

# **CSE331L\_5 – Flow Control Instructions**

## 1. Write an ASM code to input 2 numbers and print their sum

```
.MODEL SMALL
.STACK 100H

.DATA
    PROMPT_1 DB  \'Enter the First digit : $\'
    PROMPT_2 DB  \'Enter the Second digit : $\'
    PROMPT_3 DB  \'Sum of First and Second digit : $\'

    VALUE_1 DB  ?
    VALUE_2 DB  ?

.CODE
MAIN PROC
    MOV AX, @DATA           ; initialize DS
    MOV DS, AX

    LEA DX, PROMPT_1        ; load and display the PROMPT_1
    MOV AH, 9
    INT 21H

    MOV AH, 1               ; read a character
    INT 21H

    SUB AL, 30H             ; save First digit in VALUE_1 in ASCII code
    MOV VALUE_1,AL

    MOV AH, 2               ; carriage return
    MOV DL, 0DH
    INT 21H

    MOV DL, 0AH             ; line feed
    INT 21H

    LEA DX, PROMPT_2        ; load and display the PROMPT_2
    MOV AH, 9
    INT 21H

    MOV AH, 1               ; read a character
    INT 21H

    SUB AL, 30H             ; save Second digit in VALUE_2 in ASCII code
    MOV VALUE_2,AL

    MOV AH, 2               ; carriage return
    MOV DL, 0DH
    INT 21H

    MOV DL, 0AH             ; line feed
    INT 21H

    LEA DX, PROMPT_3        ; load and display the PROMPT_3
    MOV AH, 9
```

```

    INT 21H

    MOV AL, VALUE_1          ; add First and Second digit
    ADD AL, VALUE_2

    ADD AL, 30H              ; convert ASCII to DECIMAL code

    MOV AH, 2                ; display the character
    MOV DL, AL
    INT 21H

    MOV AH, 4CH              ; return control to DOS
    INT 21H
MAIN ENDP
END MAIN

```

## 2. Write an ASM code to input a number and print whether the number is positive, negative or zero

```

.MODEL SMALL
.STACK 100H

.DATA
    PROMPT DB 'Enter the digit : $'
    MSG     DB 'The entered digit is : $'

.CODE
MAIN PROC
    MOV AX, @DATA          ; initialize DS
    MOV DS, AX

    LEA DX, PROMPT         ; load and print PROMPT
    MOV AH, 9
    INT 21H

    MOV AH, 1              ; read a character
    INT 21H

    MOV BL, AL             ; save the input character into BL

    MOV AH, 2              ; carriage return
    MOV DL, 0DH
    INT 21H

    MOV DL, 0AH            ; line feed
    INT 21H

    LEA DX, MSG            ; load and print MSG
    MOV AH, 9
    INT 21H

    CMP BL, 30H            ; compare input digit and 0

    JL @NEGATIVE           ; jump to label @NEGATIVE if digit<0
    JZ @ZERO               ; jump to label @ZERO if digit=0
    JG @POSITIVE           ; jump to label @POSITIVE if digit>0

    @NEGATIVE:             ; jump label

```

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```
        MOV DL, 'N'
        JMP @DISPLAY                ; jump to label @DISPLAY

@ZERO:                ; jump label
        MOV DL, 'Z'
        JMP @DISPLAY                ; jump to label @DISPLAY

@POSITIVE:            ; jump label
        MOV DL, 'P'
        JMP @DISPLAY                ; jump to label @DISPLAY

        @DISPLAY:                ; jump label
        MOV AH, 2                ; print the character
        INT 21H

        MOV AH, 4CH                ; return control to DOS
        INT 21H
MAIN ENDP
END MAIN
```

### 3. Write an ASM code to copy element from one array to another.

```
DATA SEGMENT
A DB 1,2,3,4,5,6,7,8,9,10
B DB 10 DUP(0)
DATA ENDS
CODE SEGMENT
        ASSUME DS:DATA,CS:CODE
START:
        MOV AX,DATA
        MOV DS,AX
        MOV CL,10
        LEA BX,A
        LEA SI,B
L1: MOV CH,BYTE PTR[BX]
        MOV BYTE PTR[SI],CH
        MOV DH,BYTE PTR[SI]
        INC BX
        INC SI
        DEC CL
        CMP CL,00
        JNZ L1
        MOV AH,4CH
        INT 21H
CODE ENDS
END START
```

### 4. Write an ASM code to read a letter and print if it is Upper case or Lower case

```
.MODEL SMALL
.STACK 100H

.DATA
PROMPT DB  \'Enter the character : $\'
MSG_1  DB  \'The input letter is : $\'
MSG_2  DB  \'The input character is not \'y\' or \'Y\'.'.$\'
```

