AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH
Faculty of Engineering

Course/Lab Name:	Microprocessor and Embedded Systems		**Semester: Fall 2023-24**
Term: Mid	**Assignment**: 02	**Total**: 20	**Submission Date: 21.10.2023**

Course Outcome Mapping with Questions

Item	COs	POIs	K	P	A	Marks	Obtained Marks
Q1	**CO1**	**P.a.4.C3**	**K4**	**P1, P3, P7**		**10**	
Q2	**CO1**	**P.a.4.C3**	**K4**	**P1, P3, P7**		**10**	
					Total:	**20**	

Student Information:

Class SL:	24	Section: G		Department:	CSE
Student Name:	**Mrittika, Wasifa Tasnim**			Student ID:	**21-45108-2**

Marking Rubrics (to be filled by Faculty):

Problem #	Excellent [10]	Proficient [8]	Good [6]	Acceptable [4]	Unacceptable [2]	No Response [0]	Secured Marks
	Detailed unique response explaining the concept properly and answer is correct with all works clearly shown.	Response with no apparent errors and the answer is correct, but explanation is not adequate/unique.	Response shows understanding of the problem, but the final answer may not be correct	Partial problem is solved; response indicates part of the problem was not understood clearly.	Unable to clarify the understanding of the problem and method of the problem solving was not correct	No Response/(Copied/identical submissions will be graded as 0 for all parties concerned)	
1							
2							
Comments						Total marks (20)	

Q1 To detect the gas leakage, an Arduino base security system is installed. This system **[10]** performs a security check in a specific time interval. Apply the knowledge of Arduino to **compute** the required **timer counts** for the time intervals **AB** ms and **CDE** ms. The available pre scalers in the system are 1, 8, 64, 256 and 1024. Which timer is required to obtain the specific delay? Consider the clock frequency 16 MHz and value of A, B, C, D, E from your ID XX-**ABCDE**-X

Q2 By using the concept of timer, **produce F** sec delay**.** Select an appropriate timer **[10]** (TIMER0/TIMER1) and **set up the necessary registers** associated with the used timer to achieve the **F** sec time count. Consider the clock frequency 20 MHz and Prescalers value of 1024. Also, **compute** the maximum possible time that can be counted using this timer. Consider the value of F from your ID XX-XXXXX-**F.**

Follow the following conditions to set up the register.
TIMER0
The useful bits of TCCR0A are bit 0 and bit 1, representing WGM00 and WGM01 respectively.
Bits 0 to 3 are the useful bits from TCCR0B.
Bit 3 represents WGM02.
Bits 0 to 2 represent the clock select functions CS00, CS01, CS02 respectively.

TIMER1
The useful bits of TCCR1A are bit 0 and bit 1, representing WGM01 and WGM11 respectively.
Bits 0 to 4 are the useful bits from TCCR1B.
Bits 3 and 4 represent WGM12 and WGM13 respectively.
Bits 0 to 2 represent the clock select functions CS10, CS11, CS12 respectively.

**Consider WGM = 0 for normal mode of operation. The bits not mentioned here can be ignored/considered as 0.

CSx2	CSx1	CSx0	Pre scaler
0	1	0	8
0	1	1	64
1	0	0	256
1	1	1	1024

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A = 4, B = 5, C = 1, D = 0, E = 8

Q1 Answer:

① for 45 ms,

frequency = 16 MHz
pre scaler value = 1024
required delay = 45 ms
Timer count = ?

$$\text{Timer count} = \frac{\text{Required delay} \times \text{frequency}}{\text{Pre scaler}} - 1$$

$$= \frac{45 \times 10^{-3} \times 16 \times 10^{6}}{1024} - 1$$

$$= 702 \cdot 1$$

$$\approx 702$$

So, Timer-1 will be needed to obtain a delay of 45 ms.

⑪ for 108 ms,

$$\text{Timer count} = \frac{R \cdot D \times \text{freq.}}{\& P \cdot S} - 1$$

$$= \frac{108 \times 10^{-3} \times 16 \times 10^{6}}{1024} - 1$$

$$= 1686 \cdot 5$$

$$\approx 1687$$

→ So, Timer-1 will be needed to obtain a delay of 108 ms.

Q2 Answer:

$F = 2$

required delay = 2 sec

frequency = 20 MHz

pre scaler value = 1024

$$\text{Timer count} = \frac{2 \times 20 \times 10^6}{1024} - 1$$

$$= 39061.5$$

$$\approx 39062$$

Timer-1 should be used to get a delay of 2 s.

$$\text{Maximum possible time} = \frac{1}{20 \times 10^6} \times 65536$$

$$= 5 \times 10^{-8} \times 65536$$

$$= 0.00328 \text{ sec (Ans)}$$

Bit	7	6	5	4	3	2	1	0	
(0x85)				TCNT1 [15:8]					TCNT1H
(0x84)				TCNT1 [7:0]					TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial value	0	0	0	0	0	0	0	0	