key

جامعة بيرزيت
BIRZEIT UNIVERSITY

Computer Systems Engineering Department
Computer Organization – ENCS238
Second Exam

Name: key **ID:** **Section: 1 2 3**

Question 1: [30] (Multiple choice; 2 pts each)

1. CPU checks for an interrupt signal during
   (A) Starting of last Machine cycle
   (B) During execution cycle
   (C) Operand Fetch cycle
   (D) Instruction fetch cycle

2. In 8086 the Overflow flag is set when
   (A) the sum is more than 16 bits
   (B) Signed numbers go out of their range after an arithmetic operation
   (C) Carry and sign flags are set
   (D) During subtraction

3. Which of the following is an illegal instruction
   (A) MOV AX, 25000 (B) DEC AL
   (C) AND BX, CX (D) MOV DS, 7000H

4. In a 16-bit floating point format with 6 bits exponent, and 9-bits mantissa, the value of the exponent for the binary number 101.100×2^3
   (A) 34 (B) 5
   (C) 36 (D) 67

5. Which of the following variables uses the most amount of RAM:
   (A) x db 255 **(B)** y db 80 dup('Z')
   (C) z dw 50 dup(0) **(D)** small dd 40 dup(0)

6. The result of mov al, 65 is to store
   (A) 0100 0010 in al **(B)** ASCII code of 'A' in al
   (C) store 42H in al **(D)** store 1000 0001 in al

7. The effect of the following instructions

```
push ax
add ax, 4
pop bx
mov cx, ax
push bx
pop ax
```

on the ax register is

(A) leave it with its original value **(B)** add 4 to it
(C) clear it **(D)** double it

8. To copy the hexadecimal number A to the bh register you write

(A) mov 0bh, ah **(B)** mov bh, 0ah
(C) mov bh, ah **(D)** mov bh, [ah]

9. Given that al contains the ASCII code of an uppercase letter, it can be converted to lowercase by

(A) add al,32 **(B)** sub al, 32
(C) or al, 1101 1111 **(D)** and al, 0010 0000

10. The word size of an 8086 processor is

(A) 8 bits (B) 16 bits
(C) 32 bits (D) 64 bits

11. One of the following instruction is illegal:

(A) mov al,[bx] (B) mov [bx],[2000]
(C) inc [bx] (D) add cx,[200]

12. A computer system has 64MB of memory (Byte addressable), the minimum size of MAR

(A) 24 bit (B) 8 bit
(C) 26 bit (D) 16 bit

13. Which register will be affected by the instruction **MUL BX**

(A) BX (B) AX
(C) DX (D) Both AX and DX

14. The bp register is typically used for accessing

(A) strings (B) memory
(C) stack (D) data segment

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	B	D	C	D	B	A	B	A	B	B	C	D	C	X

Question 2: [15]

Consider a 16-bit floating-point format given in Figure below:

Sign (1 bit)	Exponent (7 bit)	Significant (8 bit)

a) What is the absolute maximum and absolute minimum normalized numbers that can be represented in this floating-point format? C5PTS3

Bias = $2^6 - 1 = 63$

max. exponent = 126, max significant = FFH

abs. Max = $\pm 1.11111111 \times 2^{63}$

min. exp = 1 $\Rightarrow 1 - 63 = -62$

min. sig. = 00H

So, abs. min = $\pm 1.00000000 \times 2^{-62}$

b) Let A= $(BD70)_H$ and B = $(42C8)_H$ are two floating-point numbers, expressed in hexadecimal. Let C = A + B, find the representation of C in 16-bit format given in figure above (show how the floating point calculations are performed step by step)[10] Bias = 63

A = 1 011 1101 | 0111 0000
exp. sig.

exp. = 61 − 63 = −2

$A = -1.0111 \times 2^{-2}$

$A = -0.00010111 \times 2^{3}$

B = 0 | 1000010 | 11001000
exp. sig.

exp = 66 − 63 = 3

$B = +1.11001 \times 2^{3}$

1.1100 1000 00
− 0.0001 0111 1
+1.1011 1001

$C = +1.10111001 \times 2^{3}$

sign = 0

exp. = 3 + 63 = 66 = $(1000010)_2$

sig. = 10111110

in 16-bit Floating-point

C = 0 | 1000010 | 10111100

4 2 B E

$C = (42BE)_H$

or Rounded to

0/1000010/10111101

42BDH

Question 3:[15]

a) What is interrupt? [2pts]

Mechanism by which other Modules (e.g I/O) may interrupt normal sequence of processing to improve process efficiency.

b) Mention three sources that cause an interrupt? [3 pts]

1) I/O (external signals such as from printer)
2) Program (overflow, divide by zero)
3) Timer ⓦ HW failure.

c) Consider a system with five I/O devices: D1, D2, D3, D4 and D5. Interrupts from D1 and D2 has the same priority = 2, D3 has priority = 4, and D4 has priority = 7, and D5 has priority = 5. A user program begins at time t = 0:

- at t = 10 D2 interrupt occurs and it needs 20 sec to be handled
- at t = 15 D4 interrupt occurs and it needs 15 sec to be handled
- at t = 20 D1 interrupt occurs and it needs 10 sec to be handled
- at t = 25 D3 interrupt occurs and it needs 25 sec to be handled
- at t = 30 D5 interrupt occurs and it needs 10 sec to be handled