```

.CODE
MAIN PROC
    MOV AX, @DATA                ; initialize DS
    MOV DS, AX

    LEA DX, PROMPT               ; load and print PROMPT
    MOV AH, 9
    INT 21H

    MOV AH, 1                    ; read a character
    INT 21H

    MOV BL, AL                   ; save the input character into BL

    MOV AH, 2                    ; carriage return
    MOV DL, 0DH
    INT 21H

    MOV DL, 0AH                 ; line feed
    INT 21H

    CMP BL, \"y\"                ; compare input character and \"y\"
    JE @DISPLAY                  ; jump to label @DISPLAY if input=y

    CMP BL, \"Y\"                ; compare input character and \"Y\"
    JE @DISPLAY                  ; jump to label @DISPLAY input=\"Y\"

    LEA DX,MSG_2                 ; load and print MSG_2
    MOV AH, 9
    INT 21H

    JMP @EXIT                    ; jump to label @EXIT

@DISPLAY:                       ; jump label
    LEA DX,MSG_1                 ; load and print MSG_1
    MOV AH, 9
    INT 21H

    MOV AH, 2                    ; print the character
    MOV DL, BL
    INT 21H

@EXIT:                           ; jump label

    MOV AH, 4CH                  ; return control to DOS
    INT 21H
MAIN ENDP
END MAIN

```

## 5. Write an ASM code to read a binary number and revise it bit wise.

```

.MODEL SMALL
.STACK 100H

.DATA
PROMPT_1 DB \"Enter the binary number (max 8-bit) : $\"

```

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```
PROMPT_2 DB 0DH,0AH,\'The given binary number in reverse order is : $\'
```

```
.CODE
```

```
MAIN PROC
```

```
MOV AX, @DATA ; initialize DS
```

```
MOV DS, AX
```

```
LEA DX, PROMPT_1 ; load and display PROMPT_1
```

```
MOV AH, 9
```

```
INT 21H
```

```
XOR BL, BL ; clear BL
```

```
MOV CX, 8 ; initialize loop counter
```

```
MOV AH, 1 ; set input function
```

```
@INPUT: ; jump label
```

```
INT 21H ; read a digit
```

```
CMP AL, 0DH ; compare digit with carriage return
```

```
JE @END ; jump to label @END if carriage return
```

```
AND AL, 0FH ; convert ascii to decimal code
```

```
SHL BL, 1 ; rotate BL to left by 1 bit
```

```
OR BL, AL ; set the LSB of BL with input
```

```
LOOP @INPUT ; jump to label @INPUT
```

```
@END: ; jump label
```

```
MOV AL, BL ; copy BL into AL
```

```
MOV CX, 8 ; initialize loop counter
```

```
@LOOP: ; loop label
```

```
SHL AL, 1 ; shift AL to left by 1 bit
```

```
RCL BL, 1 ; rotate BL right through carry
```

```
LOOP @LOOP ; jump to label @LOOP
```

```
LEA DX, PROMPT_2 ; load and display PROMPT_2
```

```
MOV AH, 9
```

```
INT 21H
```

```
MOV CX, 8 ; initialize loop counter
```

```
MOV AH, 2 ; set output function
```

```
@OUTPUT: ; jump label
```

```
SHL BL, 1 ; shift left BL by 1 bit
```

```
JNC @ZERO ; jump to label @ZERO if CF=0
```

```
MOV DL, 31H ; set DL=1
```

```
JMP @DISPLAY ; jump to label @DISPLAY
```

```
@ZERO: ; jump label
```

```
MOV DL, 30H ; set DL=0
```

```
@DISPLAY: ; jump label
```

```
INT 21H ; display digit
```

```
LOOP @OUTPUT ; jump to label @OUTPUT
```

```

        MOV AH, 4CH                ; return control to DOS
        INT 21H
    MAIN ENDP
END MAI

