Medical Electronics – Laboratory 2

Exercise 1

Build a circuit that displays number 10 on the 2-digit 7-segment display.

Schematic of a 1-digit 7-segment display:
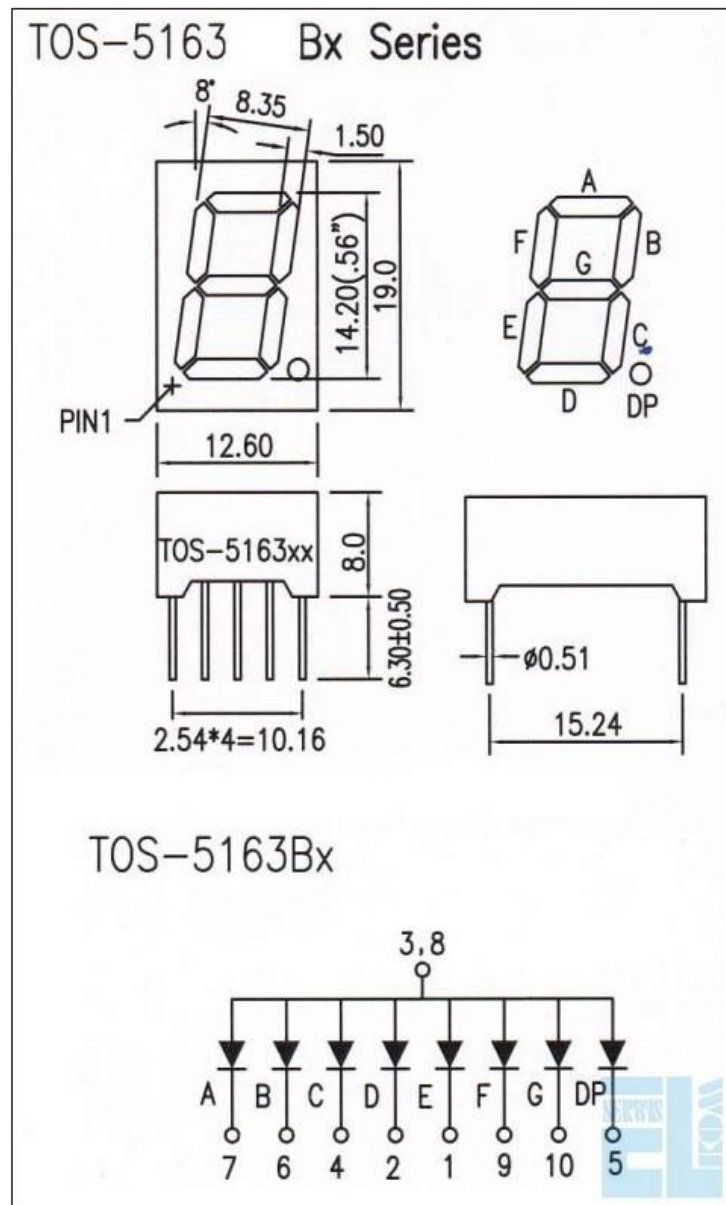

Figure 1 Documentation for the 7-segment display

Pins are counted in the anti-clockwise direction, starting from pin 1 at the left bottom corner.

Ports D4 and D5 on Arduino board are the control ports for digit 1 and 2. Segments of the digit from A to G are connected to Arduino ports D6-D12. Place the displays on the breadboard next to each other so that each pin is placed in the separate column. Use other 9 columns for connection to the Arduino board. The connection is presented in Figure 2. The relation between segments A(a)-G(g) is given in Figure 1. Complete circuit is shown in Figure 3.
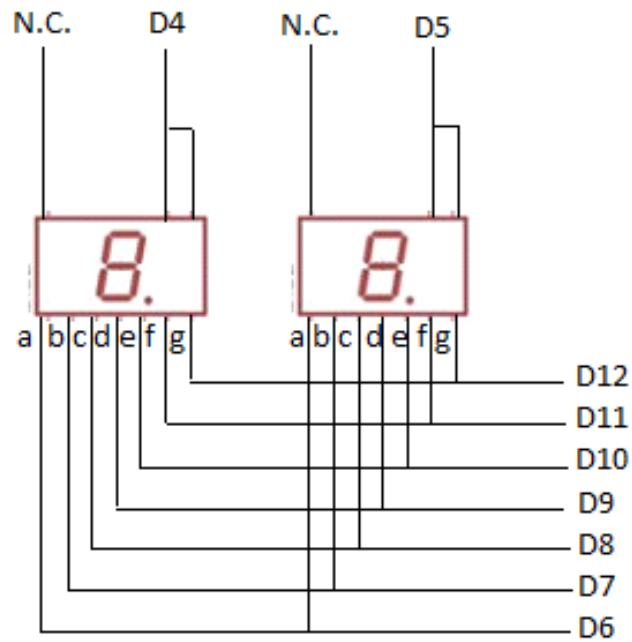

