Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 1
SESSION 2019/2020

COURSE NAME	:	MICROCONTROLLER
COURSE CODE	:	DAE 32203
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	DECEMBER 2019/JANUARY 2020
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **THREE (3)** QUESTIONS ONLY IN SECTION A AND **ALL** QUESTION IN SECTION B.

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

SECTION A

Q1 (a) Microcontroller technology is currently used widely in many applications such as in industry, medical, robotics and others.

(i) Give the definition of microcontroller.

(2 marks)

(ii) List **five (5)** elements in microcontroller.

(5 marks)

(b) (i) System bus is a collection of wires carrying information within a computer system. Briefly explain the **three (3)** types of busses.

(6 marks)

(ii) There are 8 data buses and 12 address buses connected between CPU and memory. Considering 1Kb is equal to 1024bytes. Calculate the size of the memory for this microcontroller.

(3 marks)

(c) **Figure Q1(c)** shows the UART, I2C, and SPI pins on an Arduino UNO. Define each of the terminologies and differentiate the characteristics of the protocols.

(9 marks)

Q2 (a) For digital Input/Output (I/O) pins, there are three (3) modes that can be used.

(i) State all the **three (3)** modes.

(3 marks)

(ii) From your answer in **Q3(a)(i)**, explain it properties.

(3 marks)

(b) Based on the circuit in **Figure Q2(b)**, write a complete code to turn ON the LED when push button is pressed and turn it OFF when push button is released.

(8 marks)

(c) Instead of using delay(), using timer, millis() offers a better alternative as it does not blocks other processes. In your own words, explain what the piece of code below does.

```
if (millis()>=time_action_0){
    time_action_0 = millis() + interval_0;
   }
```

(3 marks)

(d) Based on the circuit in **Figure Q2(d)**, write a code using interrupt to turn ON the LED WHILE the button is PRESSED, and OFF when it is RELEASED.

(8 marks)

Q3 (a) (i) Briefly explain **three (3)** components in LCD memory.

(6 marks)

(ii) Differentiate between command and data registers in LCD.

(4 marks)

(b) Write the correct syntax for the following statements.

(i) Display value of val in LCD.
(ii) Turn on blinking cursor
(iii) Reset display on LCD screen

(3 marks)

(c) Based on **Figure Q3(c)** build an Arduino program that display text "DAE 32202" in second row of LCD and it scrolling from left to right and then right to left and repeated again.

(12 marks)

Q4 (a) Microcontroller can controlled electric motor using Pulse Width Modulation (PWM), either to control speed or direction.

(i) Give **three (3)** types of motor than can be controlled using PWM.

(3 marks)

(ii) Define PWM.

(2 marks)

(iii) Sketch **three (3)** complete cycle of PWM with 90% duty cycle of a 5V input.

(3 marks)

(iv) Calculate the average output voltage of PWM in **Q4(a)(iii)**.

(3 marks)

(b) Based on the **Figure Q4(b)**, write a program to control a DC motor direction using two push buttons. Push button A is used to rotate the DC motor clockwise while push button B is use to rotate the DC motor anti-clockwise.

(14 marks)

SECTION B

Q5 Design a simple weather station system to monitor the surrounding temperature and measuring the wind speed. You are given an LM35 sensor to measure temperature and an anemometer to measure the wind speed. The specification of these two sensors as illustrated **Table Q5**. Two LEDs (i.e. Red and Green) are used as indicators of temperature and wind speed measurement. If the temperature is less than 33°C and the wind speed is below 50km/h, the Green LED will turn ON indicating that the weather condition is fine, while Red LED is OFF. Whereas, if the temperature is more than 33°C or the wind speed is more than 50km/h, the Red LED will turn ON to notify a warning of bad weather, while Green LED is turn OFF. Based on the information given,

(a) Illustrate the circuit diagram of the system.

(8 marks)

(b) Develop a program based on the operation stated.

(17 marks)

- END OF QUESTION -

FINAL EXAMINATION

SEMESTER/SESSION: SEM 1/2019/2020 PROGRAMME CODE: DAE
COURSE NAME : MICROCONTROLLER COURSE CODE: DAE 32203

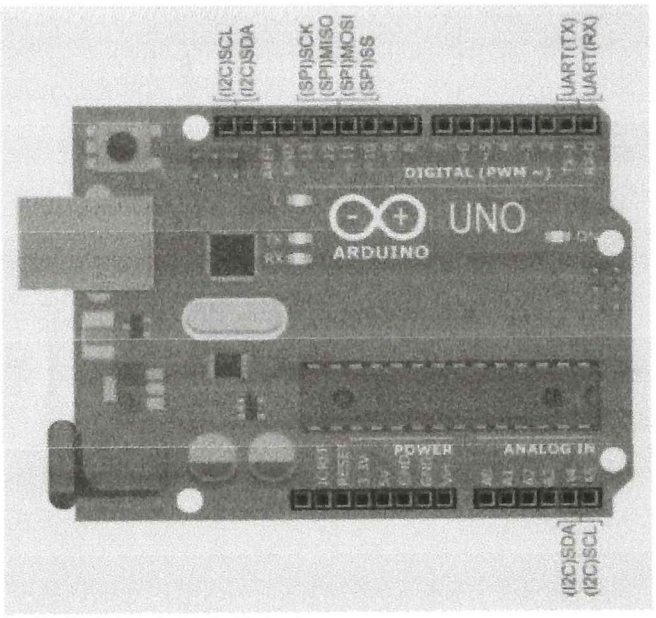


Figure Q1(c)