```

## 6. Write an ASM code to read a HEX number and print the binary of it.

```

.MODEL SMALL
.STACK 100H

.DATA
    PROMPT_1 DB  \'Enter the hexadecimal number ( max 4-digit ) : $\'
    PROMPT_2 DB  0DH,0AH,\'The equivalent 16-bit binary number is : $\'
    ILLEGAL   DB  0DH,0AH,\'Illegal hex number. Try again : $\'

    COUNT     DB  ?

.CODE
MAIN PROC
    MOV AX, @DATA                ; initialize DS
    MOV DS, AX

    LEA DX, PROMPT_1             ; load and display the string PROMPT_1
    MOV AH, 9
    INT 21H

    JMP @START                   ; jump to label @START_2

@START_1:                       ; jump label
    LEA DX, ILLEGAL              ; load and display the string ILLEGAL
    MOV AH, 9
    INT 21H

@START:                         ;
    XOR BX, BX                  ; clear BX
    MOV COUNT, 30H              ; initialize loop counter

@START_2:                       ; jump label
    MOV AH, 1                   ; set input function
    INT 21H                    ; read a character

    CMP AL, 0DH                 ; compare AL with CR

    JNE @SKIP                   ; jump to label @SKIP if AL!=CR

    CMP COUNT, 30H              ; compare COUNT with 0
    JBE @START_1                ; jump to label @START_1 if COUNT<=0
    JMP @END                    ; jump to label @END

@SKIP:                         ; jump label

    CMP AL, \'A\'               ; compare AL with \'A\'
    JB @DECIMAL                 ; jump to label @DECIMAL if AL<A

    CMP AL, \'F\'               ; compare AL with \'F\'
    JA @START_1                 ; jump to label @START_1 if AL>F
    ADD AL, 09H                 ; add 9 to AL

```

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```

    JMP @OK                                ; jump to label @OK

@DECIMAL:                                ; jump label
    CMP AL, 30H                            ; compare AL with 0
    JB @START_1                           ; jump to label @START_1 if AL<0

    CMP AL, 39H                            ; compare AL with 9
    JA @START_1                           ; jump to label @START_1 if AL>9

@OK:                                      ; jump label

    INC COUNT                             ; increment the COUNT variable

    AND AL, 0FH                           ; convert the ascii into binary code

    MOV CL, 4                             ; set CL=4
    SHL AL, CL                            ; shift AL towards left by 4 positions

    MOV CX, 4                             ; set CX=4

@LOOP_1:                                  ; loop label
    SHL AL, 1                             ; shift AL towards left by 1 position
    RCL BX, 1                             ; rotate BX towards left by 1 position
                                         ; through carry
    LOOP @LOOP_1                          ; jump to label @LOOP_1 if CX!=0

    CMP COUNT, 34H                         ; compare COUNT with 4
    JE @END                               ; jump to label @END if COUNT=4
    JMP @START_2                           ; jump to label @START_2

@END:                                      ; jump label

    LEA DX, PROMPT_2                       ; load and display the string PROMPT_2
    MOV AH, 9
    INT 21H

    MOV CX, 16                             ; set CX=16
    MOV AH, 2                             ; set output function

@LOOP_2:                                  ; loop label
    SHL BX, 1                             ; shift BX towards left by 1 position
    JC @ONE                               ; jump to label @ONE if CF=1
    MOV DL, 30H                           ; set DL=0
    JMP @DISPLAY                           ; jump to label @DISPLAY

@ONE:                                      ; jump label
    MOV DL, 31H                           ; set DL=1

@DISPLAY:                                  ; jump label
    INT 21H                               ; display a character
    LOOP @LOOP_2                          ; jump to label @LOOP_2 if CX!=0

    MOV AH, 4CH                           ; return control to DOS
    INT 21H

    MAIN ENDP
END MAIN

```



**7. Write an ASM code to read a binary number (8-digit) and print the sum.**

```

.MODEL SMALL
.STACK 100H

.DATA
PROMPT_1 DB 0DH,0AH,\ 'Enter the first binary number ( max 8-digits ) : $\'
PROMPT_2 DB 0DH,0AH,\ 'Enter the second binary number ( max 8-digits ) : $\'
PROMPT_3 DB 0DH,0AH,\ 'The SUM of given binary numbers in binary form is : $\'
ILLEGAL   DB 0DH,0AH,\ 'Illegal character. Try again.$\'

.CODE
MAIN PROC
    MOV AX, @DATA                ; initialize DS
    MOV DS, AX

    JMP @START_2                ; jump to label @START_2

@START_1:                       ; jump label
    LEA DX, ILLEGAL              ; load and display the string ILLEGAL
    MOV AH, 9
    INT 21H

@START_2:                       ; jump label
    XOR BX, BX                  ; clear BX

    LEA DX, PROMPT_1            ; load and display the string PROMPT_1
    MOV AH, 9
    INT 21H

    MOV CX, 8                   ; initialize loop counter
    MOV AH, 1                   ; set input function

@LOOP_1:                        ; loop label
    INT 21H                    ; read a character

    CMP AL, 0DH                 ; compare AL with CR
    JNE @SKIP_1                 ; jump to label @SKIP_1 if AL!=0DH

