**ii)If given data is odd or even**

```
DATA SEGMENT
    X DW 27H
    MSG1 DB 19,13,'NUMBER IS EVEN$'
    MSG2 DB 10,13,'NUMBER IS ODD$'
DATA ENDS

CODE SEGMENT
  ASSUME CS:CODE,DS:DATA
  START: MOV AX,DATA
        MOV DS,AX
        MOV AX,X
           TEST AX,01H          ;Test for Even/Odd number.
          JNZ EXIT              ;If it is Even go to Exit label.
                                ;(alternate logic)
                                ;MOV BL,2
                                ;DIV BL
                                ;CMP AH,0H
                                ;JNZ EXIT
           LEA DX,MSG1          ;Declare it is Even number.
           MOV AH,09H
           INT 21H
           JMP LAST

    EXIT:   LEA DX,MSG2       ;Declare it is Odd number.
           MOV AH,09H
           INT 21H
    LAST:   MOV AH,4CH
           INT 21H

   CODE ENDS
   END START
```

Output: Number is ODD

### iii) Logical ones and zeros in a given data

```
DATA SEGMENT
      X DB 0AAH
      ONE DB ?
      ZERO DB ?
DATA ENDS

CODE SEGMENT
  ASSUME CS: CODE,DS:DATA
  START:  MOV AX,DATA
        MOV DS,AX
        MOV AH,X
        MOV BL,8            ;Initialize BL to 8.
        MOV CL,1            ;Initialize CL to 1.
  UP:  ROR AH,CL            ;Perform the single bit rotate operation
                            ;with respect to right.
        JNC DOWN            ;If no carry go to DOWN label.
        INC ONE             ;Increment one.
        JMP DOWN1           ;Jump to DOWN1.
  DOWN:   INC ZERO          ;Increment ZERO.
  DOWN1:  DEC BL            ;Decrement the BL.
        JNZ UP              ;If no zero go to UP label.

        MOV AH,4CH
        INT 21H

CODE ENDS
END START
```

Output: Ones--------04
Zeros--------04

**iv) 2 out of 5 code**

```
DATA SEGMENT
      X DW 82H
      MES DB 10,13,'VALID 2 OUT OF CODE $'
      MES1 DB 10,13,'NOT A VALID 2 OUT OF CODE $'
DATA ENDS

CODE SEGMENT
   ASSUME CS:CODE,DS:DATA
   START: MOV AX,DATA        ;Load the Data to AX.
          MOV DS,AX          ;Move the Data AX to DS.
          MOV AX,X           ;Move the Data word to AX.
          MOV BX,0H          ;Initialize the BX.
          AND AX,0E0H        ;Perform the AND operation of first 3 bit.
          JNZ DISP           ;If no zero jump to DISP label.
          MOV CL,05          ;If zero, Initialize the counter for check the last 5 bit.
          MOV AX,X           ;Move the Data word to AX.
     UP:  ROR AX,1           ;Rotate right side one time.
          JNC DOWN           ;If no carry jump to DOWN label.
          INC BX             ;Increment the BX.
DOWN:DEC C                   ;Decrement the counter.
          JNC UP             ;If no carry jump to UP label.
          CMP BX,02H         ;Compare the BX with 2.
          JNZ DISP           ;If no zero jump to DISP label.
          LEA DX,MES         ;Declared as 2 out of 5 code .
          MOV AH,09H
          INT 21H
          JMP EXIT
DISP: LEA DX,MES1            ;Declared as not valid code .
          MOV AH,09H
          INT 21H
 EXIT:MOV AH,4CH
          INT 21H

CODE ENDS
END START
```

Output: Not a valid 2 out of 5 code.

**v) Bit wise palindrome**

```
DATA SEGMENT
      X DW 0FFFFH
      MSG1 DB 10,13,'NUMBER IS PALINDROME$'
      MSG2 DB 10,13,'NUMBER IS NOT PALINDROME$'
DATA ENDS

CODE SEGMENT
  ASSUME CS:CODE,DS:DATA
  START: MOV AX,DATA        ;Load the Data to AX.
       MOV DS,AX            ;Move the Data AX to DS.
       MOV AX,X             ;Move DW to AX.
       MOV CL,10H           ;Initialize the counter 10.
  UP: ROR AX,1              ;Rotate right one time.
       RCL DX,1             ;Rotate left with carry one time.

       LOOP UP              ;Loop the process.
       CMP AX,DX            ;Compare AX and DX.
       JNZ DOWN             ;If no zero go to DOWN label.
       LEA DX,MSG1          ;Declare as a PALINDROME.
       MOV AH,09H
       INT 21H
       JMP EXIT             ;Jump to EXIT label.
DOWN: LEA DX,MSG2           ; Declare as not a PALINDROME
       MOV AH,09H
       INT 21H
EXIT:MOV AH,4CH
       INT 21H

CODE ENDS
END START
```

Output: Number is Palindrome

**vi) Nibble wise palindrome**

```
DATA SEGMENT
      X DW 2662H
      TEMP DW 0H
      MES DB 10,13,'THE WORD IS NIBBLEWISE PALINDROME $'
      MES1 DB 10,13,'THE WORD IS NOT NIBBLEWISE PALINDROME $'
DATA ENDS

CODE SEGMENT
  ASSUME CS:CODE,DS:DATA
  START:  MOV AX,DATA
        MOV DS,AX
        MOV AX,X
        MOV BX,X
           MOV CL,04              ;Initialize counter.
           AND AX,0000FH          ;Perform the and  operation between
                                  ;last nibble of AX and 000FH.
           AND BX,0F000H          ;Perform the and  operation between
                                  ;last nibble of BX and 000FH.
           ROL BX,CL              ;Rotate left side 4 times the BX.
           CMP AX,BX              ;Compare AX with BX.
           JNZ TER                ;If no zero go to TER label.
           MOV AX,X               ;Move the DW to AX.
           ROR AX,CL              ;Rotate right side 4 times the AX.
           MOV BX,AX              ;Move AX to BX.
           AND AX,000FH           ; Perform the and  operation with last nibble.
           ROR BX,CL              ;Rotate right side 4 times the BX.
           AND BX,000FH           ;Perform the and  operation with last nibble of BX.
           CMP AX,BX              ;Compare AX with BX.
           JNZ TER                ;If no zero go to TER label.
           MOV AH,09H
           LEA DX,MES             ;Declared as a PALINDROME.
           INT 21H
           JMP LAST
    TER:MOV AH,09H
           LEA DX,MES1            ;Declared as a non palindrome.
           INT 21H
   LAST:MOV AH,4CH
      INT 21H

   CODE ENDS
   END START
```

