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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2014/2015**

COURSE NAME : MICROCONTROLLER  
COURSE CODE : DAE 32203  
PROGRAM : 2 DAE  
EXAMINATION DATE : JUNE 2015 / JULY 2015  
DURATION : 2 ½ HOURS  
INSTRUCTION : ANSWER FOUR (4) QUESTIONS ONLY.

THIS QUESTION PAPER CONSISTS OF ELEVEN (11) PAGES

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**QUESTIONS IN ENGLISH**

- Q1** (a) Define briefly Microcontroller and compare **two (2)** differences between Microcontroller and Microprocessor. (7 marks)
- (a) Explain briefly the advantages of higher programming language. (2 marks)
- (b) **Figure Q1(c)** shows the memory structure of microcontroller. There are 8 data buses and **twelve (12)** address buses connected between CPU and memory. Considering 1Kb is equal to 1024bytes, calculate the size of the memory for this microcontroller. (2 marks)
- (c) **Figure Q1(d)** shows a sample circuit of keypad 1x2 connected to a microcontroller. Construct the circuit of keypad with size 3 x 3. (4 marks)
- (d) There are **two (2)** groups of memory system in Microcontroller to support the data or instruction executions.
- (i) List the **two (2)** group of memory systems and its definition. (2 marks)
- (ii) Briefly explain the definition of EEPROM and EPROM. (4 marks)
- (e) Microcontroller has mechanism called watchdog timer and hardware timer to support its operation.
- (i) Explain briefly the watchdog timer and how it works? (2 marks)
- (ii) Compare the difference between watchdog timer and hardware timer. (2 marks)

**Q2** Base on the circuit **Figure Q2**, write a running light application using MikroC language base on the condition below:

- (a) When button SW1 is pressed LED will light from D1 to D8 and when the SW2 is pressed LED will light from D8 to D1, while in standby mode all LED lights. During running light, only **one (1)** LED is ON in one time. Use **one (1)** second delay for each LED to switch ON and OFF.

(20 marks)

- (b) Construct the circuit to support answer in Q2(b).

(5 marks)

**Q3** Circuit in **Figure Q3** operates by showing the counter value by rising up the number value beginning from 0 to 9 with time interval 1 second. Delay Timer PIC is from Hardware Timer (TMR0) with prescaler 1:256 and preload value TMR0 is set to 100. If the PIC is provided with Oscillator frequency ( $F_{osc}$ ) 4 MHz,

- (a) Determine:

- (i) Time taken for TMR0 to overflow starting from 100 to 255.

(3 marks)

- (ii) Number of TMR0 overflows required to get 2 seconds delay.

(2 marks)

- (b) By using the TMR0 Timer write a C program where the Seven Segment display will show counting value from 0 to 9 continuously with time interval 1 second. Use the **Table Q3(b)** for Seven Segment binary number.

( 20 marks)

- Q4** (a) ADC is a unit in most modern microcontroller. Explain the purpose of having ADC unit in microcontroller. (2 marks)
- (b) (i) One of the specifications of ADC is resolution. Give reason why do we need that. (2 marks)
- (ii) Give **three (3)** examples of analog signals around us. (3 marks)
- (c) List all registers associate with an ADC. (4 marks)
- (d) Illustrate the connection of variable resistor to the input of ADC in PIC16F877A. (4 marks)
- (e) Explain each line of programming command listed below. (10 marks)
- ```
L1: TRISC = 0b11101000;  
L2: ADCON1 = 0x80;  
L3: Lcd_Config(&PORTD, 3, 1, 2, 7, 6, 5, 4);  
L4: Lcd_Out(2, 3, text1);  
L5: adcresult = Adc_Read(2);
```

**Q5** (a) **Figure Q5** shows the circuit of temperature sensor LM35 which analog input to a microcontroller. The output voltage of LM35 is proportional to the temperature by 0.1V: 1°C. Voltage reference( $V_{ref}$ ) used is +5V. Show the calculation to find :

(i) ADC value when  $V_{in}$  to AN2 is 4.5V (3 marks)

(ii) Temperature value in degree Celsius when  $V_{in}$  to AN2 is 3V. (2 marks)

(b) Write a C program for temperature application on PIC 16F877A based system. The system should show the current temperature value in degree Celsius on the LCD and two LEDs should active base on the **Table Q5(b)**:

**TABLE Q5(b)**

|                    | <b>LED D1</b> | <b>LED D2</b> | <b>Alarm</b> |
|--------------------|---------------|---------------|--------------|
| <b>Above 50° C</b> | ON            | OFF           | ON           |
| <b>Below 50° C</b> | OFF           | ON            | OFF          |

(20 marks)

**Q6** Circuit in **Figure Q6** operates by showing the direction of stepper motor rotation into LCD display and also on LED when one of the direction buttons is pressed.

(a) (i) Explain the function of ULN2003A driver.

(2 marks)

(ii) Evaluate how the speed of stepper motor can be controlled?

(2 marks)

(b) Stepper motors are very different from a regular DC motors. Instead of spinning like DC motors do, stepper motor steps at a specific resolution for each pulse.

