

Taibah University		College of Computers science and Engineering
Computer Organization and Architecture COE 224		Date: Mon 22 April 2019 Time: 10:30 — 12:3
Final Exam		Total Marks: 40
Name:		ID:

Question 01

[10 Marks]

(A) [5 Marks]

Regarding the assembly program shown below— written for 8086 Microprocessor

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1399:0100 B401      MOV     AH,01
1399:0102 CD21      INT     21
1399:0104 88C3      MOV     BL,AL
1399:0106 80CB20     OR      BL,20
1399:0109 B402      MOV     AH,02
1399:010B 88DA      MOV     DL,BL
1399:010D CD21      INT     21
1399:010F B44C      MOV     AH,4C
1399:0111 CD21      INT     21

```

- The program will be saved to memory starting at physical address of
 - 13A90
 - B401
 - 1399
 - 0100
- The machine code of the instruction INT 21 is
 - CD21
 - 0102
 - 1399
 - B402
- The complete machine instruction that is saved to starting from memory address 13A96 H is
 - 80CB20
 - 88DA
 - B44C
 - B402
- The instruction OR BL,20 is _____ Byte (s) Instruction
 - One
 - Two
 - Three
 - Zero
- The end of the program is at effective address equal to
 - 1399
 - 0111
 - 010F
 - 0112
- What is the function of the first INT
 - Read character
 - Print character
 - Print message
 - Halt
- After executing the 8th instruction, AH register =
 - 4C
 - BL
 - 02
- The instruction, **MOV AX, 0005H** belongs to the address mode
 - Register
 - Direct
 - Immediate
 - Register relative
- The instruction, **MOV AX, [2500H]** is an example of
 - Immediate addressing mode
 - Direct addressing mode
 - Indirect addressing mode
 - Register addressing mode
- The instruction, **MOV AX,[BX]** is an example of
 - Direct addressing mode
 - Register addressing mode
 - Register indirect addressing mode
 - None of the above



(B)

[5 Marks]

(a) Find the memory address of the next instruction executed by the microprocessor for the following CS:IP combinations: CS = 5000H and IP = 2000H	(b) A code segment is to be located from address B0000 to BFFFF . What value must be loaded into CS ?
(c) Write a program to subtract a hex number in offset address 0055H from a hex number in offset address 0065H and store the result to location addressed by offset address 0070H	(d) If the current values in the code segment register and the instruction pointer are 0200 and 01AC , respectively, what physical address is used in the next instruction fetch?

Question 2:

[10 Marks]

(A) [5 Marks]

Consider a hypothetical 32-bit microprocessor having 32-bit instructions composed of two fields: the first byte contains the opcode and the remainder contains the immediate operand or an operand address.

(a) What is the maximum directly addressable memory capacity (in bytes)?	(b) How many bits are needed for the program counter and the instruction register?
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How many instructions are there in the instruction set of this processor?

(B) [5 Marks]

Consider a computer system that contains an I/O module controlling a simple keyboard/printer teletype. The following registers are contained in the processor and connected directly to the system bus:

INPR: Input Register, 8 bits
OUTR: Output Register, 8 bits
FGI: Input Flag, 1 bit
FGO: Output Flag, 1 bit
IEN: Interrupt Enable, 1 bit

Keystroke input from the teletype and printer output to the teletype are controlled by the I/O module. The teletype is able to encode an alphanumeric symbol to an 8-bit word and decode an 8-bit word into an alphanumeric symbol.

(a) Describe how the processor, using the first four registers listed in this problem, can achieve I/O with the teletype.

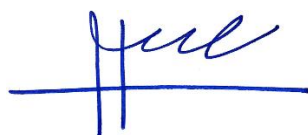
(b) Describe how the function can be performed more efficiently by also employing IEN

Question 3:

[10 Marks]

Consider a machine with a byte addressable main memory of 2^{16} bytes and block size of 8 bytes. Assume that a direct mapped cache consisting of 32 lines is used with this machine

(a) How is a 16-bit memory address divided into tag, line number, and byte number?	(b) Into what line would bytes with each of the following addresses be stored? 1010 1010 <u>1010</u> 1010
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(c) How many total bytes of memory can be stored in the cache?

(d) Suppose the byte with address 0001 1010 0001 1010 is stored in the cache. What are the addresses of the other bytes stored along with it?

Question 4:

[10 Marks]

- (a) Consider the page stream of page requests. **1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2**: Determine the **hit ratio h** for this stream using the **Least Frequently Used LFU “Optimum”** replacement policy, assume the main memory can hold **three pages** and initially all of them are vacant

- (b) A benchmark program is run on a 40 MHz processor. The executed program consists of 100,000 instruction executions, with the following instruction mix and clock cycle count: Determine the effective **CPI**, **MIPS** rate, and **execution time** for this program.

Instruction Type	Instruction Count	Cycles per instruction
Integer arithmetic	45000	1
Data transfer	32000	2
Floating point	15000	2
Control transfer	8000	2

- (c) Given that: Cache **access time T_c** = **100 ns**, Memory **access time T_m** = **500 ns**, If the effective access time is 10% greater than the cache access time, **what is the hit ratio h** ?