Output: The word is nibble wise palindrome

## 6. PROGRAMS INVOLVING BRANCH/LOOP INSTRUCTIONS / PROGRAMS ON ARRAYS

### i)ADDITION OF n NUMBERS

```
DATA SEGMENT                          ;start of data segment

    ARR DW 0010H,0020H,0030H,0040H,0050H
      LEN EQU ($-ARR)/2
      SUM DW ?
DATA ENDS

CODE SEGMENT
      ASSUME CS:CODE,DS:DATA
      START:  MOV AX,DATA
              MOV DS,AX
              LEA SI,ARR
              CLC
              XOR AX,AX
              MOV CX,LEN

      UP:     ADC AX,[SI]

              INC SI
              INC SI
              DEC CX
              JNZ UP

              MOV SUM,AX

              MOV AH,4CH
              INT 21H
CODE ENDS
END START
```

OUTPUT: 00F0

```
;end of data segment

;start of code segment

;initialize data segment

;SI points to the LSB of data ARR
;clear carry
;clear AX register
;load CX with the number of data words in ARR
;add the number pointed by SI to A register
;point to the next data word
;decrement Cx
;and check if all numbers are added if no then add
;store the addition result in user defined memory location sum
;terminate the process
;end of code segment
```

**ii)PROGRAM TO SUBTRACT N NUMBERS**

```
DATA SEGMENT                        ;start of data segment
     ARR DW 50H,10H,20H,10H,05H
       LEN EQU ($-ARR)/2
       DIF DW ?
DATA ENDS                           ;end of data segment

CODE SEGMENT                        ;start of code segment
   ASSUME CS:CODE,DS:DATA
   START:  MOV AX,DATA              ;initialize data segment
           MOV DS,AX
           LEA SI,ARR               ;SI points to the LSB of data ARR
           CLC                      ;clear carry flag
           MOV CX,LEN-1             ;load CX register with the number of
                                    data words in ARR
           MOV AX,[SI]              ;make a copy of the first number
                                    pointed by SI in AX
      UP:  SUB AX,[SI+2]            ;subtract the next number from the
                                    contents of AX and store the result in AX
           INC SI                   ;point to the next number
           INC SI
           DEC CX                   ;decrement CX
           JNZ UP                   ;and check if all subtraction of all
                                    numbers is complete if no then subtract
           MOV DIF,AX               ;store the difference in user defined
                                    memory location DIFF
           MOV AH,4CH               ;terminate the process
           INT 21H
CODE ENDS                           ;end of code segment
END START
```

OUTPUT: 0005

**PROGRAMS TO FIND LARGEST AND SMALLEST NUMBER**

**iii)PROGRAM TO FIND LARGEST NUMBER AMONG THE SERIES**

```
DATA SEGMENT                    ;start of data segment
        X DW 0010H,52H,30H,40H,50H
        LAR DW ?
DATA ENDS                       ;end of data segment

CODE SEGMENT                    ;start of code segment
    ASSUME CS:CODE,DS:DATA
    START: MOV AX,DATA          ;initialize data segment
           MOV DS,AX
           MOV CX,05H           ;load CX register with number of datawords
                                in X
           LEA SI,X             ;initialize SI to point to the first number
           MOV AX,[SI]          ;make a copy of the number pointed by SI in
                                AX
           DEC CX               ;set count value in CX for comparison
      UP:  CMP AX,[SI+2]        ;compare two adjacent numbers(one is in
                                AX and the other is pointed by SI+2)
           JA CONTINUE          ;if contents of AX is greater than the next
                                number in array retain the contents of AX
           MOV AX,[SI+2]        ;if not make a copy of the larger number in
                                AX
 CONTINUE:ADD SI,2              ;point to the next number
           DEC CX               ;decrement CX to check if all numbers are
                                compared
           JNZ UP               ;if no continue to compare
           MOV LAR,AX           ;if yes make a copy of AX(largest number)
                                in user defined memory location LAR
           MOV AH,4CH           ;terminate the process
           INT 21H
CODE ENDS                       ;end of code segment
END START
```

**iv)PROGRAM TO FIND THE LARGEST NUMBER USING DOS DISPLAY INTERRUPTS**

```
DATA SEGMENT                                    ;start of data segment
    X DW 0010H,0052H,0030H,0040H,0050H

      MES DB 10,13,'LARGEST NUMBER AMONG THE SERIES IS $'
DATA ENDS                                       ;end of data segment
CODE SEGMENT                                    ;start of code segment
    ASSUME CS:CODE,DS:DATA
    START: MOV AX,DATA                  ;initialize data segment
           MOV DS,AX
           MOV CX,05H                   ;load CX register with
                                        number of datawords in array X
           LEA SI,X                     ;SI points to start of dataword
                                        array X
           MOV AX,[SI]                  ;make a copy of the first
                                        number in AX
           DEC CX                       ;initialize CX with count
                                        value for comparison
      UP:  CMP AX,[SI+2]                ;compare the contents of AX
                                        and the number pointed by SI+2
           JA CONTINUE                  ;if AX is greater than the next
                                        number in array then retain the
                                        contents of AX
           MOV AX,[SI+2]                ;else make a copy of the next
                                        number (larger number)in AX
    CONTINUE:ADD SI,2                   ;point to next number in array
           DEC CX                       ;decrement CX
           JNZ UP                       ;check if all numbers are
                                        compared if no continue comparison
           AAM                          ;if yes convert largest binary
                                        number in AX to unpacked BCD
           ADD AX,3030H                 ;convert unpacked BCD to
                                        unpacked ASCII equivalent
           MOV BX,AX                    ;make a copy of it in AX
           MOV AX,09H                   ;display the message stored at
                                        user defined memory location MES
           LEA DX,MES
           INT 21H
           MOV DL,BH                    ;display the largest number
           MOV AH,02H
           INT 21H
           MOV DL,BL
           INT 21H
           MOV AH,4CH                   ;terminate the process
           INT 21H
CODE ENDS                                       ;end of code segment
END START
```

