EE 337: Microprocessors Laboratory (Spring 2021)
Indian Institute of Technology Bombay

Project: 20 points Date: March 8, 2021

Bank Queue Simulator on Pt-51

1. [20 points] In this project, you will be writing a program to simulate the behavior of a queue in a bank with 4 counters labeled A, B, C, D. The actions of the bank customers and tellers (employees manning the counters) will be simulated using key presses on a keyboard connected to Pt-51 using UART.

   - Each customer who enters the bank obtains a token number by pressing the `t` key.
     - The token numbers start from 1 and count upwards until 99. After 99, the token number cycles back to 1.
   - The LCD must show the token numbers currently being served by the four counters.
     - The first line in the LCD should show `A: XX B: XX`.
     - The second line in the LCD should show `C: XX D: XX`.
     - The `XX` in the above description is the two-digit token number being currently served by a counter. Use zero-prefix for single digit token numbers. For example, display token number 2 as `02`.
   - Initially, the counters are not serving any customers even if some customers have collected token numbers. The LCD should display blanks in place of the `XX` locations.
   - Each of the counters is associated with one of the 4 switches on the Pt-51 board. A bank teller wanting to serve the next customer will toggle the switch associated with his counter. The smallest token number which has not yet been served will appear on the LCD next to the counter name.
     - For example, suppose no customers are being served. The LCD will display `A: B:` on the first row and `C: D:` on the second row. Now suppose the switch associated with counter B is toggled and the next token number is 1. Then the LCD will display `A: B: 01` on the first row and `C: D:` on the second row.
     - Now if the switch associated with counter B is toggled again, then the LCD will display `A: B: 02` on the first row and `C: D:` on the second row.
     - Now if the switch associated with counter A is toggled, then the LCD will display `A: 03 B: 02` on the first row and `C: D:` on the second row.
   - If there are no customers waiting to be served, then toggling the switch corresponding to a counter with a customer should erase the token number and replace it with a blank. In this sense, the toggle of the switch is an indication that the counter has finished serving the current customer and is ready to serve the next customer.
   - When a new customer presses the `t` key to pick a token number, the LCD should display the text `Token: XX` on the first row for 2 seconds where `XX` is the token number. The counter states will disappear during these two seconds and reappear afterwards.