Sekolah:	**SEKOLAH KEJURUTERAAN ELEKTRIK**	
Nama Matapelajaran: Kod Matapelajaran : SKEE 3732	Semakan : 1 Tarikh Keluaran : October 2020 Pindaan Terakhir : October 2020 No. Prosedur : **PK-UTM-SKE-(0)-10**	

SEKOLAH KEJURUTERAAN ELEKTRIK
FAKULTI KEJURUTERAAN
UNIVERSITI TEKNOLOGI MALAYSIA
KAMPUS SKUDAI
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SKEE 3732

MICROPROCESSOR LABORATORY

## Laboratory 2: Digital Input/Output and Timer on ATmega32.

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I. PRELIMINARY REPORT (15 marks)

Important Note: You are required to do following BEFORE the lab session.

1. Referring to the program "Lab2Exp1.c" in Figure A.6(a) of "Appendix A For SKEE3732 Laboratory 2 Sheet.pdf", create the GCC C executable project named "Lab2Exp1" for device "ATmega32" and write the program.

2. Compile the program to see if the program is free from errors. It can be done by clicking **Build > Build Solution** to compile the program. Take a screenshot of successfully compiled program.

3. Determine the code in program "Lab2Exp1.c" that initialize the input/output port. Identify the port used.
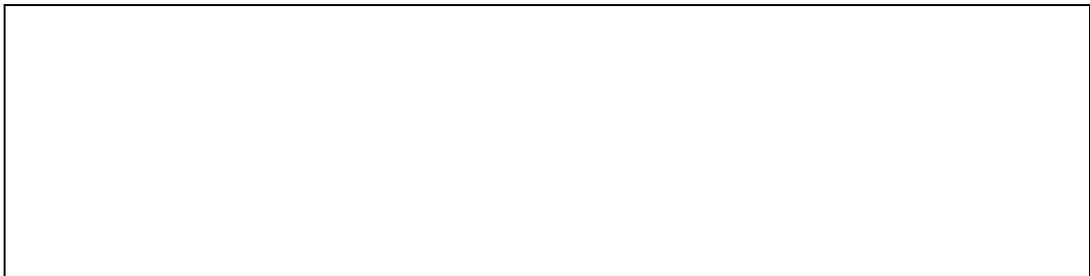
4. Determine the code in program "Lab2Exp1.c" that read the data from SWITCHES.
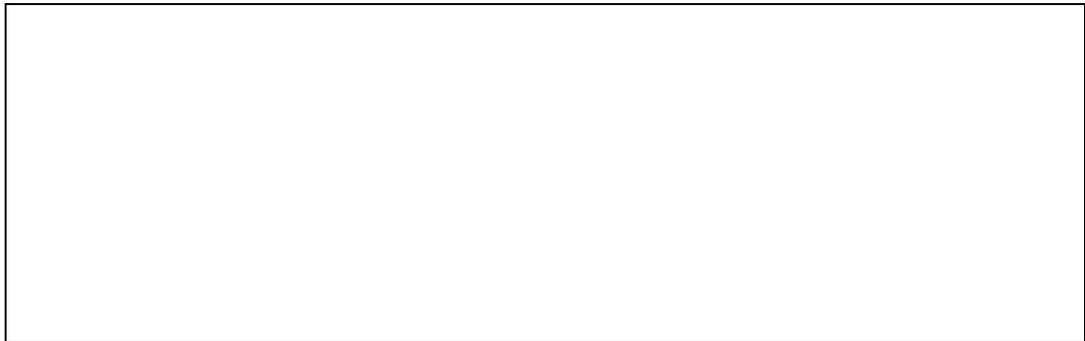
5. By using Timer 0, normal mode with XTAL frequency of 1MHz, calculate the TCTN value in order to generate 100ms delay. Use the following formula given in Figure A.2(a)(iii) of "Appendix A For SKEE3732 Laboratory 2 Sheet.pdf".

$$\text{Time Count} = \frac{\text{Required Delay}}{\text{Clock Time Period}} - 1$$

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6. Download AVR IDE simulator from https://www.oshonsoft.com/downloadspage.php and install it to your computer.

II. LABORATORY SHEET

1   Title: Using Input/Output, Timer on AVR IDE Simulator.

2   Objective:

1.   To initialize input/output port.

2.   To calculate and programming delay using Timer.

3.   To simulate the outputs of firmware using AVR IDE Simulator.

4.   To add additional code to upgrade the operation of firmware.

3   Equipment/Software/Reference:

1.   A computer system running either Window 8 or Window 10.

2.   Atmel Studio 6 installed on the system.

     Atmel Studio 7 (as-installer-7.0.634-full.exe) is needed for Windows 10.

