Lab 4

Instructions

- Complete each task and demonstrate the working program to your tutor. Tasks should be demonstrated using the board provided. You will have two lab sessions to work on this lab, and all questions must be marked by the end of the second session.
- An example program that uses the LCD is provided on the course page under lab 4.
- Make reasonable assumptions if something is not explicitly specified. State all those assumptions to the tutor when you are getting marked.

Part A – keypad (3 Marks)

Write a program to detect keypad presses and display them on the LEDs. Buttons 0-9 should display their numeric value in binary, with the LSB at the bottom. The other buttons do not need to be handled.

The keypad should be connected to PORTL, with none of the wires crossed over (same as lab 3). The low 4 bits will be connected to the rows, and the high 4 bits will be used to read the column outputs.

You will need to activate the pull-up resistors on the input pins to reliably detect key presses.

Examples:
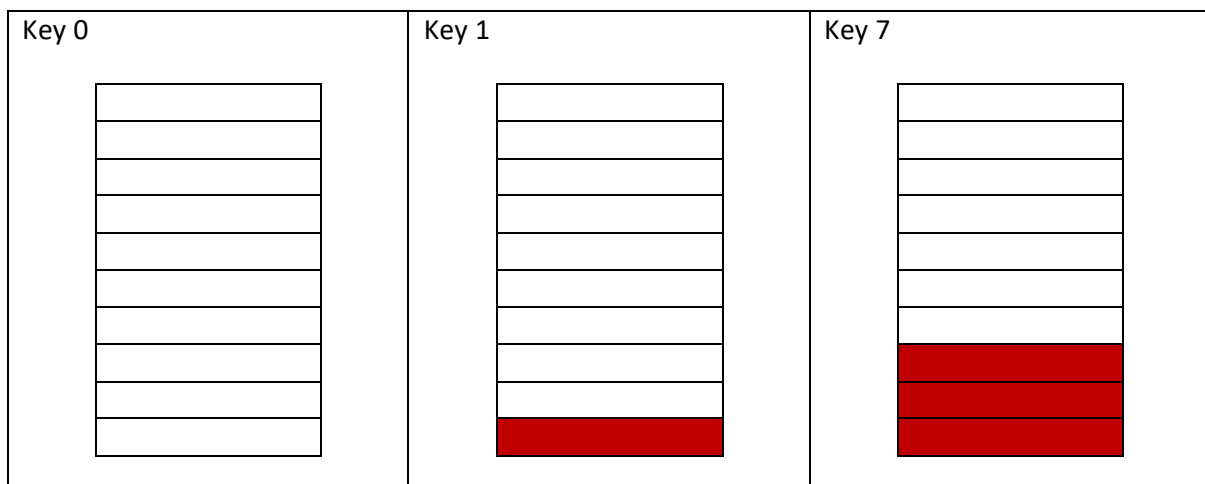
Part B – LCD (2 Marks)

Write a program to display some text on the LCD. The top line should display 'Lab 4' and the bottom should display 'COMP2121' as below.

Lab 4
COMP2121

The LCD manual lists available commands and is available in the AVR resources section on the course website.
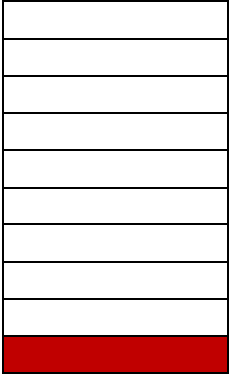
The LCD data pins D0-D7 should be connected to PORTF0-7. The four LCD control pins BE-RS should be connected to PORTA4-7.

Part C – Lift floor select buttons (3 marks)

Extend Part A above such that the keypad represents the floor select buttons on the lift. Keys 1-9 to represent floors 1-9 and key 0 represents the 10th floor. The other buttons do not need to be handled. The detected floor request (the keypress) should be now displayed on:

- the LED bar according to the same scheme as in lab 3-part A, and
- the left bottom corner of the LCD display (you can use the binary to ASCII converter you wrote in lab 1)

Examples :

Key 1	Key 5	Key 0
LED bar:	LED bar:	LED bar:
LCD:	LCD:	LCD:
Floor request 1	Floor request 5	Floor request 10

Part D – lift Emergency (2 marks)

Extend part D of lab 3 (or part C if you haven't completed part D) to handle a lift emergency. The '*' button on the keypad represents an emergency. Pushing the emergency button should stop the servicing of the lift and the lift should go to the 1st floor (i.e., floor 1), the lift should then open and close to get the people out (represent by the blinking the bottom LED several times per second as in Part C of lab 3 – for 5 seconds), and the lift should halt. The LCD should show the following message

Emergency
Call 000

The strobe LED (LED near the motor) should blink several times per second to denote the alarm for the emergency. The lift should resume normal operation only when the '*' button is pressed again.