(i) Construct the forward and reverse 8 step switching sequence for stepper motor.

(5 marks)

(ii) Based on answer in Q6 (b) (i), write a MikroC program to rotate the stepper motor with direction of button pressed and show the direction of rotation on LED and LCD.

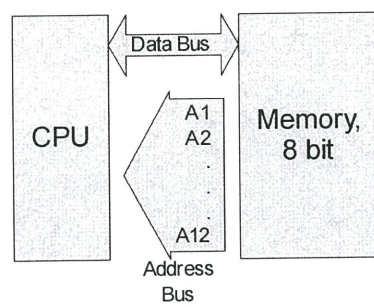
(16 marks)

**-END OF QUESTION-**

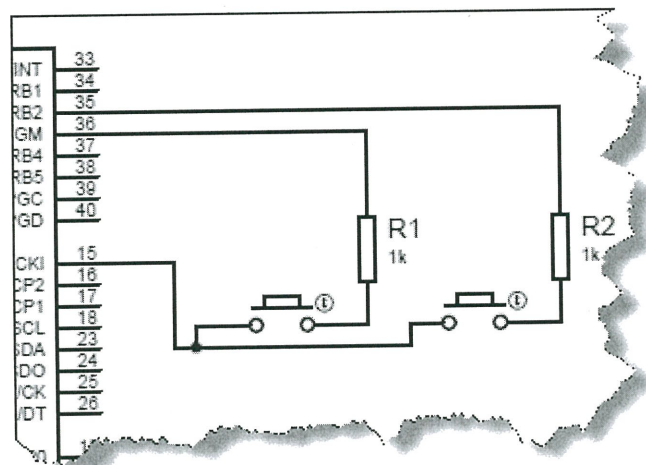
**FINAL EXAMINATION**

SEMESTER / SESSION: SEM II / 2014/2015  
COURSE NAME: MICROCONTROLLER

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COURSE CODE: DAE 32203



**FIGURE Q1(c)**



**FIGURE Q1(d)**

FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2014/2015  
COURSE NAME: MICROCONTROLLER