**OUTPUT: LARGEST NUMBER AMONG THE SERIES IS 0052**

**v)PROGRAM TO FIND THE SMALLEST NUMBER AMONG THE SERIES**

```
DATA SEGMENT                                    ;start of data segment
     X DW 0060H,0020H,0030H,0040H,0050H

       MES DB 10,13,'SMALLEST NUMBER AMONG THE SERIES IS $'
DATA ENDS                                       ;end of data segment

CODE SEGMENT                                    ;start of code segment
     ASSUME CS:CODE,DS:DATA
     START: MOV AX,DATA                         ;initialize data segment
            MOV DS,AX
            MOV CX,05H                          ;load CX with number of
                                                datawords in array X
            LEA SI,X                            ;SI points to the first number
                                                in array X
            MOV AX,[SI]                         ;make a copy of the first
                                                number in AX
            DEC CX                              ;intialize CX with count
                                                value for comparison
       UP:  CMP AX,[SI+2]                       ;compare the contents of AX
                                                with next number in array pointed
                                                by SI+2
            JB CONTINUE                         ;if AX is smaller than the
                                                next number retain the contents of
                                                AX
            MOV AX,[SI+2]                       ;else make a copy of the smaller
                                                number in AX
  CONTINUE:ADD SI,2                             ;SI points to the next number
            DEC CX                              ;decrement the count value
            JNZ UP                              ;check if all the numbers are
                                                compared if no continue
                                                comparison
            AAM                                 ;if yes convert the smallest
                                                binary number to unpacked BCD
            ADD AX,3030H                        ;convert the unpacked BCD
                                                to unpacked ASCII equivalent
            MOV BX,AX                           ;make a copy of the unpacked
                                                ASCII in BX
            MOV AH,09H                          ;display the message stored at
                                                user defined memory location
                                                MES using DOS interrupts
            LEA DX,MES
            INT 21H
            MOV DL,BH                           ;display the smallest number
                                                in array X using DOS interrupts
            MOV AH,02H
            INT 21H
```

```
        MOV DL,BL
        INT 21H
        MOV AH,4CH                    ;terminate the process
        INT 21H
CODE ENDS                             ;end of code segment
END START
```

OUTPUT: SMALLEST NUMBER AMONG THE SERIES IS 0020

**vi)PROGRAM TO SORT THE NUMBERS IN ASCENDING/DESCENDING ORDER**

```
DATA SEGMENT                    ;start of data segment
        x DW 42H,34H,26H,17H,09H
        LEN EQU 05
        ASCD DB 10 DUP(0)
DATA ENDS                       ;end of data segment

CODE SEGMENT                    ;start of code segment
      ASSUME CS:CODE,DS:DATA
      START:  MOV AX,DATA       ;initialize data segment
              MOV DS,AX
              MOV BX,LEN-1      ;load BX(counter1) with count
                                value(number of datawords in array - 1)
              MOV CX,BX         ;make a copy of the count value in CX(counter2)
        UP1:  MOV BX,CX         ;load the updated CX in BX
              LEA SI,X          ;SI points to the first number in the array
        UP:   MOV AX,[SI]       ;make a copy of the number pointed by SI in
                                AX
              MOV DX,[SI+2]     ;make a copy of the next number in DX
              CMP AX,DX         ;compare both the numbers
             JB DOWN/JA DOWN    ;if AX < DX/AX > DX retain them as it is
              MOV [SI],DX       ;if not sort the numbers in ascending order
              MOV [SI+2],AX
     DOWN:  INC SI              ;point to the next number
              INC SI
              DEC BX            ;decrement the counter1
              JNZ UP            ;compare till the larger number is sorted at
                                the end of the array
              DEC CX            ;decrement counter2
              JNZ UP1           ;compare till the numbers are sorted in
                                ascending order
              MOV AH,4CH        ;terminate the process
              INT 21H
CODE ENDS                       ;end of code segment
END START
```

OUTPUT: 09 17 26 34 42

**PROGRAMS ON STRING MANIPULATION LIKE STRING TRANSFER, STRING REVERSING, SEARCHING FOR A CHARACTER IN A STRING AND PALINDROME**

**vii) PROGRAM FOR STRING TRANSFER**

```
DATA SEGMENT                    ;start of data segment
        STR1 DB 'HOW ARE YOU'
        LEN EQU $-STR1
        STR2 DB 20 DUP(0)
DATA ENDS                       ;end of data segment

CODE SEGMENT                    ;start of code segment

   ASSUME CS:CODE,DS:DATA,ES:DATA
   START:   MOV AX,DATA         ;initialize data segment
            MOV DS,AX
            MOV ES,AX           ;initialize extra segment for string operations
            LEA SI,STR1         ;SI points to starting address of string at
                                ;STR1
            LEA DI,STR2         ;DI points to starting address of where the
                                string has to be transferred
            MOV CX,LEN          ;load CX with length of the string
            CLD                 ;clear the direction flag for auto increment SI
                                ;and DI
            REP MOVSB           ;the source string is moved to destination
                                address till CX=0(after every move CX is
                                ;decremented)
            MOV AH,4CH          ;terminate the process
            INT 21H
CODE ENDS                       ;end of code segment
END START
```

**viii)PROGRAM TO REVERSE A STRING**

```
DATA SEGMENT                        ;start of data segment
        STR1 DB 'HELLO'
        LEN EQU $-STR1
        STR2 DB 20 DUP(0)
DATA ENDS                           ;end of data segment

CODE SEGMENT                        ;start of code segment

      ASSUME CS:CODE,DS:DATA,ES:DATA
      START: MOV AX,DATA            ;initialize data segment
             MOV DS,AX
             MOV ES,AX              ;initialize extra segment for string operations
             LEA SI,STR1            ;SI points to the starting address of the string
                                    at STR1
             LEA DI,STR2+LEN-1      ;DI points to the address of the last character in
                                    the string(here address of '0')
             MOV CX,LEN             ;load CX with count value equal to number of
                                    characters in the string
        UP:  CLD                    ;clear the direction flag to autoincrement SI
                                    register
             LODSB                  ;load AX with the character pointed SI
                                    register
             STD                    ;set the direction flag to autodecrement DI
                                    register
             STOSB                  ;the contents of AX is stored at the address
                                    pointed by DI
             LOOP UP                ;decrement CX and continue the transfer till
                                    CX is zero
             MOV AH,4CH             ;terminate the process
             INT 21H
CODE ENDS                           ;end of code segment
END START

OUTPUT: OLLEH
```

