American International University- Bangladesh (AIUB)
Faculty of Engineering

Course Name:	Microprocessor and Embedded Systems	**Course Code:**	EEE 4103
Semester:	Spring 2022-23	**Term:**	Mid
Total Marks:	20	**Submission Date:**	08-03-2023
Instructor Name:	Tahseen Asma Meem	**Assignment:**	02

Course Outcome Mapping with Questions

Item	COs	POIs	K	P	A	Marks	Obtained Marks
Q1	**CO1**	**P.a.4.C3**	**K4**	**P1, P3, P7**		**5**	
Q2	**CO1**	**P.a.4.C3**	**K4**	**P1, P3, P7**		**5**	
Q3	**CO1**	**P.a.4.C3**	**K4**	**P1, P3, P7**		**5**	
Q3	**CO1**	**P.a.4.C3**	**K4**	**P1, P3, P7**		**5**	
					Total:	**20**	

Student Information:

Student Name:	**MD. ABDUL MUNEEM ADNAN**	**Section:**	**E**
Student ID #:	**20-44213-3**	**Department:**	**CSE**

Marking Rubrics (to be filled by Faculty):

Problem #	**Excellent [5]**	**Proficient [4]**	**Good [3]**	**Acceptable [2]**	**Unacceptable [1]**	**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							
3							
4							
Comments						Total marks (20)	

1. In an ultimate fun factory, you as a player want to play an interesting game named as Laser Tag. In the preparation room, every player was requested to wear a vest to get identified in the dark maze play zone. The vest contains 1 light in the middle of the vest in front, 2 lights on 2 shoulders (left and right) and 1 light on the behind of the vest and, these 4 lights flash together periodically. It was found that the system is built with an Arduino Uno at the heart. Interestingly, the Arduino was already set up to consume as little power as possible not to strain the vest's efficiency. Now, prepare a program in the Arduino Uno platform to control the 4 lights mounted on the vest so that all the lights flash together every 5s to indicate every player. [5]

2. Prepare a flowchart to explain the flow of logic for the program in Q1 so that the vest can be modified and perfect the program easily if the vest requires any maintenance after every game is over. [5]

3. Prepare an algorithm to explain the flow of logic for the program in Q1. [5]

4. On new year's eve, the Hatirjheel authority is planning to shoot high powered high frequency laser light waves as pulses into space for research purposes. These pulses are to be shot at a **3 µs** interval. The authority has an **ATMega328P MCU** available and decided to use it to count the time. Every **3 µs** a timer interrupt will be triggered by the MCU and the pulse will be shot. For this purpose, considering the power consumption and necessity, it has been decided that the Timer0 interrupt will be used. If the MCU is running at 16 MHz, prepare a program that triggers Timer0 interrupt every **3 µs**. Timer0 is an 8-bit timer, and the available pre-scalers are 1, 8, 64, 25, and 1024.

[Hint: **Bits 0 to 2** of the **TCCR0B** register must be set. These bits correspond to the pre-scaler to be used. The pre-scaler selection bits are shown in the **table below**. Output Compare Register 0A: **OCR0A** holds the necessary Timer0 count to achieve the required delay. **Bit 1** from **TIMSK0** is **OCIE0A** – this bit must be set to enable comparison match A. Any bits not mentioned here are to be considered as 0. All registers mentioned are 8-bit registers.] [5]

CSx2	CSx1	CSx0	Prescaler
0	0	1	1
0	1	0	8
0	1	1	64
1	0	0	256
1	0	1	1024

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Answer to the Question no 1

```
# define left_Light 6
# define right_light 7
# define front_light 8
# define back_light 9

void setup () {
 pinMode (left_light, OUTPUT);
 pinMode (right_light, OUTPUT);
 pinMode (front_light, OUTPUT);
 pinMode (back_light, OUTPUT); }

void loop () {
  // turn on all lights.
 digitalWrite (Left_light, HIGH);
 digitalWrite (right_light, HIGH);
 digitalWrite (front_light, HIGH);
 digitalWrite (back_light, HIGH);
 delay (5000/2);
```