3.   AVR IDE Simulator.

4.   Reference 1 - Appendix C For SKEE3732 Laboratory 1 Sheet.pdf

5.   Reference 2- Appendix A For SKEE3732 Laboratory 2 Sheet.pdf

6.   Reference 3– Atmega32 Reference manual **.pdf**

7.   Reference 4– Embedded C Programming and the Atmel AVR, Second Edition.pdf

8.   Reference 5– AVR libc function reference.pdf

All softcopy of the references can be sourced in the "Reference For Laboratory 2" sub-folder of the folder site where this Laboratory 2 Sheet is located.

4   Procedures

Note: You must complete Preliminary Preparation before proceeding this section. Make sure that AVR Studio 6.2 has been installed on your window system.

I.   **To Open Project (create during pre-lab session)**

Open Project named "Lab2Exp1" which you have created as instructed in section 1 of "Preliminary Report" by double clicking "Lab2Exp1.atsln" in the "Lab2Exp1" directory

II.   **To Wire up peripherals on AVR Simulator IDE.**

Connect the AVR Simulator IDE as shown in the Figure 1.1 below. Make sure to select 8 x LED Board (to connect to PORTC), Microcontroller view and 7-Segment LED Displays Panel (to connect to PORTB) from **Tools**.
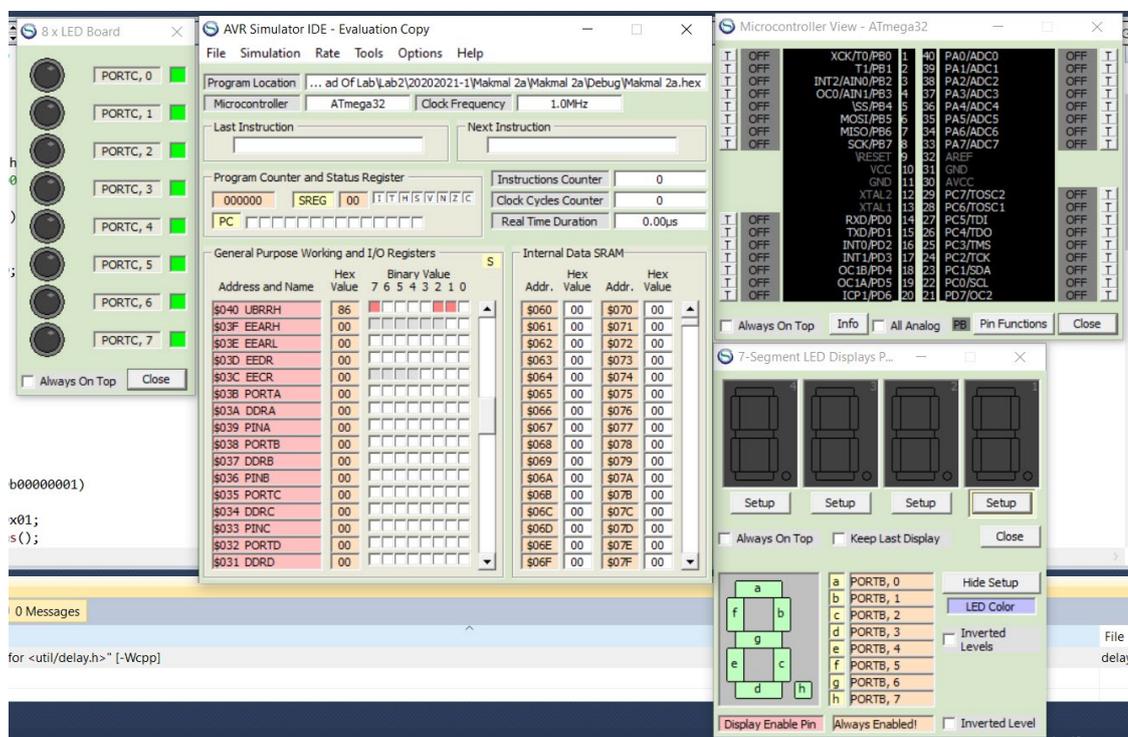
Figure 1.1

III.   **To load Atmel Studio Project "Lab2Exp1" to AVR Simulator IDE.**

a.   Load project "Lab2Exp1" to the AVR Simulator IDE by select **File > Load Program** and locate Lab2Exp1.hex file. Then click OK.

b.   Confirm the Microcontroller used is ATmega32 and CPU Frequency is 1.0 MHz (refer Figure 1.2). Double click to change setting.
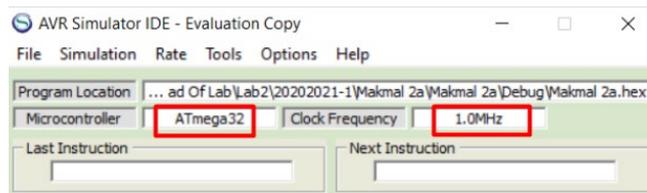
Figure 1.2

IV. Programming "Lab2Exp1" project to the AVR Simulator.

a. Program the AVR Simulator by select **Simulation > Start.** You will see the simulator will start running and gives output at 7 Segment LED Display Panel.

b. Report result as required in Table 1. Make sure that the PA0 – PA7 switches are not pressed (refer Figure 1.3) when the program starts. Click T to press the switches and click once more to toggle it back.

