CSSE2010/CSSE7201 – Introduction to Computer Systems
Semester Two, 2021

Lab 6 Preparation Task

You should complete a logic diagram and a circuit schematic diagram as described below before your lab 6 session in week 4. You should consult the device pinout information on Blackboard. You will be either constructing or simulating this circuit (or a similar circuit) during the prac session. A description of a similar task has been provided in week 3 lecture 6 and it is recommended you watch that lecture recording before attempting this task.

You are to design a combination lock circuit based on a 4-bit wide shift-register with two stages. The combination lock has

- 4 switches to specify a digit value (decimal 1 to 9, binary 0001 to 1001)
- a push button to enter (i.e. clock-in or shift-in) that digit
- an LED indicating that the lock is open (i.e. unlocked)
- an LED indicating that the lock is closed (i.e. locked)
- a reset push button

The circuit is based on a two-stage 4-bit shift register (i.e. 8 flip-flops). The circuit operates as follows. After a reset (i.e. reset button pushed and released) the flip flops in each stage should contain 0000. The user configures the 4 input switches to represent a digit and then clocks them in the first stage (by pressing and releasing the clock push-button). The contents of the first stage are moved to the second stage. The user then configures the switches to represent a second digit and then clocks them into the first stage of the 4-bit shift register. (The contents of the first stage are moved to the second stage.) If the digits entered match the expected pattern (see below) then the lock should unlock ("unlocked" LED should be on, "locked" LED should be off). At all other times the "locked" LED should be on and the "unlocked" LED should be off. (The lock remembers the last two digits entered - if they match the code, the lock will open. For example if the code is 34 and you enter 5 then 3 then 4, the lock will unlock after the third digit.)

The correct code for your lock is the last two digits of your student number, with any zeroes changed to ones. For example, if your student number is 40123456 then your code is 56 (i.e. 5 should be entered first, followed by 6). If your student number is 46543210 then your code is 11.

You should complete a **logic diagram** and **circuit schematic diagram** using the device pinout information on Blackboard. IN mode students are expected to simulate in Logisim and then build the circuit and test in on breadboard. EX mode students are expected to simulate the circuit in Logisim and verify the correct functionality of the design.