UNIVERSITY OF LIVERPOOL

Department of Electrical Engineering and Electronics

ELEC422

Microprocessor Systems

Assignment 1

Module	ELEC422
Coursework name	Assignment 1
Component weight	Assignment 1 = 30%
Semester	2
HE Level	7
Lab location	EEE Building A402 as timetabled – Thursday 9am-noon
Work	Individually
Timetabled time	21 hours (3 hours per week – Thursday 9am-noon)
Suggested private study	10 hours including report writing
How much time did it take you?	Let us know anonymously via https://bit.ly/EEECARES
Assessment method	Individual, formal word-processed reports (Diagrams can be hand drawn and scanned into the report)
Submission format	Online via Canvas
Submission deadline	Sunday week 6 - 10th March 2024
Late submission	Standard university penalty applies
Resit opportunity	Students failing the module and Assignment 1 will have an alternative assignment in the Summer
Marking policy	Marked and moderated independently
Anonymous marking	Yes
Feedback	Via comments on CANVAS submission on-line
Learning outcomes	LO2: On successful completion of the module students should be able to program the Cortex M series in Assembly Language.

Marking Criteria

Section	Marks available	Indicative characteristics	
		Adequate / pass (50%)	**Very good / Excellent**
Presentation and structure	20%	• Contains cover page information, table of contents, sections with appropriate headings. • Comprehensible language; punctuation, grammar and spelling accurate. • Equations legible, numbered and presented correctly. • Appropriately formatted reference list.	• Appropriate use of technical, mathematic and academic terminology and conventions. • Word processed with consistent formatting. • Pages numbered, figures and tables captioned. • All sections clearly signposted. • Correct cross-referencing (of figures, tables, equations) and citations.
Introduction, Method and Design	40%	• Problem background introduced clearly. • Evidence of a Top Down Design approach • Testing approach introduced	• Appropriate range of references used. • Design decisions justified with alternatives given. • Justification of design choice decisions.
Results	30%	• Results presented with explanations of what they represent.	• Full coverage of all testing and results.
Discussion	10%	• Discussion on what worked and what didn't.	• Discussion on how the system was fully tested and how the system could be improved.

DEPARTMENT OF ELECTRICAL ENGINEERING AND ELECTRONICS

ELEC422 Microprocessor Systems: Assignment 1: Due 10th March 2024

30% of the total marks for ELEC422 are for Assignment 1.

REMINDER – READ THIS CAREFULLY

Most of the marks come from completion of a good design, testing and documentation to show this has been done.

Give ONLY items requested – make sure you give everything requested BUT nothing else.

Simply providing a program which is claimed to work **might only obtain a mark of 10%**

This assignment has been split into 3 parts, Parts A, B & C. Before starting coding you should use a top down design methodology to design your program. You should submit the design documentation in your report. Flow charts, or an equivalent, should be used to design your code.

Submission Deadline

Electronic copy: Sunday 10th March 2024 @ 11:59pm (via Canvas)

J.S. Smith – 12th February 2024

Part A - Display

Part A is to get you familiar with the FRDM-K64F board, MBED and how to use the application shield. You should develop a program that displays your name and your user ID on the LCD screen of the Application Shield. Then when the user presses the up cursor key the number should increment, similarly when the user presses the down cursor key the number should decrement. Your code should adjust the rate at which the number changes to make it relatively easy to increment and decrement numbers. You are free to use any MBED libraries that you can find to drive the LCD, read the cursor etc.

Part B – Assembly Square root

Part B is to improve your assembly language programming of the Cortex M4. You are to write two assembly language subroutines that calculates the square root of a number entered. As you are only required to deal with positive integers it should select the largest positive integer closest but less than or equal to the square root of the number.

You should add your assembly language modules to the code you developed in Part A such that the one routine is called with the current number selected when the left cursor key is pressed and the other routine when the right cursor key is pressed. The value returned by your square root subroutine should then be displayed on the LCD display. One of the routines should use the FPU whilst the other should not. Using whatever method you wish indicate which routine is quickest and by how much.

Part C – ADC using Freescale Libraries

Part C is to give you experience of using the Manufacturers' supplied SDK (KSDK) to access peripherals on the Microcontroller. Therefore, you are not allowed to use MBED libraries for this part but only the Manufacturers' libraries that have been uploaded onto Canvas and are also available as examples in Keil.

The assignment requires you to read the values of the ADC inputs that are connected to Pot 1 and Pot 2 of the Application shield and display the results on a PC connected via the serial port. The PC should be running a terminal program which displays the ascii values sent from the FRDM-K64F board via the serial port. Messages like 'Pot 1 = 1.15V" should be displayed on the terminal.

The value from Pot 1 should be repeatedly sampled at a user defined rate, whilst the value of Pot 2 should be sampled when the Joystick is pressed up. There are a number of different methods for doing this sampling and your report should justify the choice of your method. You can choose to have a fixed user defined rate for Pot 1 or allow it to be adjusted by your software.

ELEC422: Assignment 1

Part A (30 marks maximum) – Note if you complete Part B you don't need to write a separate report for Part A as the material will be included in Part B

i) Top down structure diagram
ii) Flow charts or equivalent
iii) The source file for your program – **must match design files and be well commented.**
iv) Testing scheme (including results) – Write your programme using compact subroutines to make this stage easier.
v) Photos of LCD display showing name and number.

Part B (30 marks maximum)

i) Top down structure diagram
ii) Flow charts or equivalent (of Square root function)
iii) The source file for your program – **must match charts and be well commented.**
iv) The list file produced by the assembler
v) Testing scheme (including results)
vi) Short (max 200 words) explanation of what results were obtained.
vii) Photos of LCD display showing results

Part C (40 marks maximum)

i) Outline of methods used
ii) Top down structure diagram
iii) Flow charts or equivalent (of functions)
iv) The source file for your program – **must match charts and be well commented.**
v) Testing scheme (including results)
vi) Short (max 200 words) explanation of what results were obtained.
vii) Screen dumps of serial terminal display showing results
viii) Explanation as to how the system could be improved.

Warning

When marking the reports I will be looking very closely for any signs of collusion, as this is unacceptable. I need to assess your own ability not that of your friend or colleague. If I find any evidence of collusion then the formal University rules will be followed which normally results in all parties involved in the collusion being awarded 0 (i.e. if you do the original work and knowingly let somebody copy it you will be awarded 0). The points that I will be looking for, to indicate collusion, will be similar filenames, similar variable names, similar register usage etc.