Figure 2 Connection of 2 7-segment displays to Arduino board
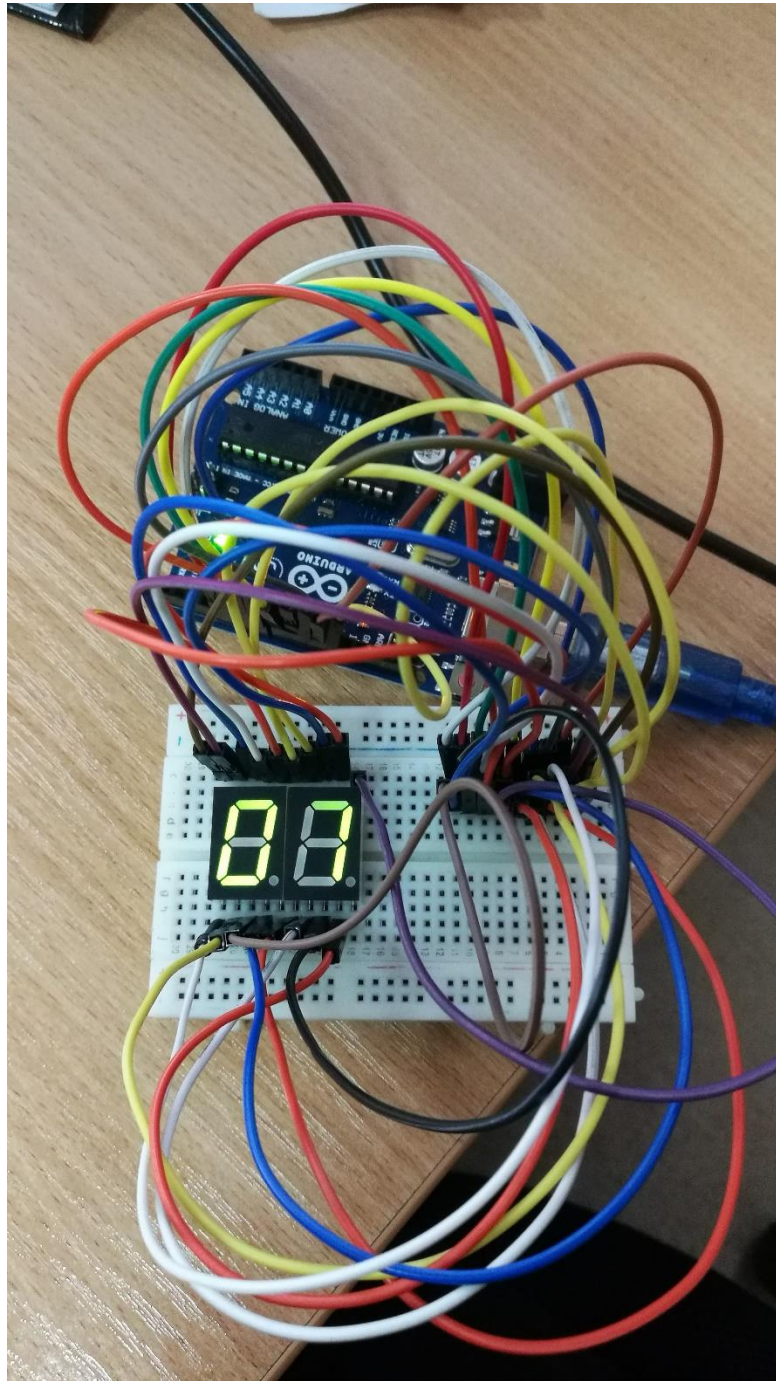
Figure 3 Complete circuit

The code for displaying number 10 is as follows:

```
#include "SevSeg.h"
SevSeg sevseg;
int a = 10;
unsigned long timer;
void setup() {
     sevseg.Begin(1,2,3,4,5,6,7,8,9,10,11,12,13);
}
void loop() {
  // put your main code here, to run repeatedly:
  sevseg.PrintOutput();
  unsigned long mils=millis();
  if (mils-timer>=1000)
  {
    timer=mils;
    sevseg.NewNum(a,(byte) 2);
  }
}
```

Exercise 2

Modify the code for the 2-digit 7-segment display to count from 0 to 10 in a loop in 1 second intervals.

