

# ELEC334 Project2

November 23, 2020



## Objective

---

Main objective of this project/midterm is to create a **fully operational scientific calculator** in C. This calculator will have a keypad connected to enter the numbers and execute basic scientific and trigonometric functions. A 4-digit seven segment display should be used to display these numbers.

## Approach

---

1. Draw a detailed flowchart of the design. Determine interrupts, what will happen in them, what will happen in your main loop, vs. This flowchart will be very helpful for your coding process.
  - Utilize interrupts for all functionality.
  - Probably your main loop should be empty.
2. Determine tasks for the project. These tasks should be as basic as possible, and once completed, can be checkmarked easily. Requirements items should be considered as part of these tasks.
3. Gradually complete the tasks and incorporate them into your project. Don't do everything at once. Your flowchart here will help you a lot.

## Requirements for the project

---

*Make sure to read and understand the requirements for each section since your grade will depend on it.*

### Technical requirements

- Written in C. No HAL or equivalent libraries.
- A keypad and a seven-segment display should be attached.
- On power up SSD should show your ID (last 4 digits).
  - As soon as a number is pressed, everything should be cleared and only your number should be displayed.
  - If no button is pressed for 10 seconds, the SSD should turn off - go back to the IDLE state.
- When keys are entered, the SSD should shift the numbers to the left, while not displaying anything for empty digits.
- If the digits are already full, new number key presses should be ignored.
- ABCDEF keys should be used as:
  - A is for addition
  - B is for subtraction
  - C is for multiplication
  - D is for division
  - E key is scientific mode, and will expect another keypress.
    - EA is for log

- EB is for  $\ln$
- EC is for  $\sqrt{x}$
- ED is for  $x^2$
- EE is for trigonometric mode, and will expect another keypress.
  - EEA is for  $\sin$
  - EEB is for  $\cos$
  - EEC is for  $\tan$
  - EED is for  $\cot$
  - EEE is for  $\pi$  (will replace the number with 3.141)
- F key is for enter/equal
- Scientific and trigonometric modes will require floating point number system.
  - Floating point numbers should be displayed with the appropriate dot. For example if you want to show 1.2345152 – SSD should display 1.234 and if you want to display 4213.123 it should display 4213.
- Negative numbers should have a negative sign. i.e -124 on the SSD.
- If the numbers overflows 9999 or -999, it should display overflow (i.e. OuFL)
- If the operation is invalid (i.e.  $3/0$  or  $\sqrt{-2}$ ) it should display invalid (i.e. Invd)
- If no keys are pressed for 10 seconds, the SSD should turn off. – go back to IDLE state.
- If directly a function is invoked, the current value should be used. For example, if the last answer is 4 and - 4 is pressed, it should do  $4 - 4$  operation and display 0. If in the beginning, the number should be assumed 0.

## Quality requirements

- No bouncing on the buttons
- No considerable delay with button presses
- No flickering on the displays
- Code should be properly commented with your name / school ID added in the beginning

## Submission requirements

1. A 1-minute video of your project demonstration
  - Record the video explaining your code briefly, and show the demonstration.
  - Preferably hold the camera still.
  - Upload the video to wherever you want (youtube / onedrive / stream) and give a link.
2. A well-written report in PDF format
  - Cover page
  - Block diagram as well as connection diagram
  - Flow chart
  - Parts list (w/ prices)
  - Project setup w/ picture
  - Task list and their completion status (checkmark / x should be suffice)
  - Methodology for any numerical work
  - References
  - Properly formatted code list in Appendix. Your code list should have a fontsize of 10 and single spaced with monospace font.
  - Any missing parts of the project and explanation why they are missing
  - Any challenges that you faced and how you resolved them.
  - conclusion about what you learned from the project
3. Your submission should be a zip file with the following name  
 yourname.lastname.project2.zip

The zip file should have the following folder structure

---

```
1  yourname.lastname.project2/  
2    report/  
3      yourname.lastname.project2.report.pdf  
4    code/  
5      project2.c  
6      project2.h  
7      anyextrafiles.c/h  
8    video/  
9      video_link.txt
```

---