Figure 1.3

c. If the is simulation is too slow, you can increase it speed by select **Rate** and choose the appropriate speed.

V. Write a program to generate delay.

By using Timer 0 and normal mode calculate the TCNT value to generate 200ms delay. Shows the calculation clearly and write the "Delay200msUsingTimer0" function. Fill in Figure 2.

VI. Implementing the Complete Function of "Lab2Exp1.c" as required in Table 2.

Modify the program such that the program will executes the pattern sequence as specified in Table 2 for command if SW2 and SW3 is pressed. Run the program after modification and get an endorsement in **Figure 3** from the supervising lecturer after showing the working program.

Hint: You will need an additional Function and Case conditions.

Table 2

Switch Pressed	LEDs panel display requirement when respective button is selected	Remarks
No switches pressed	Seven Segment LED display will display: **S K E E 3 7 3 2 – <Group code>** *for example: if you are section 5 group 1, thus: S K E E 3 7 3 2 – 5 0 1	Time delay for each blinking is 400ms
SW2	**Pattern1** (see table below) **Bold indicate LED ON**	Time delay for each blinking is 200ms
SW3	**Pattern2** (see table below) **Bold indicate LED ON**	Time delay for each blinking is 200ms

Pattern1

State #	Led7	Led6	Led5	Led4	Led3	Led2	Led1	Led0
0	●	●			●	●		
1			●	●			●	●

Bold indicate LED ON

Pattern2

State #	Led7	Led6	Led5	Led4	Led3	Led2	Led1	Led0
0				●	●			
1			●			●		
2		●					●	
3	●							●
4		●				●		
5			●			●		
6				●	●			

Bold indicate LED ON

Table 1(a): Result to be taken in Procedure IV

Input	Describe Display at Seven Segment Panel	Describe Pattern generated at LED Panel	Content of PINA
No Push Button pressed			
SW0 pressed			
SW1 pressed			
SW2 pressed			
SW3 pressed			

*Contents of PINA can be referred as shown in Figure 1.4.

Figure 1.4

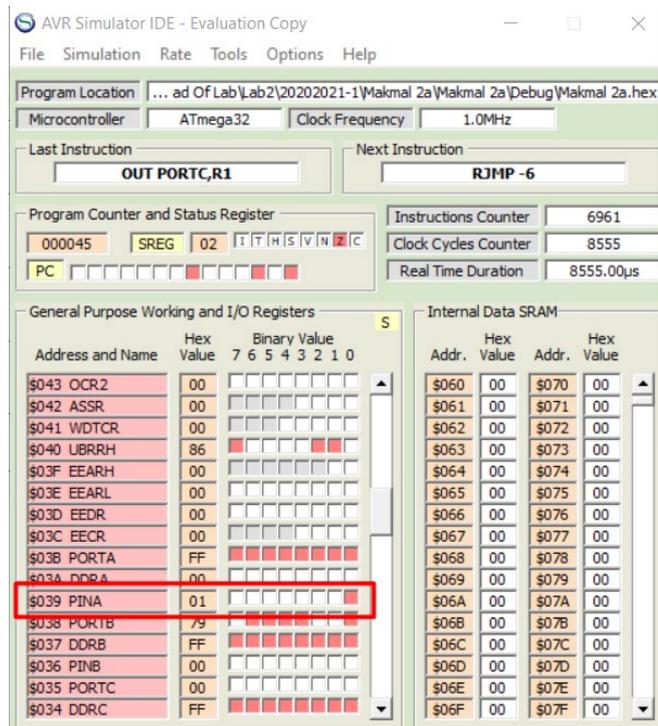**200ms Delay calculations using Timer 0:**

"Delay200msUsingTimer0" Function coding:

Figure 2

Wirite the additional code and its location in the program "Lab2Exp1.c" that need to be made to implement Procedure VI.

You may Cut and Paste from modified program:

Execution of Command when SW3 pressed: Working/Not working

Execution of Command when SW4 pressed: Working/Not working

Name and Signature of Lecturer:

Figure 3

5 Report Writing

Title:

Objective:

Equipment/Software Used:

Procedure:

    Written in third person (reporting) speech:

Result:

    Fill Table and Figures for Result and attach with result. Readings from I/O views, Watch etc. will require snapshot as evidence.

Discussion:

    Discuss based on Objective and Result. There shouldn't be any alien Objective and Result.

Conclusion:

    Conclude based on Objective, Result and Discussion.