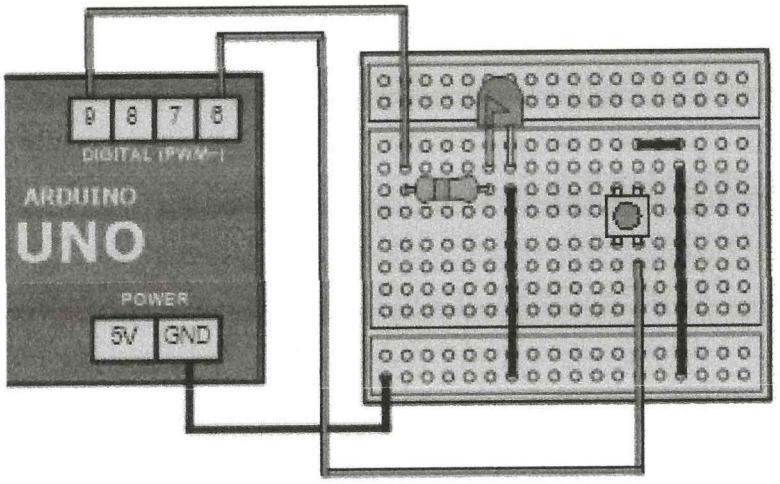


Figure Q2(b)

FINAL EXAMINATION

SEMESTER/SESSION: SEM 1/2019/2020 PROGRAMME CODE: DAE
COURSE NAME : MICROCONTROLLER COURSE CODE: DAE 32203

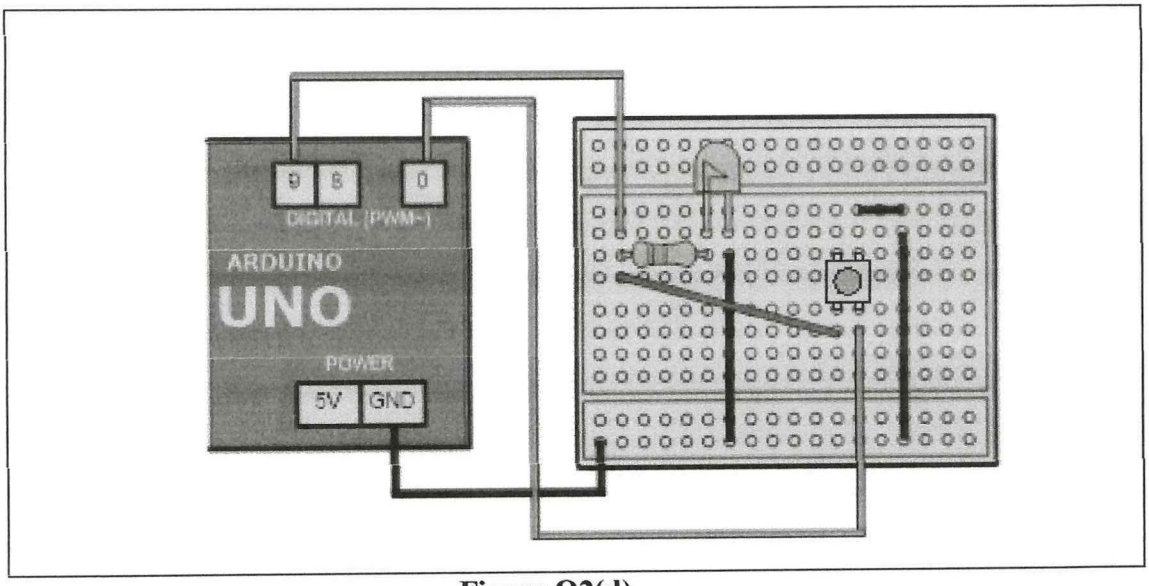


Figure Q2(d)