    CMP CX, 8                   ; compare CX with 8
    JE @START_1                 ; jump to label @START_1 if CX=8
    JMP @EXIT_LOOP_1            ; jump to label @EXIT_LOOP_1

@SKIP_1:                        ; jump label
    AND AL, 0FH                 ; convert ascii into decimal code
    SHL BL, 1                   ; shift BL towards left by 1 position

    OR BL, AL                   ; set the LSB of BL with LASB of AL
    LOOP @LOOP_1                ; jump to label @LOOP_1 if CX!=0

@EXIT_LOOP_1:                   ; jump label

    LEA DX, PROMPT_2            ; load and display the string PROMPT_2
    MOV AH, 9
    INT 21H

    MOV CX, 8                   ; initialize loop counter
    MOV AH, 1                   ; set input function

```

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```

@LOOP_2:                ; loop label
    INT 21H              ; read a character

    CMP AL, 0DH           ; compare AL with CR
    JNE @SKIP_2          ; jump to label @SKIP_2 if AL!=0DH

    CMP CX, 8             ; compare CX with 8
    JE @START_2          ; jump to label @START_2 if CX=8
    JMP @EXIT_LOOP_2     ; jump to label @EXIT_LOOP_2

@SKIP_2:                ; jump label
    AND AL, 0FH          ; convert ascii into decimal code
    SHL BH, 1            ; shift BH towards left by 1 position
    OR BH, AL            ; set the LSB of BH with LASB of AL
    LOOP @LOOP_2         ; jump to label @LOOP_2 if CX!=0

@EXIT_LOOP_2:           ; jump label

    LEA DX, PROMPT_3     ; load and display the string PROMPT_3
    MOV AH, 9
    INT 21H

    ADD BL, BH           ; add BL and BH
    JNC @SKIP            ; jump to label @SKIP if CF=1
    MOV AH, 2            ; print the digit 1 i.e. carry
    MOV DL, 31H
    INT 21H

@SKIP:                 ; jump label

    MOV CX, 8            ; initialize loop counter
    MOV AH, 2            ; set output function

@LOOP_3:               ; loop label
    SHL BL, 1            ; shift BL towards left by 1 position
    JC @ONE              ; jump to label @ONE if CF=1
    MOV DL, 30H          ; set DL=0
    JMP @DISPLAY         ; jump to label @DISPLAY

@ONE:                  ; jump label
    MOV DL, 31H          ; set DL=1

@DISPLAY:              ; jump label
    INT 21H              ; print the character
    LOOP @LOOP_3        ; jump to label @LOOP_3 if CX!=0

    MOV AH, 4CH          ; return control to DOS
    INT 21H

    MAIN ENDP
END MAIN

```

**8. Write an ASM code to check a palindrome string.**

Data Segment

```

str1 db \'MADAM\','\'$\'
strlen1 dw $-str1
strrev db 20 dup(\' \')
str_palin db \'String is Palindrome.\','\'$\'
str_not_palin db \'String is not Palindrome.\','\'$\'
Data Ends

```

Code Segment

Assume cs:code, ds:data

Begin:

```

mov ax, data
mov ds, ax
mov es, ax
mov cx, strlen1
add cx, -2

lea si, str1
lea di, strrev

add si, strlen1
add si, -2
L1:
    mov al, [si]
    mov [di], al
    dec si
    inc di
    loop L1
    mov al, [si]
    mov [di], al
    inc di
    mov dl, \'$\'
    mov [di], dl
    mov cx, strlen1

```

Palin\_Check:

```

lea si, str1
lea di, strrev
repe cmpsb
jne Not_Palin

```

Palin:

```

mov ah, 09h
lea dx, str_palin
int 21h
jmp Exit

```

Not\_Palin:

```

mov ah, 09h
lea dx, str_not_palin
int 21h

```

Exit:

```

mov ax, 4c00h

```

```

    int 21h
Code Ends
End Begin

```

## 9. Write an ASM code to read a binary number and print the factorial of the binary number (MUL instruction)

```

.MODEL SMALL
.STACK 100H

.DATA
PROMPT_1 DB  \'Enter a Positive Binary number (max. 1000) : $\'
PROMPT_2 DB  0DH,0AH,\'The Factorial of the given number is : $\'
ILLEGAL   DB  0DH,0AH,\'Illegal character. Try again : $\'

.CODE
MAIN PROC
    MOV AX, @DATA           ; initialize DS
    MOV DS, AX

    LEA DX, PROMPT_1        ; load and display the string PROMPT_1
    MOV AH, 9
    INT 21H

    CALL BINARY_INPUT        ; call the procedure BINARY_INPUT

    CALL FACTORIAL           ; call the procedure FACTORIAL

    LEA DX, PROMPT_2        ; load and display the string PROMPT_2
    MOV AH, 9
    INT 21H

    CALL BINARY_OUTPUT       ; call the procedure BINARY_OUTPUT

    MOV AH, 4CH              ; return control to DOS
    INT 21H
MAIN ENDP

;----- Procedure Definitions -----;

;----- BINARY_INPUT -----;

BINARY_INPUT PROC

    ; this procedure will read a number in binary form

    ; input : none
    ; output : store binary number in BL
    ; uses : MAIN