PROGRAMME : 2 DAE  
COURSE CODE: DAE 32203

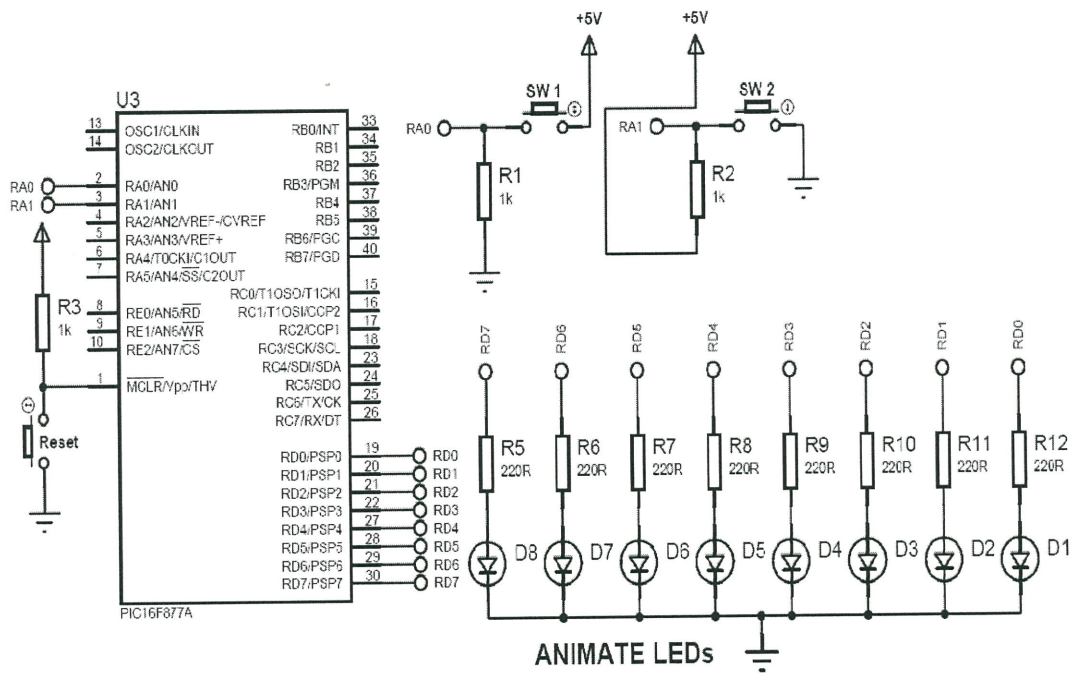


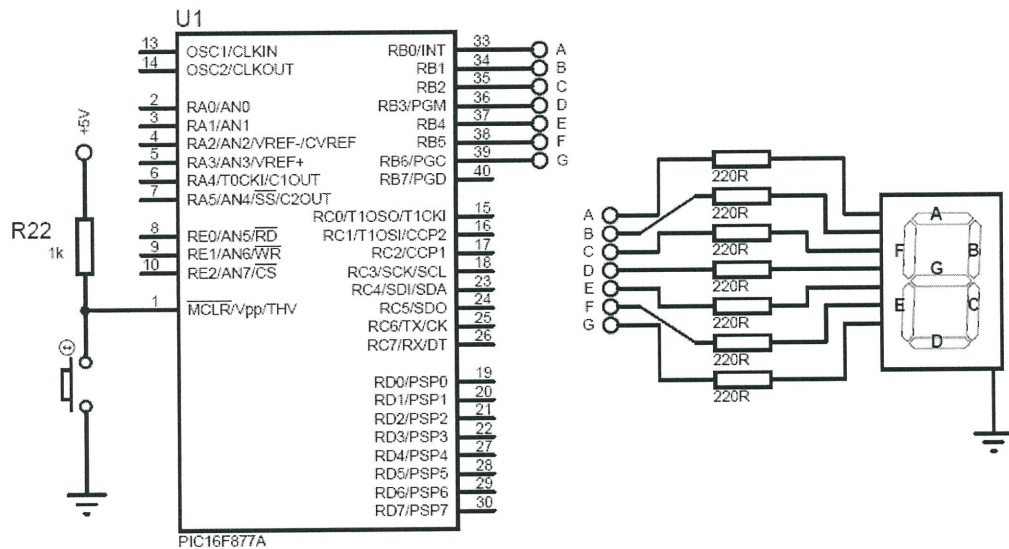
FIGURE Q2



**FINAL EXAMINATION**

SEMESTER / SESSION: SEM II / 2014/2015  
 COURSE NAME: MICROCONTROLLER

PROGRAMME : 2 DAE  
 COURSE CODE: DAE 32203



**FIGURE Q3**

**FIGURE Q3(b)**

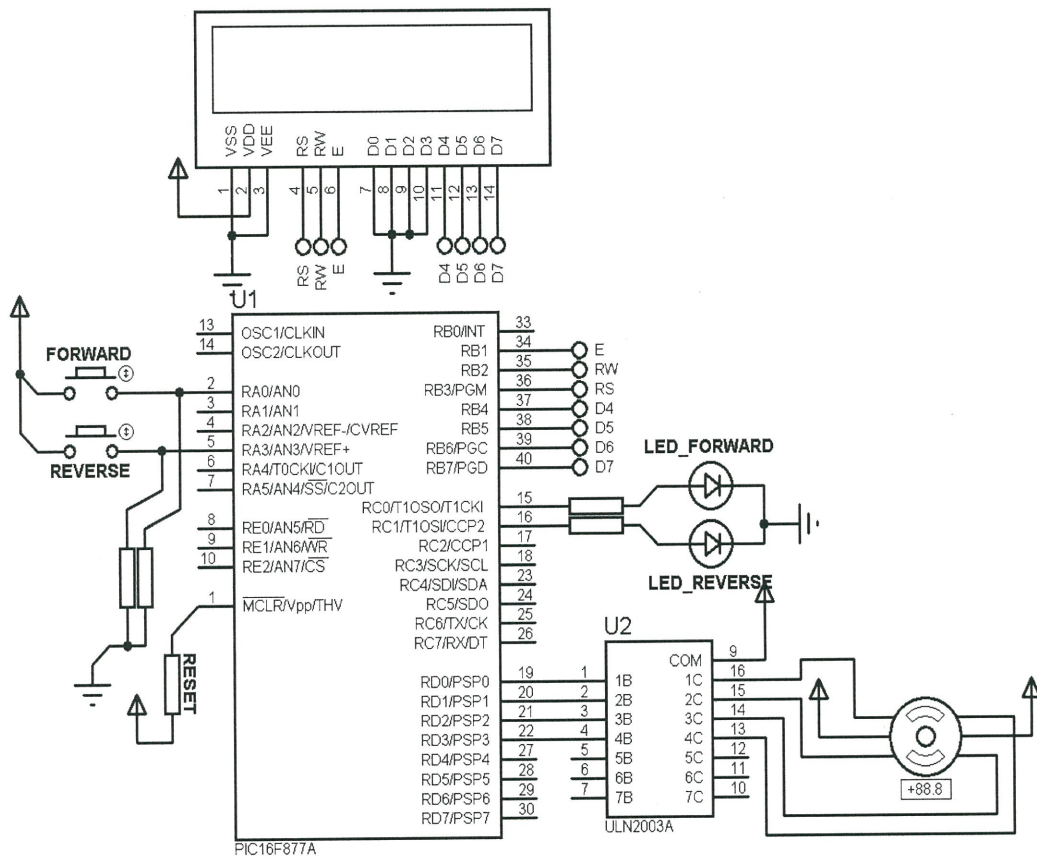
| Seven Segment No. | Binary value |
|-------------------|--------------|
| 9                 | 01101111     |
| 8                 | 01111111     |
| 7                 | 00000111     |
| 6                 | 01111101     |
| 5                 | 01101101     |
| 4                 | 01100110     |
| 3                 | 01001111     |
| 2                 | 01011011     |
| 1                 | 00000110     |
| 0                 | 00111111     |



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**FIGURE Q6**