



ABU DHABI POLYTECHNIC
Electromechanical Engineering
Department

EMEE-207
Embedded Systems

Final Examination

Semester 1 2017/2018

2 hours

Instructor

Students answer on the question paper
Calculators, drawing kits and dictionaries are allowed
No additional materials are required

STUDENT NAME

STUDENT
NUMBER

A

CRN

DEPARTMENT

READ THESE INSTRUCTIONS CAREFULLY

Write your name, number, and department clearly in the boxes above.

Answer **all** questions.

You may use a pencil for all your work.

Answers that are not **clearly readable**, if any, will not be marked.

Question	Score
1	/15
2	/10
3	/10
4	/10
5	/10
Total	

All mobile devices are not allowed during examination.

Abu Dhabi Polytechnic considers cheating or attempting to cheat a serious offense that will result in disciplinary action taken against involved individuals.

Question 1 (CLO:3,5):

1. A char variable size is
 - a. 8 bits
 - b. 16 bits
 - c. 32 bits
 - d. 1 bit

2. The ADC in the Arduino Uno Microcontroller is
 - a. 8 bits
 - b. 10 bits
 - c. 12 bits
 - d. 16 bits

3. For 25% duty cycle, the following decimal value must be sent to the analogWrite()
 - a. 0
 - b. 64
 - c. 127
 - d. 255

4. The maximum output of the PWM in the Arduino is equivalent to
 - a. 4 bits
 - b. 8 bits
 - c. 10 bits
 - d. 16 bits

5. -- performs the following operation
 - a. Decrement
 - b. Addition
 - c. Subtraction
 - d. Increment

6. The size of a float in the Arduino is
 - a. 8 bits
 - b. 16 bits
 - c. 32 bits
 - d. 64 bits

7. During operation, when the timer register reaches its maximum value, it
 - a. Stops
 - b. Overflows
 - c. Keeps incrementing

- d. Starts to decrement
8. An 8 bit timer can count from 0 to:
- 63
 - 127
 - 255
 - 1023
9. The following is a scheme to represent negative numbers in binary
- 2's complement
 - 1's complement
 - Both
 - None of the above
10. Bit number 3 of an 8-bit register (PORTB) needs to be set. Which of the following is an incorrect statement:
- $\text{PORTB} = 8;$
 - $\text{PORTB} = 1 \ll 3;$
 - $\text{PORTB} = 0b00001000;$
 - $\text{PORTB} = 0x03;$
11. If the clock frequency of a microcontroller is 4 MHz and the timer has a prescaler set to 128. Find:
- The time period T .
 - The total time (maximum delay) for an 8 bit timer register.
 - The total time (maximum delay) for a 16 bit timer register.
12. To enable the ADC of the microcontroller using AVR Port programming, bit number ____ of the ADCSRA register must be set to 1.
13. The AVR ATmega328P microcontroller has ____ 8 bit and ____ 16 bit timer(s).

Question 2 (CLO:3,4):

The code for the following question must use **port programming**.

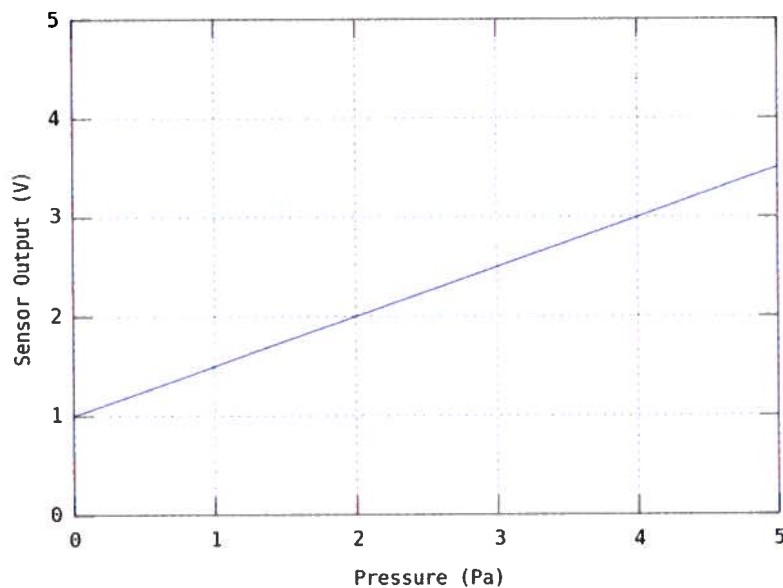
A Green LED is connected to pin number 0 of Port C.

A Red LED is connected to pin number 1 of Port C.

A gas container contains pressurized gas. The sensor gives an output voltage related to Pa (the unit of pressure). The characteristics of the sensor are shown in the figure below.

Using the figure, determine the offset and the coefficient values.

Hint: Unit of offset is V and unit of coefficient is V/Pa



Write a code to read the pressure of the container using the pressure sensor.

The Green LED should be switched on if the pressure reading is less than 200 Pa.

The Red LED should be switched on if the pressure reading exceeds 200 Pa.

DO NOT USE THE FOLLOWING COMMANDS IN YOUR PROGRAM:

ANALOGREAD, PINMODE, DIGITALWRITE

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Question 3 (CLO:2,4):

In the Arduino Uno microcontroller, there are 2 interrupt pins as shown in the table below:

Board	int.0	int.1
Uno	2	3

A button is connected to pin 3 of the Arduino Uno. This will be used to enable the interrupt.

An LED is connected to pin 10 of the Arduino Uno.

Using Arduino programming, write a code that toggles the LED (switches it on and off) every 5 seconds.

When the interrupt (pin 3) is enabled, the program should change the **toggling speed** to 2 second.

Question 4 (CLO:2.4):

Write an Arduino program for a circuit that includes a keypad and LCD.

The program allows the user to enter two numbers using the keypad.

The first number entered will be printed on the first line of the LCD and the second number will be printed on the second line of the LCD.

The numbers should remain on the screen unless the user enters another two numbers. Continue the code given below:

```
#include <LiquidCrystal.h>
#include <Keypad.h>
char key;
const int ROWS = 4; //four rows
const int COLS = 3; //three columns
char keys[ROWS][COLS] = {'1','2','3'},{'4','5','6'},{'7','8','9'},{'*','0','#'};
byte rowPins[ROWS] = {8,9,10,11}; //connect to the row pinouts of the keypad
byte colPins[COLS] = {12,13,A5}; //connect to the column pinouts of the keypad
Keypad keypad = Keypad( makeKeymap(keys), rowPins, colPins, ROWS, COLS );
LiquidCrystal lcd(2,3,4,5,6,7);
void setup() {lcd.begin(16, 2);}
void loop() {
```

Question 5 (CLO:2):

An AVR microcontroller has a clock frequency of 16 MHz.

Write a code to toggle an LED connected to pin 2 of Port B every 100 msec (millisecond) using an 8 bit timer.

The code **must** select a prescaler from among the following: 8, 64, 256 or 1024.

This program will require you to use interrupts.

Clearly show any calculations before you write the final code.