**ix)PROGRAM TO SEARCH FOR A CHARACTER IN A STRING**

```
DATA SEGMENT                          ;start of data segment
        MSG DB 'HELLO'
        CNT EQU $-MSG
        SRC EQU 'E'

        MSG1 DB 10,13,'CHARACTER FOUND$'
        MSG2 DB 10,13,'CHARACTER NOT FOUND$'
DATA ENDS                             ;end of data segment

CODE SEGMENT                          ;start of code segment
    ASSUME CS:CODE,DS:DATA,ES:DATA
    START:  MOV AX,DATA               ;initialize data segment
            MOV DS,AX
            MOV ES,AX                 ;initialize extra segment
            LEA SI,MSG                ;SI points to the starting address of
                                       the string
            MOV AL,SRC                ;the character to be searched in the
                                       string is stored in AL
            MOV CL,CNT                ;CX is loaded with count value equal
                                       to number of characters in the string
            MOV CH,00H
            CLD                       ;clear the direction flag for
                                       auto increment SI and DI
        UP: SCASB                     ;check if the character in AL is the
                                       same as that pointed by index register
            JZ DOWN                   ;if it is same jump to label DOWN
            LOOP UP                   ;if not decrement CX and continue
                                       checking till CX is zero
            LEA DX,MSG2               ;display the message at MSG2 that is
                                       CHARACTER NOT FOUND
            MOV AH,09H
            INT 21H
            JMP EXIT                  ;jump to label EXIT

DOWN:       LEA DX,MSG1               ;if the character is found display the
                                       message CHARACTER FOUND
            MOV AH,09H
            INT 21H

        EXIT: MOV AH,4CH
              INT 21H
CODE ENDS
END START
```



OUTPUT: CHARACTER FOUND

```
;terminate the process
;end of code segment
```

**x)PROGRAM TO CHECK FOR PALINDROME**

```
DATA SEGMENT                                ;start of data segment
        STR1 DB 'LIRIL'
        LEN EQU $-STR1
        STR2 DB 20 DUP(0)

        MES1 DB 10,13,'WORD IS PALINDROME$'
        MES2 DB 10,13,'WORD IS NOT PALINDROME$'
DATA ENDS

CODE SEGMENT
      ASSUME CS:CODE,DS:DATA,ES:DATA
      START: MOV AX,DATA
             MOV DS,AX
             MOV ES,AX

             LEA SI,STR1
             LEA DI,STR2+LEN-1

             MOV CX,LEN

        UP:  CLD

             LODSB

             STD

             STOSB

             LOOP UP

             LEA SI,STR1

             LEA DI,STR2

             CLD
             MOV CX,LEN

             REPE CMPSB

             CMP CX,0H

             JNZ NOTPALIN

             LEA DX,MES1
             MOV AH,09H
```

```
;end of data segment

;start of code segment

;initialize data segment

;initialize extra segment for string
operations
;SI points to starting address of string
;DI points the last character in the
string
;load CX with count value equal to
number of characters in the string
;clear the direction flag to
auto increment SI
;get the character in AL from the
address pointed by SI
;set the direction flag equal to
auto decrement DI
;store the character in AL at address
pointed by DI
;decrement CX and continue with
reversing the string till CX=0
;SI points to the starting address of
original string
;DI points to the starting address of
the string reversed

;set CX as counter for checking if
palindrome
;compare the strings pointed by SI
and DI
;do the comparison till CX=0(if
palindrome)
;if CX is not zero then jump to
display WORD NOT PALINDROME
;display the message at MES1 which
is WORD IS PALINDROME
```

```
            INT 21H
            JMP EXIT                ;jump to end of the program
NOTPALIN:   LEA DX,MES2             ;display the message WORD NOT
            MOV AH,09H              PALINDROME using DOS
            INT 21H                 interrupts
EXIT:       MOV AH,4CH              ;terminate the process
            INT 21H
CODE ENDS                           ;end of code segment
END START
```

OUTPUT: WORD IS PALINDROME

**7.1.Program to use DOS interrupt INT 21H function called for reading a character from keyboard, buffered keyboard input, display of character and string on console.**

```
DATA SEGMENT
    INKEY DB ?
    BUF DB 20 DUP(0)
    MES DB 10,13, 'DAYANANDA SAGAR COLLEGE OF ENGINEERING $'
DATA ENDS

CODE SEGMENT
ASSUME CS:CODE , DS:DATA

START:  MOV AX,DATA
        MOV DS,AX
          MOV AH,01H      ;DOS function to read a character from keyboard ;with
                          echo. [AL = 8bit character]
          INT 21H

          MOV INKEY,AL     ;Returns ASCII value of the pressed key.
          MOV BUF,10      ;Load how many characters to enter.
          MOV AH,0AH      ;Dos function to read string of characters from
                          ;keyboard.
          LEA DX,BUF
          INT 21H
          MOV AH,06H      ;Dos function to display a character.
          MOV DL,'A'      ;Load the character to be displayed.
          INT 21H

           MOV AH,09H     ;Dos function to read string of characters from
                          ;keyboard.
          LEA DX,MES      ;DX = offset address of the message
          INT 21H
          MOV AH,4CH
          INT 21H
      CODE ENDS
      END START
```

**2.Creation of a new file**

```
DATA SEGMENT
        FILENAME DB'HELLO.NEW'
DATA ENDS

CODE SEGMENT
        ASSUME CS:CODE, DS:DATA
        START:      MOV AX,DATA                 ;initialise data segment
                    MOV DS,AX
                    MOV AH,3CH                  ;dos function call to create
                                                ;new file
                    MOV CX,0                    ;CX = file attribute

                   MOV DX,OFFSET FILENAME       ; dx has offset address of
                                                ;filename
                   INT 21H
        CODE

        ENDS
        END START
```

**3.Writing to a file**

```
DATA SEGMENT
        MES DB 10,13,'ENTER SOME DATA IN THE FILE$'
        FILENAME DB 'HELLO.NEW'
        BUFFER DB 22 DUP(0)
        MES1 DB 10,13, 'ERROR IN FILE HANDLING$'
DATA ENDS

CODE SEGMENT
        ASSUME CS:CODE,DS:DATA
          START:    MOV AX,DATA
                    MOV DS,AX
                    MOV AH,09H
                    LEA DX,MES
                    INT 21H
                    MOV BUFFER,20
                    MOV AH,0AH
                    MOV DX,OFFSET BUFFER
                    INT 21H
                    MOV AH,3CH
                    MOV CX,0
                    MOV DX,OFFSET FILENAME
                    INT 21H
                    MOV BX,AX
                    MOV AH,40H              ;function to write in a file
                    MOV CX,20
                    MOV DX, OFFSET BUFFER
                    INT 21H
                    JC ERROR
                    JMP EXIT
   ERROR:           MOV DX,OFFSET MES1
                    MOV AH,09H
                    INT 21H
   EXIT:            MOV AH,4CH
                    INT 21H
          CODE ENDS
          END START
```

