Minia University **Faculty of Eng.** **CSE. Dept.** **Microprocessor**		**4th Year** **Final Exam** **Jan. 2019** **Code: CSE414**
Total Degree: 90	**Time: 3:00 h.**	

Solve all the questions

1. [*12 points*] 8086 Microprocessor is an enhanced version Microprocessor that was designed by Intel in 1976.
   a. List any 4 features of the 8086 microprocessor?
   b. State the functions of the following directives?
      i. Proc ii. EndP
   c. Explain the functions of the following instructions with one example?
      i. XLAT ii. LEA

Answers:

a. 1) It is a 16 bit µp.
2) 8086 has a 20 bit address bus can access upto 220 memory locations (1 MB) .
3) It can support upto 64K I/O ports.
4) It provides 16-bit registers. AX,BX,CX,DX,CS,SS,DS,ES,BP,SP,SI,DI,IP & FLAG REGISTER
5) It has multiplexed address and data bus AD0- AD15 and A16 – A19.
6) It requires single phase clock with 33% duty cycle to provide internal timing
7) 8086 is designed to operate in two modes, Minimum and Maximum.
8) It can prefetches up to 6 instruction bytes from memory and queues them in order to speed up instruction execution.
9) Interrupts:-8086 has 256 vectored interrupts.
10) Provides separate instructions for string manipulation.
11) Operating clock frequencies 5MHz, 8MHz, 10MHz

b. i. ProC - The ProC directive is used to identify the start of a procedure. The term near or far is used to specify the type of the procedure.if the term is not specified , then assembler assumes NEAR as a type Specifier.
General Form: Procedure_name PROC [NEAR/FAR]
ii. ENDP The directive is used along with the name of the procedure to indicate the end of a procedure to the assembler.
General Form : Procedure_name ENDP

c. i. XLAT
XLAT replaces a byte in AL register with a byte from 256 byte lookup table beginning at [BX] .
AL is used as offset into this table.
Operation :- AL←[BX+AL]
ii. LEA
This instruction indicates the offset of the variable or memory location named as the source and put this offset in the indicated 16 – bit register. Example: LEA BX, PRICE ; Load BX with offset of PRICE in DS.

2. [*20 points*] The 8086 gave rise to the x86 architecture, which eventually became Intel's most successful line of processors.
   a. Identify the operand addressing mode used in each of these instructions.
      i. AND DX,AX
      ii. JMP JMPTAB[BX]
      iii. ADD DX,15
      iv. CMP WORD PTR [BX+DI],10
      v. MOV IVAL[DI+4],CX
   b. Suppose you had a different processor that was designed and operated similarly to the 8086 architecture with the following differences: All of the registers are 8-bit registers, and the physical address is a 10-bit number.
      i. What would be the size of the total addressing space on this new device?
      ii. what would be the size of the "offset window" at each segment location?

Answer:-

a.

i. AND DX,AX _____REGISTER , ii. JMP JMPTAB[BX] _____BASE+DISP
iii. ADD DX,15 _____IMMEDIATE, iv. CMP WORD PTR [BX+DI],10 ____BASE+INDEX
v. MOV IVAL[DI+4],CX _____INDEX+DISP

b.

i. 1KB or 1,024 Bytes
ii. 256 Bytes

3. [***20 points***] Write the values that stored in AX, SI, and CX after the execution of the following fragment of assembly code.

```
. DATA
        array   dw   7,6,5,4
        count   dw   4
.CODE
        xor   ax,ax
        stc
        mov   cx,count
        mov   si,offset array
label1: adc   ax,word ptr [si]
        add   si,2
        loop  label1
label2:
```

Answer:-

The body of the loop will execute 4 times (CX = 4). On each pass through the loop, AX will have the following values:

	AX		Array[SI]		CF	
AX =	0	+	7	+	1	= 8
AX =	8	+	6	+	0	= 14
AX =	14	+	5	+	0	= 19
AX =	19	+	4	+	0	= 23 = 17h

4. [***18 points***] In 8086, the interrupt vector table IVT always resides at the same location in memory, ranging from 0x0000 to 0x03ff, and consists of 256 four-byte real mode.

a. What is the use of Interrupt Vector Table of 8086 microprocessor, describe the IVT Format?

b. Using the Interrupt Vector Table shown below in Fig. 1., determine the address of the ISR (Interrupt Service Routine) of a device with interrupt vector 2H?

Dump of Interrupt Vector Table:

```
0000:0000  BB 08 0B 02 65 04 70 00-16 05 DA 09 65 04 70 00   ....e.p.....e.p.
0000:0010  65 04 70 00 D7 04 00 C0-85 98 00 F0 53 FF 00 F0   e.p.........S...
0000:0020  00 00 00 C9 28 00 DA 05-3A 00 DA 05 52 00 DA 05   ....(...:...R...
0000:0030  6A 00 DA 05 82 00 DA 05-9A 00 DA 05 65 04 70 00   j...........e.p.
```

Fig. 1: Interrupt Vector Table

Answer:-

```
Interrupt Vector Table:
0000:0000  BB 08 0B 02 65 04 70 00-16 05 DA 09 65 04 70 00
```

The Interrupt Vector Table is an array of DWORD entries (each entry is 4 bytes). The NMI Interrupt uses **vector 2**. The offset of entry 2 in the Interrupt Vector Table is at: **2 * 4 = 8**. This entry is made up of the bytes underlined above. Each entry in the table is a **SEG:OFF** pair giving the CS and IP values for the entry point of the interrupt service routine. Remembering the Intel byte ordering convention, the address of the NMI ISR is:

____09DA:0516_____

5. [***20 points***] In the intel microprocessors, 3 modes for operations real, protected, flat.

a. What are the maximum number of non-overlapping memory segments for an intel X86 microprocessor operated in the following modes.

i. Real mode ii. Protected mode

b. Write an assembly program that takes a sequence of numbers from the user, the program continues to ask for new numbers until the accumulative product of these numbers is greater than 1000 (base 10); if the user enters a non-digit character the program shall skip it.

Answer:-

a.

i) Real mode

Each segment is 64kB and the total memory is 1MB.
Therefore, 2^20/2^16=16 segments.

ii) Protected mode

13-bit selctorss, therefore 2^13 = 8192 descriptors,
but there is a bit (T1), which selects local or global
descriptor tables.
Therefore 8192+8192 = 16384 segments.

b.

```
.model small
.386
.stack 180h
.data
messg1 db "Enter the sequense :",0dh,0ah, "$"
messg2 db 0ah,0d,"the result is greater than 1000.$"
result dw 1
limit = 1000
.code
main:
mov ax,@data
mov ds,ax
    mov  ah,9
    mov  dx,OFFSET messg1
    int  21h
    l1:
            mov ah,8
            int 21h
            sub al,30h              ;convert Ascii to int
            cmp al,9          ;check if it is a number
            ja l1                   ;contenue the loop if not digit

            mov ah,2                ;show the digit
            mov dl,al
            add dl,30h              ;convert int to Ascii
            int 21h

            sub al,30h              ;again convert Ascii to int
            movzx ax,al
            mul result
            mov result,ax

            cmp result, limit
    jb l1

    mov  ah,9
    mov  dx,OFFSET messg2
    int  21h
```

Good luck

@Assoc. Prof. Dr. Hassan_Youness_Alansary

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