```

```

JMP @START                ; jump to label @START

@ERROR:                   ; jump label

LEA DX, ILLEGAL           ; load and display the string ILLEGAL
MOV AH, 9
INT 21H

@START:                   ; jump label

MOV CX, 4                 ; initialize loop counter
XOR BX, BX                ; clear BX
MOV AH, 1                 ; set input function

@INPUT:                   ; loop label
    INT 21H               ; read a digit

    CMP AL, 0DH           ; compare input and CR
    JE @END               ; jump to label @END if input is CR

    CMP AL, 30H           ; compare AL with 0
    JL @ERROR             ; jump to label @ERROR if AL<0

    CMP AL, 31H           ; compare AL with 1
    JG @ERROR             ; jump to label @ERROR if AL>1

    AND AL, 0FH           ; convert ascii to decimal code
    SHL BL, 1             ; shift BL by 1 position towards left
    OR  BL, AL             ; place the input decimal digit in BL
    LOOP @INPUT           ; jump to label @INPUT if CX!=0

@END:                     ; jump label

RET                       ; return control to the calling procedure
BINARY_INPUT ENDP

;----- BINARY_OUTPUT -----;

BINARY_OUTPUT PROC
    ; this procedure will display a number in binary form
    ; input : BX
    ; output : none
    ; uses : MAIN

    MOV CX, 16             ; initialize loop counter
    MOV AH, 2             ; set output function

@OUTPUT:                   ; loop label
    SHL BX, 1             ; shift BX by 1 position towards left
    JC @ONE               ; jump to label @ONE if CF=1
    MOV DL, 30H           ; move 0 to DL
    JMP @DISPLAY          ; jump tp label @DISPLAY

@ONE:                     ; jump label

    MOV DL, 31H           ; move 1 to DL

```

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```
        @DISPLAY:                ; jump label
        INT 21H                  ; display a digit
    LOOP @OUTPUT                  ; jump to label @OUTPUT if CX!=0

    RET                           ; return control to the calling procedure
BINARY_OUTPUT ENDP

;----- FACTORIAL -----;

FACTORIAL PROC
; this procedure will compute the factorial of a given number
; input : BL
; output : store the factorial of the number in BX
; uses : MAIN

    MOV AX, 1                    ; set AX=1

    XOR CX, CX                   ; clear CX
    MOV CX, BX                   ; set CX=BX

@LOOP:    ; loop label
    MUL CX                       ; multiply CX with AL i.e. AX=AL*CX
    LOOP @LOOP                   ; jump to label @LOOP if CX!=0

    MOV BX, AX                   ; set BX=AX

    RET                           ; return control to the calling procedure
FACTORIAL ENDP

END MAIN
```

## 10 . Write an ASM code to multiply the contain of AL by 8 using SHL instruction

```
.MODEL SMALL
.STACK 100H

.DATA
    PROMPT_1 DB 'Original value of AL : $'
    PROMPT_2 DB 0DH,0AH,'Processed value of AL : $'

.CODE
    MAIN PROC
        MOV AX, @DATA            ; initialize DS
        MOV DS, AX

        LEA DX, PROMPT_1         ; load and print PROMPT_1
        MOV AH, 9
        INT 21H

        MOV AL, 31H              ; place 1 in the AL
        MOV BL, AL               ; save AL in to BL

        MOV AH, 2                ; print the original value of AL
        MOV DL, AL
        INT 21H
```

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```
    LEA DX, PROMPT_2          ; load and print PROMPT_2
    MOV AH, 9
    INT 21H

    AND BL, 0FH               ; convert ascii to decimal code

    MOV CL, 3                 ; multiply AL by 8
    SHL BL, CL

    OR BL, 30H                ; convert decimal to ascii code

    MOV AH, 2                 ; print the processed value of AL
    MOV DL, BL
    INT 21H

    MOV AH, 4CH               ; return control to DOS
    INT 21H
MAIN ENDP
END MAIN
```