Exercise 3

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Schematic of output pins in LM35 is presented in Figure 4.
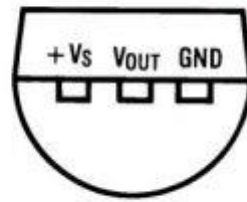
Figure 4 LM35 output pins

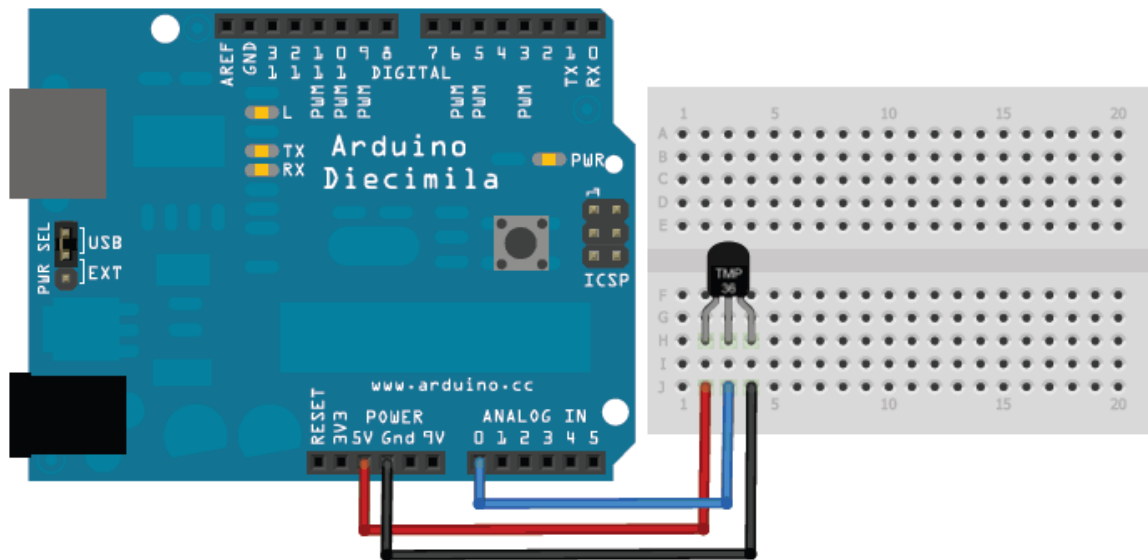Build a circuit with LM35 temperature sensor (Figure 5).

Figure 5 Connection for LM35 sensor

Implement a code to display the readings from LM35 sensor in the serial monitor of Arduino IDE:

```
int refreshTime = 500; //how many seconds should it wait before it
//checks and displays the temp again? 1000 = 1 second
unsigned long timer;
float temperature = 0;


void setup() {
  Serial.begin(9600);
}


void loop() {
    //Reads the input and converts it to Celsius degrees
  temperature = analogRead(0) * 0.004882812 * 100;


  unsigned long mils=millis();
  if (mils-timer>=refreshTime) {
    timer=mils;
    //Print teperature in serial monitor
    Serial.println(temperature);
  }
}
```