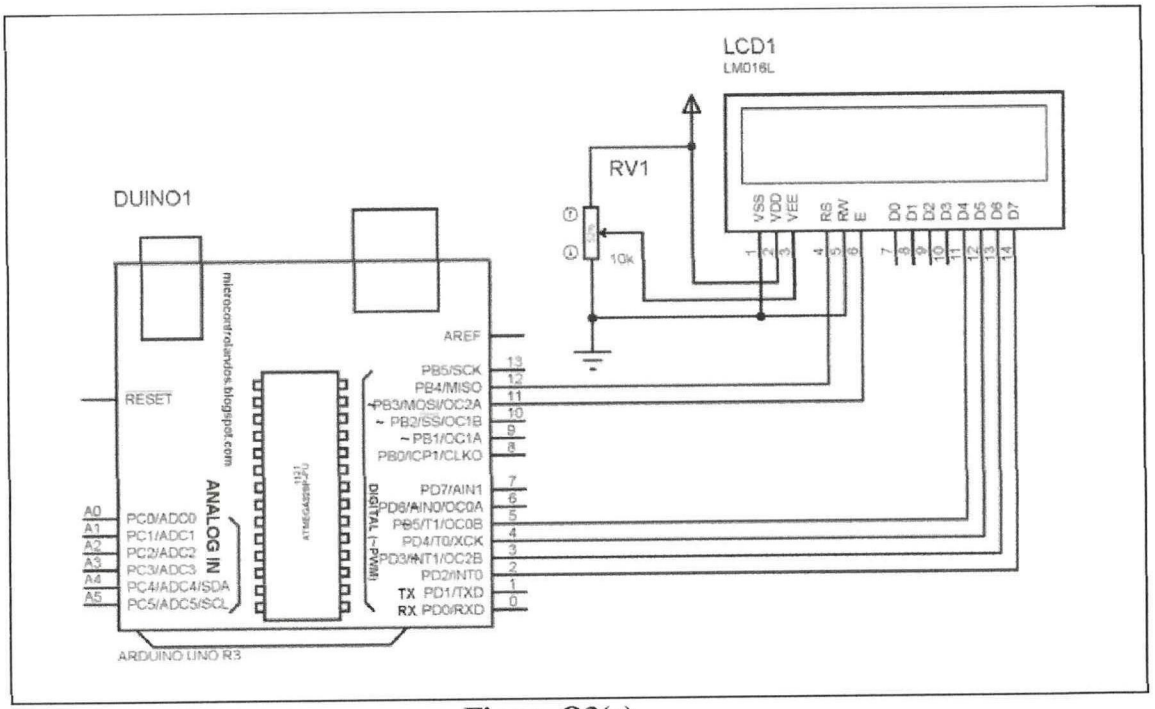


Figure Q3(c)

FINAL EXAMINATION

SEMESTER/SESSION: SEM 1/2019/2020 PROGRAMME CODE: DAE
COURSE NAME : MICROCONTROLLER COURSE CODE: DAE 32203

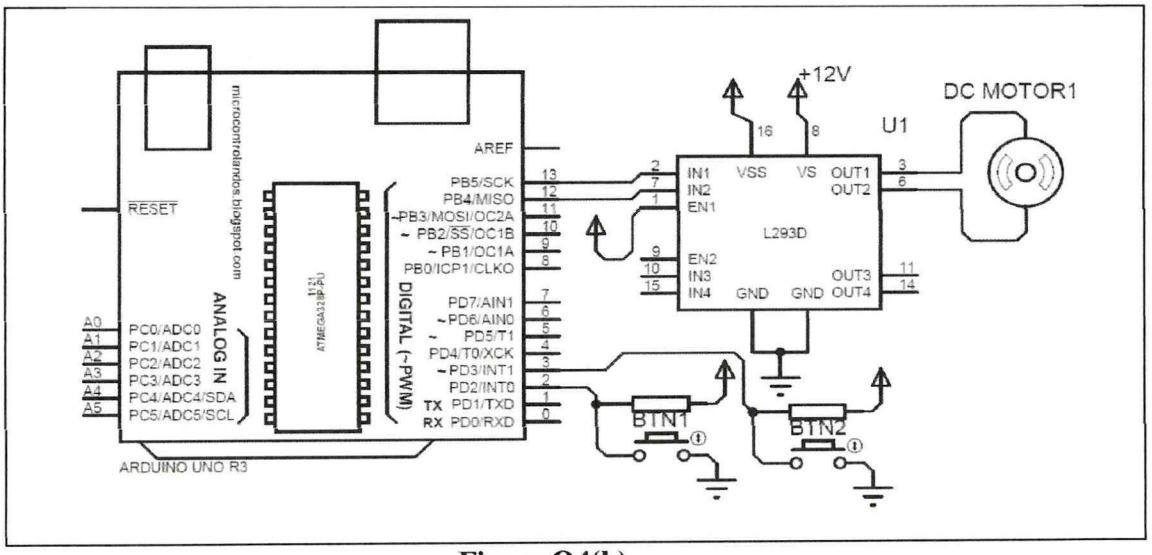
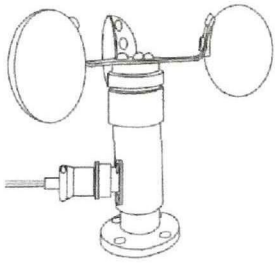


Figure Q4(b)

Table Q5

Instrument	Specification
LM35 Temperature sensor 	Vcc = 3.0V – 5.5V Temperature range: -55°C to 150°C Resolution: 10mV/ °C Pins: Vcc, GND, Vout
Anemometer 	Vcc = 3.3V – 5V Speed range: 0 km/h to 100km/h Resolution: 0.05 V/km/h Pins: Vcc, GND, Vout