$0 \rightarrow 10$ main prog.
$10 \rightarrow 15$ D2
$15 \rightarrow 30$ D4
$30 \rightarrow 40$ D5
$40 \rightarrow 65$ D3
$65 \rightarrow 80$ D2
$80 \rightarrow 90$ D1

Using nested multiple interrupts, complete the table below: [10pts]

Device	Interrupt handling start time	Interrupt handling complete
D1	t = 80	t = 90
D2	t = 10	t = 80
D3	t = 40	t = 65
D4	t = 15	t = 30
D5	t = 30	t = 40

Question 4: [20]

a) Identify the operand addressing mode used in each of these instructions: [5 pts]

1) AND DX,AX ___Register Addressing Mode. (AM)___

2) JMP TABLE[BX] ___Based A.M. (mem. Reg. Indirect).___

3) ADD DX,15 ___Immediate A.M.___

4) CMP WORD PTR [BX+DI],10 ___Based-Indexed A.M. (mem. Reg. Indirect)___

5) MOV IVAL[DI+4],CX ___Indexed with displacement A.M. (mem. Reg. Indirect)___

b) Assume (all values are in hex) [15 pts]

AX=0000 **BX**=00050 **CX**=0003 **DX**=0000 **SI**=0050 **DI**=0000
CS=2000 **SS**=4000 **DS**=5000 **ES**=2000 **SP**=3000 **BP**=00050
IP=100

```
        mov cx,7
L:      Inc DI
        Loop L ; if cx !=0 then dec cx and goto L
        or AX,[BX+2]
        Lea DX,[SI]
        POP SI
```

get 16-bit then Inc SP by two.

42FFF	12
43000	34
43001	56
43002	78
...	....
5004F	AA
50050	BB
50051	CC
50052	DD
...	...

i) What is the physical address of the next instruction to be executed? [2pts]

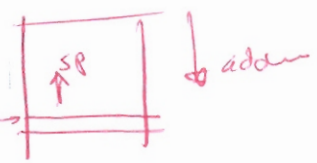
$CS*10h+IP = 20100_H$

20000
+ 100
20100

ii) What is the lowest possible address of the stack segment? [2pts]

Lowest address when SP = FFFFH

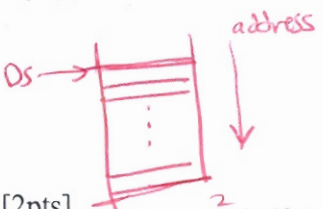
So, lowest physical address = SS*10h + FFFFH = 4FFFFH



iii) What is the highest possible address of data segment? [2pts]

Highest address when offset = FFFFH.

Highest physical address = DS*10h + FFFF = 5FFFFH



iv) What is the SP and SS after the two instructions push AX push BX: [2pts]

SP = SP - 4 ⇒ SP = 2FFCH

SP = 2FFCH SS = 4000H

2 15 15 16
3000
- 0004
2FFC

v) What is the physical address of the source operand of the fourth instruction? [2pts]

DS*10h + BX+1 = 50000 + 0050 + 1 = 50051H

vi) What is the new value of the affected registers after executing these instructions? [5pts]

CX = 0000H
DX = 0050H
DI = 0008H
SI = 3412H
AX = DDCCH

Question 5: [20]

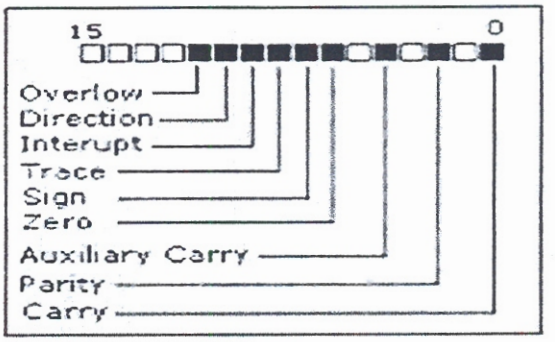
a) Show how the AL and Flags are affected by

```
Mov AL, 0BBH
ADD AL, 0CCH
```

AL= 87H CF= 1 OF= 0 ZF= 0 SF= 1

b) Given the Flags register in the following figure, write a set of instructions for setting the direction flag (DF) without changing the other flags and without using the instruction **STD.**

```
pushf
popAx
OR AX, 0400H
push AX
popf
```



c) What will be the value in AX after executing the following instructions? Give the answer in both hexadecimal and binary.

```
mov al, 15
mov ah, 15
xor al, al
mov cl, 3
shr ax, cl
add al, 90h
adc ah, 0
```

AX= (0270)(H) AX=(0000001001110000)B

d) What will be the value in AX after executing the following instructions? Assume that DS and ES are set up appropriately to access the variable 'Array'. Give the answer in hexadecimal:

```
Byte                1 0  3 2  5 4  7 6
Array   dw          11 11h, 22 22h, 33 33h, 44 44h

mov bx, 1
mov si, 6
mov ax, Array[bx][si-2]
```

AX = (3344)H