**4.Read system date**

```
DATA SEGMENT
        YY DB
        MM DB
        D DB
        TDAY DW UN,MON,TUE,WED,THU,FRI,SAT
        SUN DB'SUNDAY,$'
        MON DB'MONDAY,$'
        TUE DB'TUESDAY,$'
        WED DB'WEDNESDAY,$'
        THU DB'THURSDAY,$'
        FRI DB FRIDAY,$'
        SAT DB'SATURDAY,$'
        TMON DW JAN,FEB,MAR,APR,MAY,JUN,JUL,AUG,SEP,OCT,NOV,DEC
        JAN DB'JANUARY,$'
        FEB DB'FEBRUARY,$'
        MAR DB'MARCH,$'
        APR DB'APRIL,$'
        MAY DB'MAY,$'
        JUN DB'JUNE,$'
        JUL DB'JULY,$'
        AUG DB'AUGUST,$'
        SEP DB'SEPTEMBER,$'
        OCT DB'OCTOBER,$'
        NOV DB'NOVEMBER,$'
        DEC DB'DECEMBER,$'
DATA ENDS

CODE SEGMENT
        ASSUME CS:CODE,DS:DATA
                DISCHAR MACRO CHAR
                PUSH AX
                PUSH DX
                MOV DL,CHAR
                MOV AH,02
                INT 21H
                POP DX
                POP AX
                ENDM
   START:       MOV AX,DATA
                MOV DX,AX
                CALL PDATE
```

```
        MOV AH,4CHH
        INT 21H

    PDATE PROC NEAR
        MOV AH,2AH
        INT21H
        MOV YY,CX
        MOV MM,DH
        MOV D,DL
        MOV AH,0
        ROL AX,1
        MOV SI,OFFSET TDAY
        ADD SI,AX
        MOV DX,[SI]
        MOV AH,09H
        INT21H
        MOV AL,D
        MOV AH,00H
        AAM
        OR AH,AH
        JZ DIGIT0
        ADD AH,30H
    DISCHAR AH

DIGIT0: ADD AL,30H
        DISCHAR AL
        DISCHAR "
        MOV AL,MM
        SUB AL,1
        MOV AH,0
        ROL AX,1
        MOV SI,OFFSET TMON
        ADD SI,AX
        MOV DX,[SI]
        MOV AH,09H
        INT21H
        MOV AX,YY
        CMP AX,2000
        JB DIS19
        SUB AX,2000
        DISCHAR'2'
        DISCHAR'0'
        JMP SKIP
DIS19:  SUB AX,1900
        DICHAR'1'
        DISCHAR'9'
```

```
SKIP:   AAM
        ADD AX,3030H
        DISCHAR AH
        DISCHAR AL
        RET
PDATE ENDP

CODE ENDS
END START
```

Output: sunday,september 25,2005

**5.Set System Date**

```
DATA SEGMENT
        MES DB 10,13,'ENTER THE DATE WITH FORMAT: DD:MM:YY $'
        MES1 DB 10,13,"DATE:$"
        BUFF DB 10 DUP(0)
        DB 0
        DB 10 DUP(0)
        YY DB ?
        MM DB ?
        D DB ?
DATA ENDS

CODE SEGMENT
      ASSUME CS:CODE, DS:DATA
      START: MOV AX,DATA
                MOV DS,AX
                CALL DATEP
                MOV AH,4CH
                INT 21H

                DATEP PROC NEAR
                MOV AH,09H
                LEA DX,MES
                INT 21H

                MOV AH,09H
                LEA DX,MES1
                INT 21H

                MOV AH,0AH
                LEA DX,BUFF
                INT 21H


                MOV CL,04
                MOV DL,0H
                LEA SI,BUFF
                ADD SI,02
   BACK:          MOV AL,[SI]
                  CMP AL,':'
                  JZ TER
                  ROL DL,CL
                  SUB AL,30H
```

```
        ADD DL,AL
        INC SI
        JMP BACK

TER:    MOV DH,DL
        ADD DL,0F0H
        ROR DL,CL
        MOV AL,10
        MUL DL
        AND DH,0FH
        ADD AL,DH
        MOV DH,AL
        MOV DL,0
        INC SI

BACK1:  MOV AL,[SI]
        CMP AL,':'
        JZ TER1
        ROL DL,CL
        SUB AL,30H
        ADD DL,AL
        INC SI
        JMP BACK1

TER1:   MOV DH,DL
        AND DL,0F0H
        ROR DL,CL
        MOV AL,10
        MUL DL
        AND DH,0FH
        ADD AL,DH
        MOV MM,AL
        MOV DL,0
        INC SI

BACK2:  MOV AL,[SI]
        CMP AL,13
        JZ TER2
        ROL DL,CL
        SUB AL,30H
        ADD DL,AL
        INC SI
        JMP BACK2

TER2:   MOV DH,DL
        AND DL,0F0H
```

```
        ROR DL,CL
        MOV AL,10
        MUL DL
        AND DH,0FH
        ADD AL,0DH
        MOV YY,AL

        MOV AH,2BH
        MOV CL,YY
        MOV CH,00
        ADD CX,2000
        MOV DH,MM
        MOV DL,0DH
        INT 21H
        RET
    DATEP ENDP

CODE ENDS
END START
```

**6.READ SYSTEM TIME**

```
DATA SEGMENT
  HOUR DB ?
  MIN DB ?
DATA ENDS

CODE SEGMENT
ASSUME CS:CODE, DS:DATA

DISCHAR MACRO CHAR
              PUSH AX
                PUSH DX
               MOV DL,CHAR
              MOV AH,02
               INT 21H
               POP DX
               POP AX
               ENDM

   START:      MOV AX,DATA

              MOV DS,AX
               CALL TIME
               MOV AH,4CH
               INT21H

   TIME PROC NEAR
                MOV AH,2CH              ;function to read system time
                INT21H
                MOV HOUR,CH
                MOV MIN,CL
                CMP CH,12
                JB DOWN
                SUB CH,12
   DOWN:       MOV AL,CH
                MOV AH,00H
                AAM
                MOV AX,3030H
                DISCHAR AH
                DISCHAR AL
                DISCHAR':'
                MOV AL,CL
                MOV AH,00H
                AAM
```

```
                ADD AX,3030H
                DISCHAR AH
                DISCHAR AL
                DISCHAR' '
                CMP HOUR,12
                JB AM
                DISCHAR 'P'
                JMP DOWN1
AM:             DISCHAR'A'
DOWN1:          DISCHAR'M'
                RET
        TIME ENDP

CODE ENDS
END START
```