BD SCHOOL SHOP
ONE STOP SCHOOL SHOPPING

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```
// turn off all lights.
digitalWrite (left_light , LOW);
digitalWrite(right_light, LOW);
digitalWrite (front_light, LOW);
digitalWrite (back_light, LOW);
delay (5000/2) ;
}
```

SCHOOL SHOPPING

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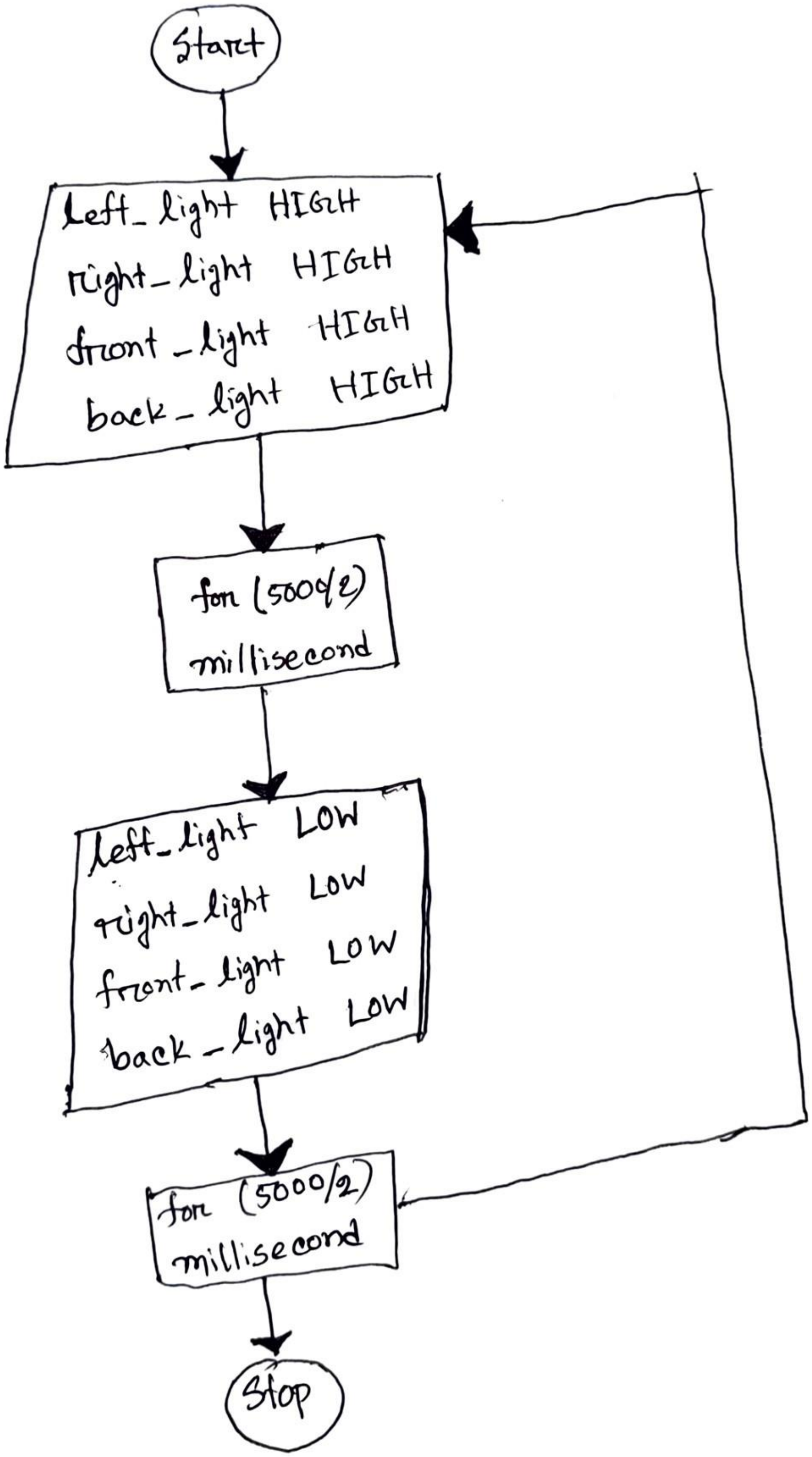
Answer to the Question no 2



BD SCHOOL SHOP
ONE-STOP SCHOOL SHOPPING

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Answer to the Question no 3

1. Define the pin numbers for each light on the vest and the interval between flashes.

2. Set each pin as an output in the 'setup ()' function.

3. In the 'loop()' function:

   i) Trun on ~~lights~~ all lights by setting the pin values to 'HIGH'.

   ii) Delay for half of the interval time using 'delay (5000/2);"

   (iii) Turn off all the light by setting the pin values to 'LOW'.

   (iv) Again, delay half of the interval time using 'delay (5000/2)';

④ Repeat steps (3(i), 3(ii), 3(iii) and 3(iv) indefinitely to keep the lights flashing every 5 seconds.

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ONE STOP SCHOOL SHOPPING

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Answer to the Question no 4

```
bool LED_ STATE'= true;
void setup()
{
 pinMode (16, OUTPUT);
 cli();
 TCCR0A = 0;
 TCCR0B = 0;
  TCCR0B1 = B00000001;
  TIMSK0  = B00000010;
  OCR0A  = 45;
  sei();
}
void loop ()
{
// main program
} ISR (TIMER0- COMPA- vect)
{
```

Theme:

Date: / /

□ Sat □ Sun □ Mon □ Tue □ wed □ Thu □ Fri

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```
TeNTO =0;

 LED_ STATE = ! LED- STATE;

 digital write (13- LED_STATE);

 }
```