	COLLEGE OF COMPUTING AND INFORMATION SCIENCES		
	Lab Assessment Summer 2020 Semester		
Class Id	104486	**Course Title**	Computer Architecture (CA)
Program	BSCS	**Campus / Shift**	Main Campus / Morning
Date	28/7/2020	**Total Marks**	20
Duration	03 hours	**Faculty Name**	Abuzar Zafar
Student Id	63555	**Student Name**	Muhammad Umair Hasan

Instructions:

- Fill out your Student ID and Student Name in above header.
- Do not remove or change any part question paper.
- Write down your answers with title "Answer for Question# 00".
- Handwritten text or image should be on A4 size page with clear visibility of contents.
- In case of CHEATING, COPIED material or any unfair means would result in negative marking or ZERO.
- **Caution:** Duration to perform LAB Assessment is **03 hours only including submission**. **Therefore, if you failed to upload answer sheet on LMS (in PDF format) within 3 hours limit, you would be considered as ABSENT/FAILED.**

Q1) You have to design a stop watch by using LCD, three push buttons and Arduino. One button is to start the time and other button is to stop the time. The third button is used to reset the timer. The display on lcd should be like this "00:00:00"

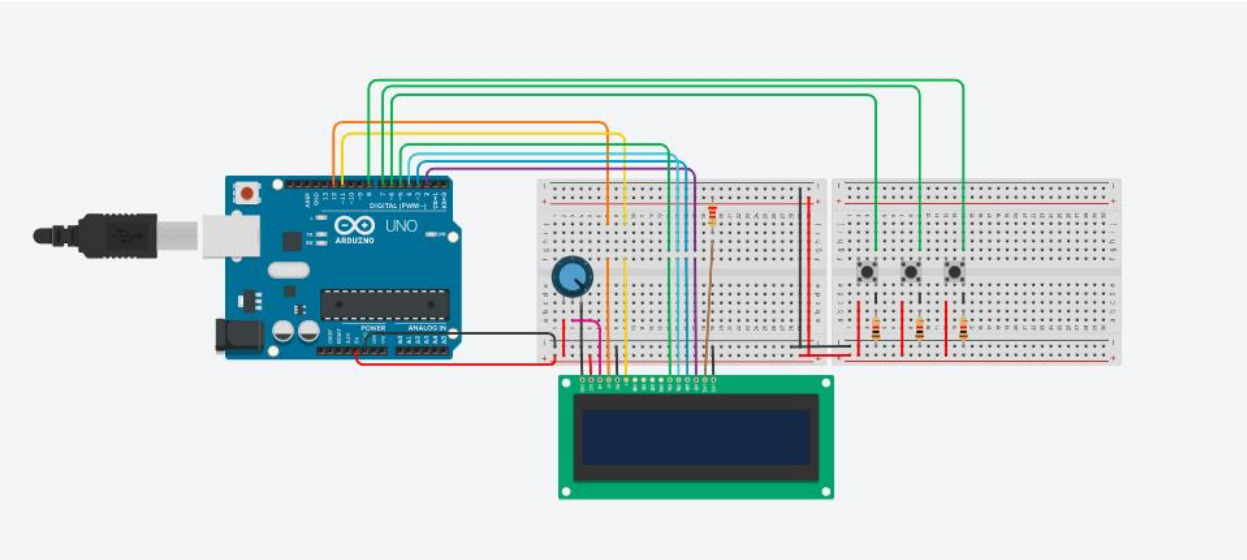
Solution:

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

const int buttonPin1 = 6;

const int buttonPin2 = 7;

const int buttonPin3 = 8;



enum eState {STOPPED, STARTED, PAUSED, BACKGROUND};



int buttonState1 = 0;

int buttonState2 = 0;

int buttonState3 = 0;

long startTime ;
```

```
long elapsedTime ;
long pausedTime;
int fractional;

long reportTime;
eState state;

void setup() {
  pinMode(buttonPin1, INPUT);
  pinMode(buttonPin2, INPUT);
  pinMode(buttonPin3, INPUT);
  lcd.begin(16,2);
  reportTime = millis();
  lcd.println("stop watch begins.");
  state = STOPPED;
}

void loop(){

    buttonState1 = digitalRead(buttonPin1);
    buttonState2 = digitalRead(buttonPin2);
    buttonState3 = digitalRead(buttonPin3);

    if(state == STOPPED) {
      if (buttonState1 == HIGH) {

        startTime = millis();
        state = STARTED;

        lcd.println(state);
        lcd.clear();
        delay(200);
```

```
   lcd.clear();
  }
 } else if(state == STARTED) {
  if (buttonState1 == HIGH) {

   state = STOPPED;
   lcd.println(state);
   delay(200);
  } else {
   elapsedTime =   millis() - startTime;
                    if(millis() - reportTime > 500) {
          reportTime = millis();

    lcd.print( (int)(elapsedTime / 1000L));

    lcd.print(".");

     fractional = (int)(elapsedTime % 1000L);

     if (fractional == 0)

       lcd.print("00");

     else if (fractional < 10)

       lcd.print("00");
     else if (fractional < 100)

       lcd.print("00");

    lcd.println(fractional);
   }
```

```
      if (buttonState2 == HIGH) {


                    state = PAUSED;
          pausedTime = elapsedTime;
        lcd.println("PAUSED ...");
        delay(200);
      }
      if (buttonState3 == HIGH) {


          state = BACKGROUND;
        lcd.println("RUNNING IN BACKGROUND ...");
        delay(200);
      }
    }
  } else if(state == PAUSED) {
    if (buttonState2 == HIGH) {


      state = STARTED;


      startTime += millis() - pausedTime;
      delay(200);
    }
  } else if(state == BACKGROUND) {
    if (buttonState3 == HIGH) {


      state = STARTED;
      delay(200);
    }
  }
}
```


UNO
ARDUINO
DIGITAL (PWM~)
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