

CS M152A: Lab 4 Proposal

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4-Digit Passcode Locker

Overview

Our lab idea is to create a locker that takes in a 4-digit input as a password, remembers it, and locks itself. When another 4-digit key is entered, but does not match the memorized key, the locker does not unlock. All the I/O will be on the Nexys3 FPGA board, with additional input boards attached (such as a number pad and speaker).

Features

- **CLEAR (C on number pad):** Pressing this button clears whatever digits were previously entered.
- **NUMBER PAD:** inputting a sequence of four of the numbers 0-9 on the attached number pad becomes the passcode.
- **LOCK / UNLOCK (B on number pad):** after a 4-digit passcode is entered, pressing the lock button will commit the passcode to memory, and the locker will "lock" itself. If there is already a memorized passcode, the locker will unlock if the 4-digit input matches the passcode.
- **RESET (BTNR, the rightmost button on the bottom edge of the board):** because of Murphy's Law, this feature must be included as a salvation from a multitude of problems.
- **BREAK (SW0, rightmost switch on the bottom edge of board):** To simulate real-world functionality, flipping this switch will break the locker. In this mode, every 5th input is dropped, and no sound will be played for the button press.
- **LED:** When a passcode is set, an LED light will turn on and remain on until the locker is unlocked.
- **SPEAKER:** When any button is pressed, a speaker plays a sound. The tones ascend chromatically with the button presses.

Instructions

This locker provides a strong security measure and can be extended to many real-life applications.

To LOCK the locker:

1. Press **CLEAR**.
2. Use the number pad to input a 4-digit sequence you want as your passcode. If you have regrets, press **CLEAR** and re-enter.
3. Press **LOCK**. The LED lights should all be on.

To UNLOCK the locker:

1. Press **CLEAR** (to clean up any digit input that may have been input while you were gone).
2. Use the number pad to input the 4-digit code you set as the passcode.
3. Press the **LOCK** key. The LED lights should begin strobing.

To use Break mode, flip the switch to **ON**. Flipping this switch to **OFF** then **ON** again resets the button count in this mode. This also occurs if the **RESET** button is pressed.

Grading

Correct functionality and reliability over a variety of test cases:

- **40% Locking/Unlocking:** Locks when 4-digit passcode is entered and **LOCK** is pressed. Unlocks when 4-digit passcode is entered and the key is pressed again, and the two passcodes match.
- **10% CLEAR:** correctly clears all user input.
- **20% Break Mode:** Correctly drops the 5th user input, while still playing a tone for that button press. Pressing **RESET** in this mode, or turning the mode off or on again, resets the button count to 0.
- **10% LED:** Solid lights when locked, strobing when unlocked.
- **20% Sound:** plays beeping sound for any button press. The tone of the beep scales chromatically: **RESET** , 0-9, C, B.

Milestones

- 2/24 : Lock core functionality
- 2/29 : CLEAR, sound and LED
- 3/2 : Break mode and testing

Songs to Play

Major scale

RESET 1 3 4 6 8 C B

Harmonic minor scale

RESET 1 2 4 6 7 C B

Ode To Joy

3 3 4 6 6 4 3 1 RESET RESET 1 3 3 1 1

Don't Worry, Be Happy

B 8 6 8 3 6 3 1 RESET 1 3 1

Jingle Bells

3 3 3 3 3 3 6 RESET 1 3

Happy Birthday

RESET RESET 1 RESET 4 3
RESET RESET 1 RESET 6 4
RESET RESET 8 4 3 3 1
9 9 8 4 6 4

5 1 5 1 5 8