جامعة بيرزيت
BIRZEIT UNIVERSITY

Computer Organization and architecture (ENCS238)
Second Exam

Spring Semester 2013/2014
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Date: 20/05/2014
Time allowed: 60 minutes

Name: Key **ID:**

Circle your section: section 1 (SMW 9:00-10:00), section 2 (SMW 11:00-12:00), section 3 (SMW 12:00-1:00)

Instructions:

- **You have 60 minutes, budget your time carefully!**
- **Turn OFF your mobile.**
- **To make sure you receive credit, please write clearly and show your work.**

Question	Maximum	Mark	Course Outcome
1	30		
2	20		
3	30		
4	20		
Total	100		

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

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) MOV CS, AX
   (C) MOV SI, CX
   (D) MOV DS, 7000H

4. Which of the following variables uses the most amount of memory:
   (A) X DB 255
   (B) Y DB 80 dup('Z')
   (C) Z DW 50 dup(0)
   (D) small DD 40 dup(0)

5. The result of **MOV AL, 97** is to store
   (A) 1001 1001b in AL
   (B) ASCII code of 'A' in AL
   (C) Store 42H in al
   (D) ASCII code of 'a' in AL

6. The effect of the following instructions on AX register is

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

   (A) Leave it with its original value
   (B) add 4 to it
   (C) Clear it
   (D) double it

7. 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]

8. 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

9. The memory size of an 8086 processor is
   (A) 2MB
   (B) 64KB
   (C) 64GB
   (D) 1MB

10. One of the following instruction is illegal:
    (A) mov al,[bx]
    (B) mov [bx],[200]
    (C) mov [bx], 200
    (D) add cx,[200]

11. Which register will be affected by the instruction mul BX
    (A) DS
    (B) AX
    (C) DX
    (D) BX

12. Which of the following is a valid segment address:

(A) 9FFE0 (B) 9FFE2
(C) 9FFE4 (D) FFE16

13. To declare (define) a matrix of 5 rows and 3 columns (5X3) we use:

(A) Matrix DB 5, 3 (B) Matrix DB 5 dup(3)
(C) Matrix DB 5 dup(3 dup(?)) (D) Matrix DB 15

14. The BP register is typically used for accessing

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

15. Consider the byte at address 13DDE within a 64K segment defined by segment address 10DE. What is its offset?

(A) 20E1 (B) 2FFF
(C) 2FFE (D) 20EF

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

Question 2:[20 marks]

a) What is interrupt? [4pts]

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

b) Mention three sources that cause an interrupt? [6pts]

1. I/O (external signals such as from printer)
2. Program (overflow, divide by zero)
3. Timer
4. 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 → 10 main Prog.
10 → 15 D2
15 → 30 D4
30 → 40 D5
40 → 65 D3
65 → 80 D2
80 → 90 D1

Complete the table below: [10pts]

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

Question 3: [30 marks]

a) Identify the operand addressing mode of the second operand used in each of these instructions: [10pts]

a) AND DX,AX Register addressing Mode

b) SUB BL, TABLE[BX] Based addressing Mode (Register Indirect)

c) ADD DX,15 Immediate Addressing Mode

d) ADD AL, [BX+DI+4] Based-Indexed with displacemd (memory Indirect)

e) MOV CX, IVAL[SI+4] Indexed with displacemd (mem. Indirect)

b) Assume (all values are in hex) [20 pts; 4 each]

AX=0000 **BX**=00F3 **CX**=0003 **DX**=0000 **SI**=0050 **DI**=0000
CS=2000 **SS**=4000 **DS**=5000 **ES**=2000 **SP**=3000 **BP**=01C1
IP=0100

i) What is the physical address of the next instruction to be executed?

CS * 10h + IP = 20100H

ii) What is the physical address of the top of stack?

SS * 10h + SP = 43000H

40000
3000 +
43000

iii) What is the highest possible address of data segment?

Highest address at offset = FFFFH

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

50000
FFFF
5FFFF

vi) What is the physical address of the first operand of the following instruction?

```
MOV [BX+1234H], AL
```

DS * 10h + Bx + 1234H = 51327H

50000
00F3
1234
51327

v) What is the physical address of the source operand in the following instruction?

```
MOV DL, [BP+SI-4]
```

SS * 10h + BP + SI - 4 = 4020DH

40000
01C1
0050
40211
4
4020D

Question 4: [20 marks; 5pts each]

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

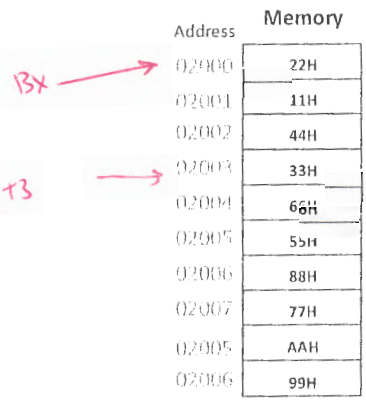
```
mov al, 09Ah
mov bl, 073h
sub al, bl ;
movsx ax, al ;
```

AX= (0027)H, CF = 0 , OF = 1 AF= 0 PF = 1

c) What will be the value in AX after executing the following instructions? Give the answer in hexadecimal:

```
.data
VAR   DW   1122h, 3344h, 5566h, 7788h, 99AAh
.code
MOV BX, OFFSET VAR
MOV SI, 6
MOV AX, [BX+SI-3]
```

AX = (6633)H



d) What will be the value in AX after executing the following instructions? Give the answer in hexadecimal:

```
.data
Table    DB   1FH, 2EH, 3DH, 4CH, 5BH, 6AH, A7H, B8H, 9CH

.code
MOV SI, 2
LEA  BX, Table[SI]
MOV AL, 5
xlatb
MOVSX AX, AL
```

AX = FFB8 H

Good Luck