

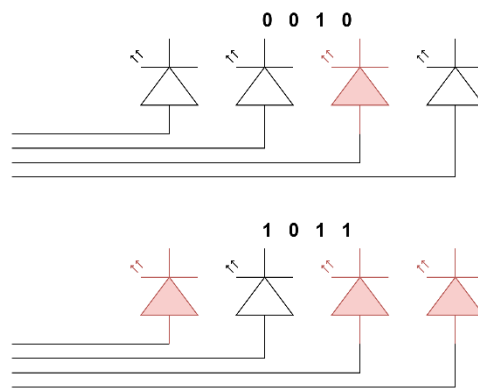
EEE 212 Microprocessors

Laboratory Assignment 3

Due Date: 15.04.2024 – 13.30

Assignment Details

In this assignment, you will implement a **4-bit binary counter with adjustable counting rate**. Counting rate and counting direction will be controlled via connected switches. Since this is a 4-bit binary counter each connected LED will represent one bit of the counter. For example, following figure show how you should represent binary 0010 and 1011.



Two of the connected switches will be controlling rate of the counting and remaining switch will determine direction of the counting. When **switch 1 is closed** counter should be in **increasing** order and when **switch 1 is open** counter should be in **decreasing** order. Switch 2 and switch 3 should control the counting rate according to table below:

Switch 2	Switch 3	Rate
Open	Open	0 ms
Open	Closed	1000 ms
Closed	Open	500 ms
Closed	Closed	250 ms

For example, if switch 1 and switch 3 are open and switch 2 is closed, your counter should count down with rate of 500ms.

Important Requirements

- You must be able to change switch configurations during run-time, so we don't want you to re-start your program for every configuration.
- You must not reset your counter when order of the counting changed during the run time. In other words, when the order is changed, you must start counting from the last number before order is changed.
- You must be able to change counting rate in the run-time without resetting the counter.

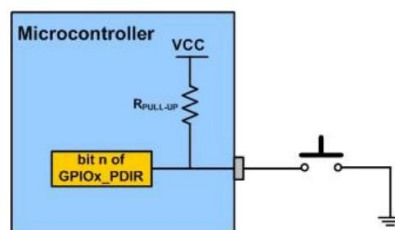
- You are not allowed to use timer functionality; you need to write your own delay function. You can find a similar delay function in the tutorial code.
- We are not expecting you to get 100% preciseness while adjusting counting rate but try to get as much close as you can get to get full credit.
- Even if you couldn't manage to implement full functionality, please try to implement some part of the assignment so that you can get partial credit. For example, if you couldn't adjust your rate/direction during the run-time, just write a code that can change direction/rate at the start-up to still get some partial credits.

Hardware Configuration

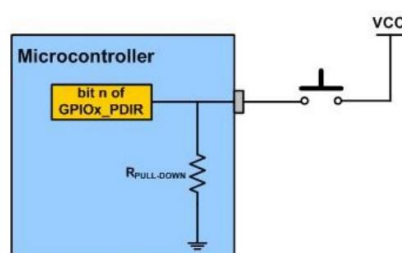
Equipment List:

- 3 switches
- 4 LED

You will need to connect 3 switches to the 3 different pins of the FRDM board. There are two different configurations on how you can connect switch to the FRDM board. You can either use internal pull-up or internal pull-down resistors. You should specify which one you are going to use while configuring your port registers. Following figures demonstrate how you should connect your switch to the board.



(a) Using Pull-up Resistor



(b) Using Pull-down Resistor

You also need to connect 4 LEDs to the 4 different pins, please do not forget to configure LED pins as output and switch pins as input.

Grading Criteria

Note that this criterion covers only the general cases, your TA can give you different grade according to your explanation of the code or due to cases that are not covered in this criterion.

- Counting order is changeable: 30 pt
- Code is functional for all four counting rates: 40 pt
- Counting is in binary: 20 pt
- Student can successfully drive one LED or read one switch: 10 pt