## 7.Set system time

```
DATA SEGMENT
        MES DB 10,13,'ENTER TIME WITH THE FORMAT :HOUR FOLLOWED BY MIN
        FOLLOWED BY AM OR PM$'
        MES1 DB 10,13 ,'TIME:$'
        BUF DB 10
        DB 0
        DB 10 DUP(0)
        HOUR DB?
        MIN DB?
DATA ENDS

CODE SEGMENT
ASSUME CS:CODE, DS:DATA
   START:       MOV AX,DATA
                MOV DS,AX
                CALL TIME
                MOV AX,4CH
                INT 21H

   TIME PROC NEAR
                 MOV AH,09H
                 LEA DX,MES
                 INT  21H
                 MOV AH,09H
                 LEA DX,MES1
                 INT 21H
                 MOV AH,0AH
                 LEA DX,BUF
                 INT 21H
                 MOV CL,4
                 MOV DL,00H
                 LEA SI,BUF
                 ADD SI,2
   UP:          MOV AL,[SI]
                CMP AL,':'
                JZ DOWN
                ROL DL,CL
                SUB AL,30H
                ADD DL,AL
                INC SI
                JMP UP
   DOWN:        MOV DH,DL
```

```
                AND DL,0F0H
                ROR DL,CL
                MOV AL,10
                MUL DL
                AND DH,0FH
                ADD AL,DH
                MOV HOUR,AL
                MOV DL,0
                INC SI
UP1:            MOV AL,[SI]
                CMP AL,' '
                JZ DOWN1
                ROL DL,CL
                SUB AL,30H
                ADD DL,AL
                INC SI
                JMP UP1
DOWN1:          MOV DH,DL
                AND DL,0F0H
                ROR DL,CL
                MOV AL,10
                MUL DL
                AND DH,0FH
                ADD AL,DH
                MOV MIN,AL
                INC SI
                MOV CH,[SI]
                CMP CH,'P'
                JNZ SKIP
                ADD HOUR,0CH
SKIP:           MOV AH,2DH
                MOV CH,HOUR
                MOV CL,MINUTE
                MOV CX,0000H
                INT 21H
                RET

                TIME ENDP

CODE ENDS
END START
```

**8.INTERFACING EXPERIMENTS**
**1)MATRIX KEYBOARD INTERFACING**

```
DATA SEGMENT
        PORTA EQU 120H
        PORTC EQU 122H
        CWRD EQU 123H
        ARRAY DB '0123456789.+-*/%ACK=MMMM'
DATA ENDS
CODE SEGMENT
ASSUME CS: CODE,DS:DATA
   START:      MOV AX,DATA
               MOV DS,AX          ;initialise data segment
               MOV AL,90H         ;initialise 8255 porta as i/p and portc as o/p
               MOV DX,CWRD
               OUT DX,AL
   REPEAT:      MOV DX,PORTC     ;make first row of the keyboard high through pc0
                MOV AL,01
                OUT DX,AL
                MOV DX,PORTA
                IN AL,DX          ; input contents of porta and check if key is pressed-
                CMP AL,00          ; in first row.
                JZ NEXT
                JMP FIRSTROW
   NEXT:        MOV DX,PORTC    ;if key not found in first row, check if key is in

                                    ;second row
                MOV AL,02
                OUT DX,AL
                MOV DX,PORTA
                IN AL,DX
                CMP AL,00
                JNZ SECONDROW
                MOV AL,04          ; if key not found then check for key closure in
                                   ;third row
                MOV DX,PORTC
                OUT DX,AL
                MOV DX,PORTA
                IN AL,DX
                CMP AL,00H
                JNZ THIRDROW
                JMP REPEAT

   FIRSTROW:  CALL DELAY                ;check all the keys one by onein first row
                LEA SI,ARRAY
```

```
UP:         SHR AL,1
            JC DISPLAY          ;if key found jump to the display subroutine
            INC SI
            JMP UP
            JMP DISPLAY

SECONDROW:CALL DELAY
            LEA SI,ARRAY+08H    ;second row keys from array +08
            UP1:SHR AL,1
            JC DISPLAY          ;if key found jump to the display subroutine
            INC SI
            JMP UP1


THIRDROW: CALL DELAY
            LEA SI,ARRAY+10H    ;third row keys from array +16(dec)
UP2:        SHR AL,1
            JC DISPLAY          ;if key found jump to the display subroutine
            INC SI
            JMP UP2
            JMP DISPLAY
DISPLAY:    MOV DL,[SI]
            CMP DL,97           ;24 in decimal. 8x3rows = 24keys
            JZ EXIT
            MOV AH,02H          ; display key no in ascii
            INT 21H
            JMP REPEAT

DELAY:      MOV BX,0FFFFH
L1:         MOV CX,0FFFH
L2:         DEC CX
            JNZ L2
            DEC BX
            JNZ L1
            RET

            EXIT:MOV AH,4CH
            INT 21H
CODE ENDS
END START
```

**2)SEVEN SEGMENT DISPLAY INTERFACE**

```
DATA SEGMENT
        PORTA EQU 120H
        PORTB EQU 121H
        PORTC EQU 122H
        CWRD EQU 123H
        TABLE DB 8CH,0C7H,86H,89H
DATA ENDS

CODE SEGMENT
  ASSUME CS:CODE, DS:DATA
  START:      MOV AX,DATA      ;intialise data segment
              MOV DS,AX
              MOV AL,80H       ;initialise 8255 portb and portc as o/p
              MOV DX,CWRD
              OUT DX,AL
              MOV BH,04        ; BH = no of digitsto be displayed
              LEA SI,TABLE     ; SI = starting address of lookup table

 NEXTDIGIT:MOV CL,08           ; CL = no of segments = 08
              MOV AL,[SI]
 NEXTBIT:  ROL AL,01
              MOV CH,AL        ;save al
              MOV DX,PORTB     ;one bit is sent out on portb
              OUT DX,AL
              MOV AL,01
              MOV DX,PORTC     ;one clock pulse sent on pc0

              OUT DX,AL
              DEC AL
              MOV DX,PORTC

              OUT DX,AL
              MOV AL,CH        ; get the sevensegment code back in al
              DEC CL           ;send all 8 bits,thus one digit is displayed
              JNZ NEXTBIT
              DEC BH
                 INC SI        ;display all the four digits
                 JNZ NEXTDIGIT

                 MOV AH,4CH    ;exit to dos
                 INT 21H
        CODE ENDS
        END START
```

