CSSE1000/CSSE7035 - Prac 4

Circuit Design Task

Goals

- Undetaker a small design task using digital logic
- Consolidate material from pracs 1-3 by revisiting key concepts while undertaking a more complex problem

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See the following topics:

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Preparation - Complete the following questions in your Prac workbook

The design task:

You are to design a combination lock. The combination lock system has

- a 2 digit 7-segment hex display for showing the input combination
- 4 toggle switches and a push button to enter the code
- one LED indicating that the lock is open,
- another LED indicating that it is closed
- a reset button.

It operates as follows: After a reset the display is set to "00" and the lock is closed. When the push button is pressed, the value on the 4 toggle switches is saved and the left hand hex digit display is set to that value. When the same button is pressed again, the second digit entered (using the same 4 toggle switches) is saved and is displayed on the left hand hex digit display. The digit that was displayed there moves to the right hand hex digit display. Only the last two digits entered are remembered. If the two digit code displayed is correct, the lock is opened with the "open" LED turned on. (Otherwise, the "close" LED remains lit.)

The correct code is the last two digits of your student number. If either or both of the last two digits of your student number happen to be a "0" please change it to a "1" instead. e.g. if your student number if 40271619 then the correct code is "19". if 40271680, the code is "81".

- Complete this specification as you see fit (dont change the circuit's fundamental operation). Assumptions and completions should be noted in your workbook. If in doubt ask the newsgroup.
- Create a **logic diagram**, **LogiSim model** and **circuit schematic** for the combination lock design. You may use any chips from previous pracs for your implementation.

Procedure

Ask a tutor to check your preparation, and in particular, provide feedback on your design. (You can start constructing your circuit(s) before this happens.)

Familiarisation with equipment (if necessary):

- Attempt to use the wire stripper to customise the length of a wire. Revise how to use the logic probe - the yellow pen shaped object attached to the logic workstation.

Standard Tasks - help will be provided by the tutor if required - don't hesitate to ask any questions.

1. Consult with your partner about your combination lock implementation, and discuss any differences in your designs.
2. Construct and test both your combination lock circuits. **Document your proceedure in your workbook.** Demonstrate at least one of your working locks to the tutor.
3. Tutor task - Once you have demonstrated your circuit(s), the tutor will give you a different combination to implement than the one you have prepared. Redo your design, circuit schematic and LogiSim model for the new combination. Demonstrate to the tutor.

*Important: **Do NOT use your fingers to remove chips from the breadboard.** Use two pens as levers on both side to "pop" it out. This will avoid the nasty (and painful) metal pins in fingernails problem, and also avoid damage to the chip.*

Challenge Task (Complete after you have been marked off)

Think about how you could modify your design such that extra toggle switches and push buttons could be used to program the combination into the lock without having to rewire logic. i.e. there is a set of switches that could be inside the safe to change the combination. Discuss your ideas with the tutor at the end of the session. Draw a logic diagram of your solution.

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Assessment

This practical is marked out of 4 and worth 2% of your mark for CSSE1000:

- Preparation - All circuit schematic diagrams & Logisim schematics completed - ***1 Mark***
- Demonstration - Required circuits demonstrated. - ***1 Mark***
- Documentation - All testing results are documented in workbook - ***1 Mark***
- Tutor Task - Tutor task completed and documented in workbook - ***1 Mark***

Equipment

- Computer
- Logic Workstation
- Breadboard
- Hook up Wire
- Wire Strippers
- Components:
  - All IC's from previous pracs.

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References

- Tanenbaum, Andrew S., *Structured Computer Organization*, 5th Ed., Prentice/Hall, 2006. ISBN: 0-13-148521-0
- Mano, M., *Digital Design*, Prentice/Hall, 1984. ISBN: 0-13-212325-8

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