Observe the output in Serial Monitor (Figure 6) and the plot (Figure 7) when keeping the sensor in your fingers to increase the temperature.
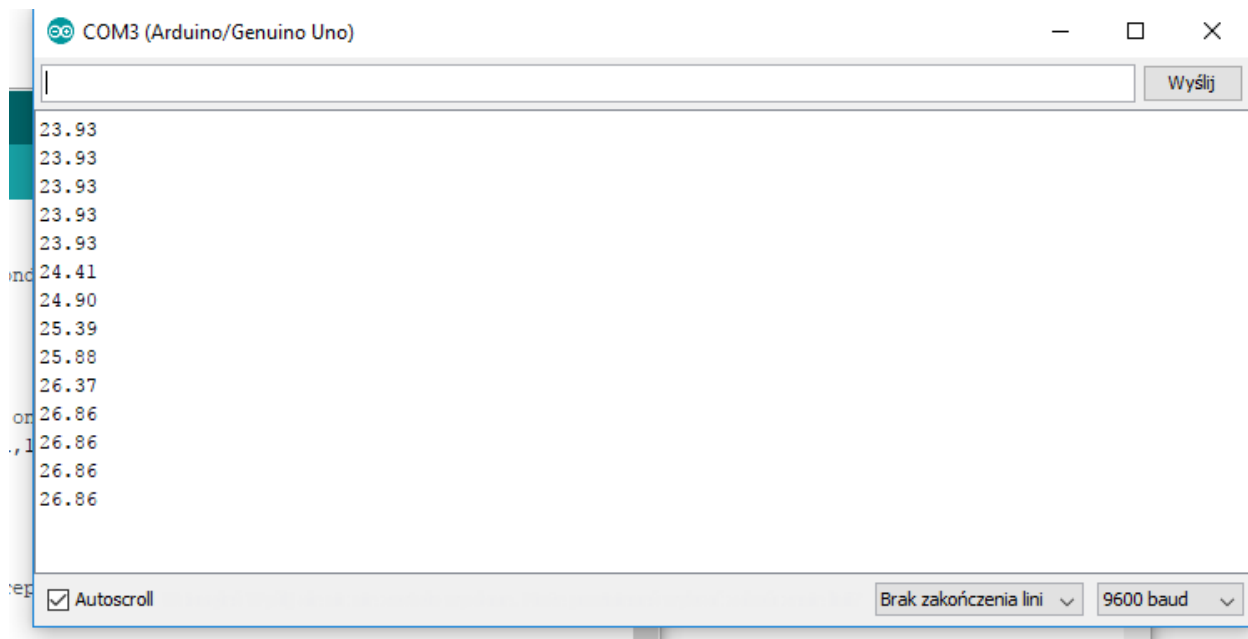
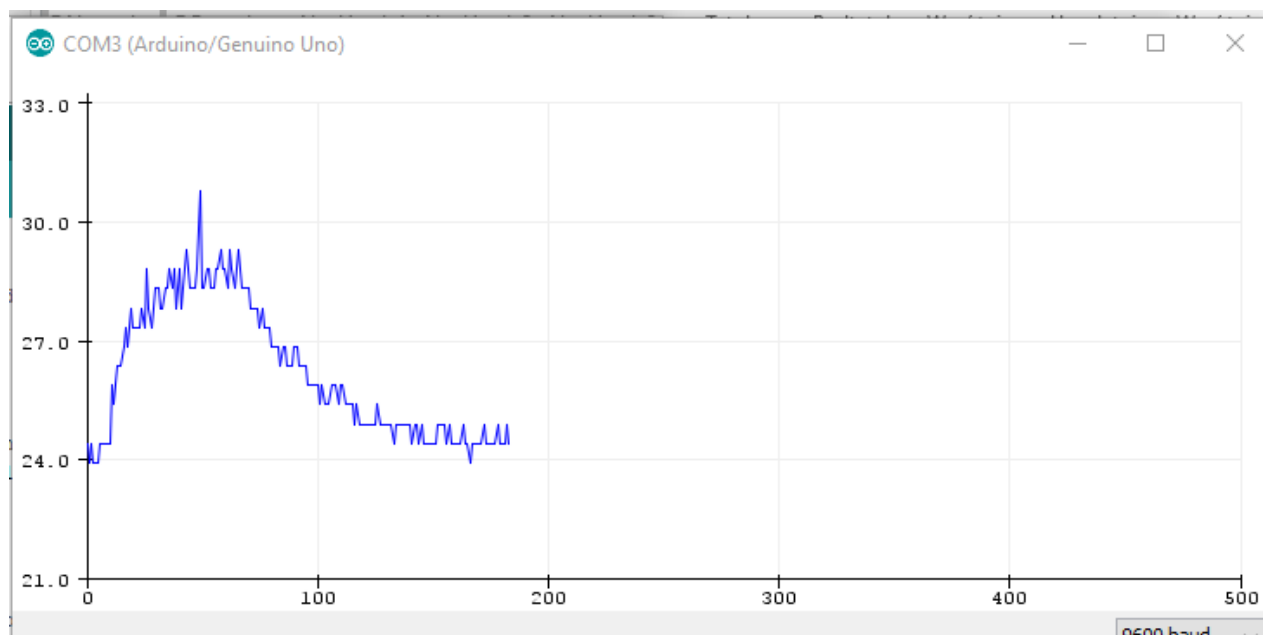*Figure 6 Data displayed in serial monitor*

Figure 7 Plotted data from temperature LM35 sensor

Exercise 4

Modify the code using the code from Exercise 1 to display the temperature from the sensor using 7-segment display.