**3) LOGICAL CONTROLLER INTERFACE**

```
DATA SEGMENT
        PA EQU 120H      ;INITIALIZE THE ADDRESS OF PORT A OF 8255
        PB EQU 121H      ;INITIALIZE THE ADDRESS OF PORT B OF 8255
        PC EQU 122H      ;INITIALIZE THE ADDRESS OF PORT C OF 8255
        CR EQU 123H      ;INITIALIZE THE ADDRESS OF  CONTROL WORD
        REGISTER
DATA ENDS

CODE SEGMENT
ASSUME CS:CODE, DS:DATA

   START:       MOV AX, DATA
                MOV DS, AX
                MOV AX, 082H     ;load the control word
                MOV DX, CR
                OUT DX,AX
   REPEAT:       MOV DX, PB        ;input the data (from dip switch)from port b
                 IN AL,DX
                 AND AL, 03H
                 CMP AL,00H
                 JZ DISPLAY

                 CMP AL,03H        ;check if input is 11
                 JZ DISPLAY

                 MOV AL,0FFH       ;display 11 if input is 01 else 10
                 MOV DX, PA         ;output to porta
                 OUT DX,AL
                 JMP REPEAT
   DISPLAY:      MOV AL,00H        ;display oo if input is 00 else 11

                MOV DX,PA          ;output to porta
                OUT DX, AL
                JMP REPEAT
   CODE ENDS
   END START
```

**4)STEPPER MOTOR INTERFACE**

```
DATA SEGMENT
        PORTA EQU 120H
        PORTB EQU 121H
        PORTC EQU 122H
        CWRD EQU 123H
DATA ENDS

CODE SEGMENT
ASSUME CS:CODE,DS:DATA
   START:   MOV AX,DATA
            MOV DS,AX
            MOV AL,80H        ;initialise 8255 ,porta as o/p port
            MOV DX,CWRD
            OUT DX,AL
            MOV DX,PORTA
            MOV AL,88H        ;load initial bit pattern
            OUT DX,AL         ;output on porta
   UP:      CALL DELAY
            ROL AL,01H        ;rotate left to get exitation sequence of 11,22,44,88
            OUT DX,AL
            JMP UP
   DELAY:   MOV CX,0FFFFH  ;delay can be adjusted to get different speeds
   UP2:     MOV BX,0FFH
   UP1:     DEC BX
            JNZ UP1
            DEC CX
            JNZ UP2
            RET
            MOV AH,4CH
            INT 21H
   CODE ENDS

    END START
```

**Branch: ELECTRONICS AND COMMUNICATION** **Semester: V**

**Subject Code: ECL57** **Duration Of Exam:3hrs**

**Subject Title: Advanced Microprocessor Lab** **Max Exam Marks: 50**

## QUESTION BANK

## PART – A

1A) Write an ALP to show the byte and word transfers in different addressing modes.
1B) Write an ALP to transfer a given block of data word from source memory to Destination memory without overlap.
1C) Write an ALP to transfer a given block of data word from source memory to destination memory with overlap.
1D) Write an ALP to interchange two blocks of data.

2A) Write an ALP to add / subtract two16 bit numbers.
2B) Write an ALP to add / subtract two32 bit numbers.
2C) Write an ALP to add / subtract two32 bit numbers using DD Directive.
2D) Write an ALP to multiply two 16 bit unsigned / signed numbers and display.
2E) Write an ALP to divide two 8 bit numbers (signed and unsigned)
2F). Write an ALP to divide two 16 bit numbers(signed and unsigned)

3A)Write an ALP to to add/substract/ multiply/divide two ASCII numbers.
3B) Write an ALP to convert 16 bit binary No to BCD.
3C) Write an ALP to convert BCD No to binary.
3D) Write an ALP to find square and cube of an 8 bit number .
3E) Write an ALP to find LCM of a 16 bit No.
3F) Write an ALP to find the GCD of two 16 bit unsigned integers.
3G) Write an ALP to find the factorial of an 8 bit number.

4A) Write an ALP to check if the number is positive or negative.
4B) Write an ALP to check if the given number is even or odd.
4C) Write an ALP to check number of ones and zeroes n the given data.
4D) Write an ALP to check if the given byte is 2 out of 5 code or not (i.e., the code is first 3 MSB must be 0 and the last 5 LSB should have two 1s).
4E) Write and Alp to check if the given 16 bit data is a palindrome (bitwise).
4F. Write and Alp to check if the given 16 bit data is a palindrome (nibble-wise).

5A) Write an Alp to add / substract 'N' 16 bit numbers and display the result.
5B)Write an ALP to find the largest of 'N' 16 bit numbers and display the result.
5C) Write an ALP to find the smallest of 'N' 16 bit numbers and display the result.
5D) Write an ALP to sort the given set of 16 bit unsigned integers in ascending order using bubble sort algorithm.

6A) Write an ALP to transfer a given source string to destination using string instructions.
6B) Write an ALP to reverse a string.
6C) Write an ALP to search for a character in a string.
6D) Write an ALP to check if the given string is a palindrome or not.

7A) Write an ALP to read a character from a keyboard with and without echo.
7B) Write an ALP to read a string of characters from the keyboard and display.
7C) Write an ALP to create a new file.
7D) Write an ALP to read the contents of a file.
7E) Write an ALP to write a new file.

8A) Write an ALP to read the system date.
8B)Write an ALP to set the system date.
8C) Write an ALP to read the system time.
8D) Write an ALP to set the system time.

**PART - B**

1A) Write an ALP to scan the keyboard for key closure and store the code of the key pressed in memory location.
1B) Write an ALP to implement a rolling display of set characters using a display interface.
1C) Interface a logic controller via 8255 using I/O cards and perform the following Operations: Read all the 8 inputs from the logic controller, Complement /XOR/AND/OR/NAND and display at the output.
1D) Write an ALP to control the speed of a stepper motor & to drive the stepper motor interface to rotate the motor in clockwise and anticlockwise directions.

