DUBLIN INSTITUTE OF TECHNOLOGY

DT211C BSc. (Honours) Degree in Computer Science (Infrastructure)

DT228 BSc. (Honours) Degree in Computer Science

DT282 BSc. (Honours) Degree in Computer Science (International)

Year 3

SUMMER EXAMINATIONS 2017/2018

PROGRAMMING FOR SMART OBJECTS [CMPU3050]

MR RICHARD LAWLOR

WEDNESDAY 16TH MAY 9.30 A.M. – 11.30 A.M.

TWO HOURS

QUESTION 1 IS **COMPULSORY**
ANSWER QUESTION 1 **AND** TWO OF THE OTHER THREE QUESTIONS

1. **(a)** Draw a schematic circuit diagram which shows how an Arduino board can be wired to read the temperature from a temperature sensor (TMP36) such that if the temperature is less than 20 degrees Celsius, a blue LED is turned on, otherwise a red one is enabled.

   Write an Arduino sketch which would output the temperature every 10 seconds and which also controls the LEDs as described above. Assume a range of -50 to 450 degrees Celsius with a sensitivity of 10mV/degree in the temperature sensor..

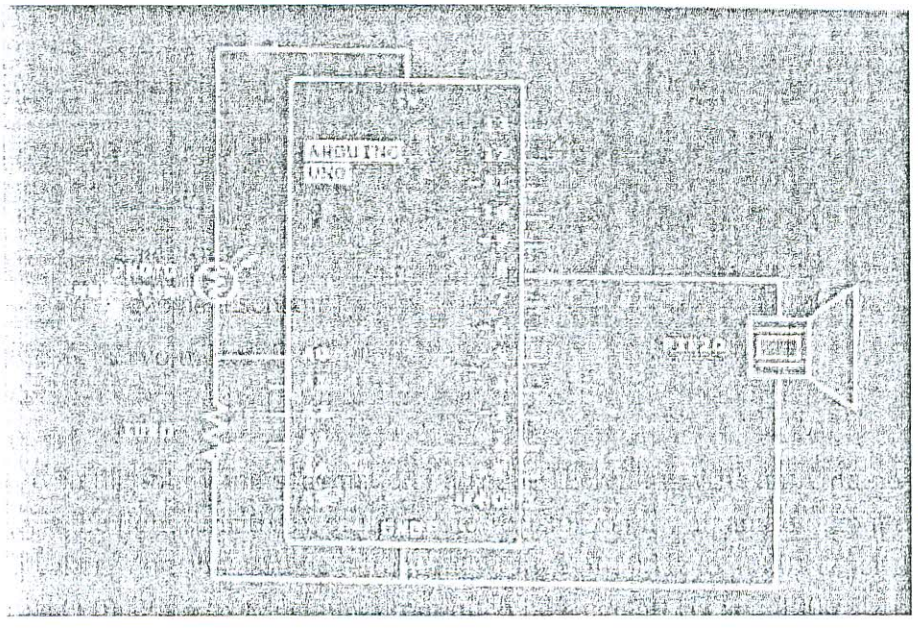
   (10 marks)

   (b) Briefly explain what the following electronic components are and what they can be used for (no circuit diagrams required):

   - photoresistor
   - potentiometer
   - capacitor
   - Piezo as a sensor
   - servo motor

   (10 marks)

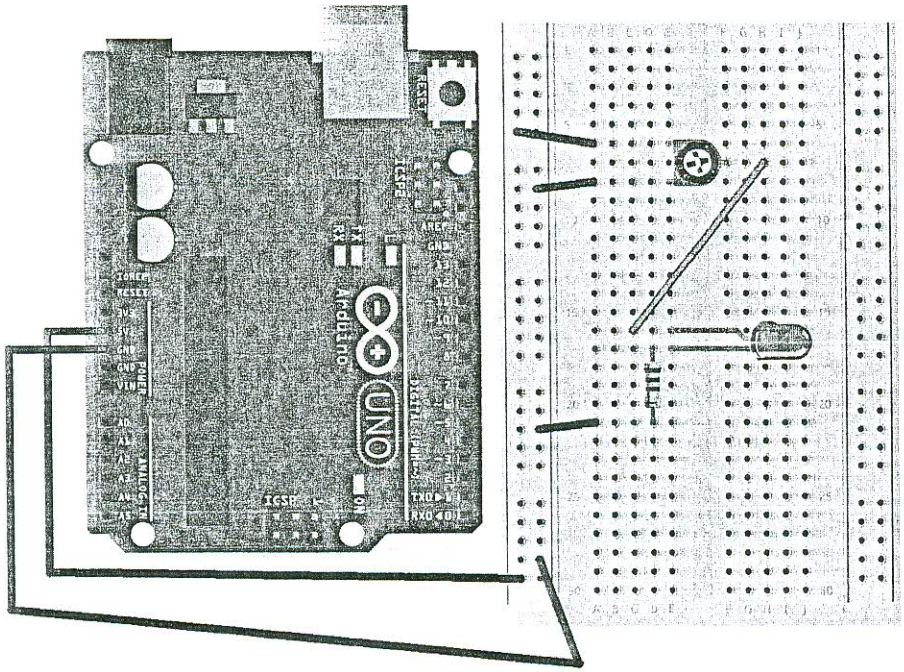
   (c) Given the following schematic of a Light Theremin, write an Arduino sketch which uses the light sensitivity of the photo-resistor to play an audio output on the piezo speaker. You can assume a frequency range of 50 Hz to 4000 Hz for the piezo. Use the map() function to select an output pitch between 50 Hz and 4000 Hz based on where the input at pin **A0** falls between the lowest and highest input values. To control the piezo, use the function: **tone(8, pitch, 20)**



   (10 marks)

(d) Given the following Arduino configuration, which uses a potentiometer's output as the LED input voltage, provide a schematic of a modified circuit so that the Arduino reads the potentiometer output and then uses it to calculate an output signal to the LED. The Arduino will supply the voltage to the LED through a PWM pin instead of the potentiometer.

Comment on difference between the two approaches.



(10 marks)

(e) Briefly describe and contrast the following wireless technologies for use in the *Internet of Things*:

- WiFi
- ZigBee
- RFID

(10 marks)

2. Critically discuss the potential impact on society of the *Internet of Things* under the heading "The Creepy New Wave of the Internet". The discussion can be divided into a number of subheadings such as:

- openness & privacy
- security & hacking
- internet of data versus internet of things
- techno-utopia as in "The Internet of Things frees human beings from the market economy to pursue nonmaterial shared interests on the Collaborative Commons"

(25 marks)

3. **(a)** Explain what a Temboo Choreo is.

(5 marks)

(b) Describe some of the preliminary security/authentication steps necessary so that a Temboo/Arduino app can append data to a Google spreadsheet.

(8 marks)

(c) Assuming that Google credentials have been setup, write down the significant code fragments along with explanatory text, to illustrate how sensor data can be appended to a Google spreadsheet. You can assume 10 minute intervals in transmitting data.

(12 marks)

4. **(a)** Briefly explain what a transistor is and how it can be used.

(5 marks)

(b) Draw a simple schematic diagram to show how a transistor could be used in conjunction with a DC motor so that it controls the motor.

(5 marks)

(c) Suppose you were to modify your circuit from part (b) by connecting a potentiometer to an analog input, and use that input to PWM the pin that controls the transistor. What do you think would happen to the motor's speed if you vary the voltage it is getting?

Draw a circuit schematic for this arrangement and write an appropriate Arduino sketch.

(15 marks)