Spring 2023

EEE-212 Microprocessors

Project Assignment 1

1- Introduction

In this lab you are asked to calculate derivative and integral of a polynomial using KL25z freedom board, 16x2 LCD and 4x4 keypad modules. Degree of the polynomial is fixed to **5**. You need to use keypad to take polynomial coefficients as input and you are expected to show your results on the LCD.

Your function should be in the following manner:

$$C_5 x^5 + C_4 x^4 + C_3 x^3 + C_2 x^2 + C_1 x + C_0$$

Each coefficient C_i will be specified according to keypad input and they should be **positive single digit integers**. For example,

$$123456 = C_5 C_4 C_3 C_2 C_1 C_0$$

2- Implementation

2.1- Determine Coefficients

At the power-up of your code you should determine polynomial coefficients. After determining coefficients according to keypad input please demonstrate your polynomial on the LCD screen. Note that you are expected to demonstrate in one of the following forms:

$$C_5 C_4 C_3 C_2 C_1 C_0$$
$$C_0 C_1 C_2 C_3 C_4 C_5$$

After displaying coefficients on the screen, wait for keypad input **"#"** to move to the next step.

2.2- Select Operation

In this step you need to wait for keypad input to determine which calculation you are going to make. First, print **"Select Operation:"** on the screen, then wait for the user input.
If user input is:
- **"#"** -> Go to derivation state.
- **"*"** -> Go to integration state.

2.3- Differentiation (30%)

In this state ask for a differentiation point from the user. Then calculate and demonstrate your differentiation result for the given differentiation point input. Print **"Enter a pt"** on the LCD while taking the input.

Note that differentiation point should be **positive integer** and you should be able to demonstrate your calculations with at least 3 significant digits after the comma (i.e. 3.**141**).

2.4- Integral (50%)

In this state ask for integration starting and ending points from the user. Then calculate and demonstrate your integration result for given inputs. Print **"Start"** on the screen. Take the input. Print **"Finish"**, take the input again. Print the result.

Note: Integration points (start and finish) should be **positive integer** and you should be able to demonstrate your calculations with at least 3 significant digits after the comma.

Note: ±5% of error will be tolerated. If the error is more than that, points will be deducted from your grade.
Note: Quality of display and ease of use are grading factors (20%). If the inputs and necessary texts are not on the screen or keypad is glitchy, points will be deducted from your grade.
Note: To finish taking inputs, use **"#".**

Hint: You can approximate the derivative with the definition of derivative.
Hint: You may use Riemann sum for integration.
Hint: You may use float data type for calculations.