**VIVA QUESTIONS IN ADVANCED MICROPROCESSOR**

1. List all the modern microprocessor
2. Name some 16 bit Processor (8086, 80286, 80386L, EX)
3. Name some 32 bit processors (80386DX, 80486, PENTIUM OVERDRIVE)
4. Name some 64 bit processor (Pentium, Pentium pro, Pentium II, Xeon, Pentium III, and Pentium IV)
5. List the address bus width and the memory size of all the processor.

| Processor | address bus | memory size |
|---|---|---|
| 8086 | 20 | 1M |
| 8088 | 20 | 1M |
| 80186 | 20 | 1M |
| 80286 | 24 | 16M |
| 80386 | 24 | 16M |
| 80386DX | 32 | 4G |
| 80386EX | 26 | 64M |
| 80486 | 32 | 4G |
| PENTIUM | 64 | 4G |
| PENTIUM O | 32 | 4G |
| PENTIUM P | 32 | 4G |
| PENTIUM 2,3,4 | 36 | 64G |

6. The memory map of any IBM COMPATIBLE PC consists of three main parts, name them [transient memory area, system area, Extended memory system]
7. The first I MB of the memory area is called as …… (Real memory area)
8. What does the TPA hold (interrupt vectors, bios, DOS, IO.SYS, MSDOS, DEVICE DRIVERS, command.com)
9. The system area contain programs in ……memory(ROM)
10. What are the main two parts of 8086 internal architecture.(BIU,EU)
11. Name the registers in BIU (CS, DS, ES, SS, IP)
12. Name the registers in EU.( AX, BX, CX, DX, SP, BP, SI, DI)
13. Name the flag registers in 8086. (O, D, I, T, S, Z, A, P, C)
14. How is the real memory semented?
15. What is the advantage of segmentation.
16. Name the default segment and offset register combinations.
17. What is the relocatable program.
18. Name the three main addressing modes in 8086.
19. Name the data addressing modes. And the program addressing modes. Give examples
20. Explain MOV AL, 'A', MOV AX, NUMBER, MOV [BP], DL, MOV CH,[1000], MOV[BX+SI],SP, MOV ARRAY[SI],BL, MOV DH,[BX+DI+10H]
21. Name the programme memory addressing modes. (Direct, relative, indirect)
22. What is an intersegment and intrasegment jump.
23. Differentiate near and short jumps (+_32k and +127to_128 bytes)
24. Differentiate near and far jumps.
25. Differentiate push and pop instructions.
26. Explain PUSH word ptr [BX], POP F.
27. JMP TABLE[BX]
28. Explain the following : ASSUME,DB,DD,DW,DQ,END

29. Give the opcode format for 8086 instructions.
(op(1-2b),(mode,reg,rem),(displacement-0-2b))
30. Explain LES BX, LEA AX, DATA, LDS DI,LIST
31. Explain how the string instructions are executed.
32. List some string instructions
33. Explain the significance of REP Prefix.
34. Explain XCHG, LAHF, SAHF, XLAT
35. What are the two types of I/O addressing modes. ( fixed port ,variable port)
36. What do you mean by segment override prefix.
37. Explain the following directives. NEAR ,FAR,BYTE PTR,ORG,OFFSET,ORG
38. Differentiate END, ENDP, ENDM
39.Differntiare PROC AND
40. What are the two basic formats used by assemblers. Where are they used.
(Models, full segment definition)
41. Explain ADD BYTE PTR (.model tiny (64kb), .model small(128 kb), .model huge.
42. Explain ADD BYTE PTR [DI], 3, SBB BYTE PTR [DI],5, CMP[DI], CH
IMUL BYTE PTR [BX], IDIV SI, CWD, CBW.
43. DAA, (ONLY ON AL), AAA, AAD, AAM, AAS.
44. Name the logical instructions. How can we invert number .(XOR WITH 1s)
45. Differentiate TEST and CMP, and NOT& NEG, SAR & SHR, RCL & ROL, SCAS & CMPS, REPE SCASB &REPNE &SCASB
46. Which are the flags affected. JA(Z=0 C=0), JB(C=0), JG (Z=0 S=0), JLE( Z=1 S<>0)
47. LOOP, LOOPNE, LOOPE LOOPZ
48. Differentiate NEAR & FAR CALL, NEAR RET & FAR RET
49. Explain, maskable, non maskable, vectored, non vectored, software & Hardware Interrupts.
50. What are interrupt vectors. (4 byte no. stored in the first 1024 bytes of memory. There are 256 interrupt vectors. Each vector contains value of CS & IP, 32 vectors are reserved for present and future. 32 to 255 are available for users.
51. Name the interrupt instructions. ( INT, INT0, INT3)
52. Give significance of INT0, INT3.
53. Give the significance of IRET instruction how is it different from RET.
(Like far RET retrieves 6 bytes from stack, two for IP, two for CS and two for flags.)
54. Explain the operation of real mode interrupt.
55. Explain the protected mode interrupt.
56. Explain how the interrupt flag bit IF and TF are used during an interrupt
57. Name the hardware and soft ware interrupt of 8086, explain about them. (NMI, INTR are hardware interrupts. INT, INT0, INT3, BOYND, are the software interrupts)
58. How can you expand the interrupt structure. ( using 74LS 244 7 more interrupts can accommodated. Daisy chained interrupt is better as it requires only one interrupt vector.)
59. Give a general description of 8259 interrupt controller.
61. Explain the above pins of 8086 TEST, READY, RESET, BHE/S7, MN/MX, ALE, DT/R, DEN, HOLD, HLDA, SO, RO/GT1, LOCK, QS1-QS0.
62. Name the maximum mode pins.
63. Name the minimum mode pins.
64. Name the function of 8284
65 How does the RESET function.

66. What is the clock frequency of the 8086.
67. How are the address and data buses are separated.
68. What is the function of the following 74LS373, 245, 244
69. Differentiate between minimum mode and maximum mode of operation.
70. What are the two methods of interfacing memory. ( linear and absolute decoding)
71. What do you understand by linear and absolute decoding.
72. What is the maximum memory capacity of 8086

73. Name the difference between 8086,8088.
74, Name the difference between 8085 and 8086.
75. Name the types of memory used in microprocessor based system.
76. What is the function of the 8288 controller
77. What are the various signals in a RAM and ROM memories.
78. Name the following. 8255, 8155, 8259, 8253, 8257, 8251
79. Give the format of control word register.
80. Explain the PPI you know.
81. Explain the modes of 8255.
82. Explain the basic function of 8279.
83. How are the delays obtained in a microprocessor based system.
84. What is an arithmetic coprocessor, What are its functions. (multiply, devide, ad, subtract, square root, calculate partial tangent, partial arctangent and logarithms)
85. What are the data types used. ( 16,32, 64 bit signed integers, 18 bit BCD data, 32, 64 and 80 bit floating point nos.)
86. What are the advantages of the 8087 coprocessor. (many times faster than the microprocessor)
87. How can we use the DOS function calls.
88. What is the function of int21 interrupts.
89. Explain PUBLIC and EXTERN statements.
90. What do you mean by modular programming, how is it accomplished in 8086.
91. what are libraries.
92. Differentiate between MACRO and PROCEDURE.
93. What are the conditional statements used in a MACRO. (REPEAT, WHILE)
94. What are the different methods of reading the keyboard using DOS function calls.
95. How can we use XLAT instruction for look up tables.
96. What are the two methods of interfacing I/O ( memory mapped I/O and I/O mapped I/O)