United International University (UIU)
Dept. of Computer Science & Engineering (CSE)
Final-Term Exam: Trimester: Spring 2023

Course Code: CSE 4325 Course Title: Microprocessors and Microcontrollers
Section: (A, B, C, D) Total Marks: 40 Duration: 2 hours
[You have to answer all the four questions]

Any examinee found adopting unfair means would be expelled from the trimester/ program as per UIU disciplinary rules.

Question 1: Answer all the questions. (10 Marks)

a.

Local Descriptor Table	
Index	Address
002 H	Base: C238000A, Limit: F175FH, Access: 02H, G = 0
014 H	Base: C38400A0, Limit: E9806H, Access: C1H, G = 1
126 H	Base: C9560A00, Limit: 85642H, Access: FEH, G = 0
158 H	Base: C002A00E, Limit: 2A043H, Access: B4H, G = 1
275 H	Base: C85200EF1, Limit: AB00FH, Access: D1H, G = 1
344 H	Base: C60401A1, Limit: 0FFFFH, Access: A0H, G = 0

Global Descriptor Table	
Index	Address
002 H	Base: D7210111, Limit: 01234H, Access: 05H, G = 1
014 H	Base: D3270011, Limit: 98765H, Access: F1H, G = 0
126 H	Base: D3741000, Limit: 1524CH, Access: 11H, G = 1
158 H	Base: D6590B00, Limit: FB000H, Access: B2H, G = 0
275 H	Base: D6870010, Limit: 0AF0EH, Access: FEH, G = 1
344 H	Base: D655000B, Limit: D015CH, Access: 07H, G = 1

1.

Part of the descriptor table for an 80386 microprocessor is given above. For a segment register value of AC6 H, **determine** the followings:

I)	Which entry, table and requested privilege level are selected?	[3]
II)	Starting and Ending address of the segment.	[2]
III)	For an offset value of D096E H, **determine** the physical address.	[1]
IV)	Segment type (CS/DS/SS/ES) and descriptor privilege level.	[2]
V)	Is access to the segment granted? Why or why not?	[2]

Question 2: Answer all the questions. (10 Marks)

a.

Virtual Page Address	Real Page Address
9	0
7	1
-	2
4	3
0	4
2	5
5	6
-	7
1	8
3	9
-	10
8	11
6	12

Primary Memory

Secondary Memory

A program of 23 KB size is written in an advanced processor. The OS of the processor saves this program by dividing this program into 5 KB pages and assigning each page a virtual address starting from "3". Before execution of this program, the page table in the processor is given above.

I)	**Draw** the updated page table after each execution of the program's page.	[3]
II)	**Determine** for which virtual page address, page fault will occur.	[1]
III)	For a linear address of D603F95A H, which entry of the page directory is accessed?	[1]

b.	A microcontroller-based system has a master device: "Master" (index: 5H) and four slave devices: "Slave 1" (index: 85H), "Slave 2" (index: 19H), "Slave 3" (index: A4H), "Slave 4" (index: 6CH). Now, in I2C data transfer protocol, Master receives 3-byte data (from char 'TaBle') from Slave 3. **Draw** the corresponding sequence diagram.	[3]
c.	What is the Clock Skew Phenomenon? **Explain** briefly why it occurs with a diagram.	[2]

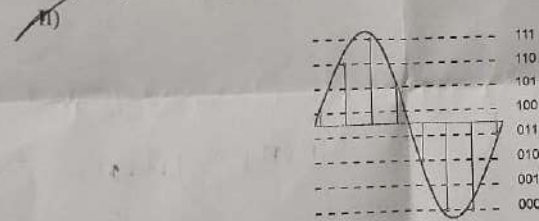## Question 3: Answer all the questions. (10 Marks)

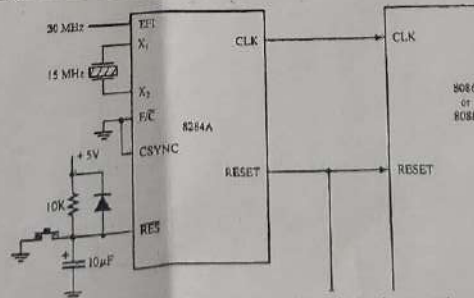|		
a.	**Draw** the timing diagram for memory write operation of 8086 microprocessor. Show the changes in all the necessary pins such as address bus, data bus, ALE, $DT/\overline{R}$, $\overline{WR}$, $\overline{DEN}$ during each clock cycle.	[4]
b.	Consider the following fetch cycles: [Fetch, Fetch, Fetch, Fetch, Fetch, Fetch, Fetch]. The 2nd fetched instruction is a "JUMP" to the 4th instruction. The 3rd fetched instruction is a memory read operation. The 5th fetched instruction is a "JUMP" to the 3rd instruction. Now **write down** the corresponding "Execute" cycles.	[4]
c.	**Explain** the function of the HOLD and HLDA pins in 8086 microprocessor.	[2]

Question 4: Answer all the questions. (10 Marks)

a.	Suppose you have to complete a project using either Raspberry Pi or Arduino board: "*Face Recognition using a Machine Learning based approach for office security*" **Explain** in details which board you should use considering your project goals.	[2]
b.	I) In a microcontroller, 12 bits digital to analog (DAC) resolution is set. During the digital to analog conversion programming, you have called the "analogWrite (511)" instruction. **Calculate** the duty cycle. **Draw** the duty cycle diagram. Consider the system voltage is 11V.	[3]

II)


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------------------------  111
------------------------  110
------------------------  101
------------------------  100
------------------------  011
------------------------  010
------------------------  001
------------------------  000
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The quantization levels of an ADC system of an Arduino is presented above. The Arduino possesses 7.5 V system voltage. Now **determine** the ADC report for an analog voltage of 2.9 V. [2]

c.	A system comprising a microprocessor 8086 or 8088, a peripheral device, and a clock generator needs to be designed in such a way that the clock generator feeds both the microprocessor and the peripheral device with 5 MHz clock signals. To ensure it, a hardware designer presents the following design where he applies 15 MHz crystal in between X1 and X2, and another 30 MHz signal to EFI to feed necessary clock signals to both the microprocessor and the peripheral device (not shown in the figure). Do the microprocessor and the peripheral device get the intended clock? **Explain** your answer.	[3]