

ECE 476/676 - Homework #3

Binary Inputs, Serial I/O

Binary Inputs

Assume a thermistor with a temperature - resistance relationship of

$$R = 2000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right) \Omega$$

1) Design a circuit which outputs

- 0V for $T < 20^\circ\text{C}$
- 3.3V for $T > 20^\circ\text{C}$

2) Using the same thermistor, design a circuit with hysteresis: the output is

- 0V for $T < 15^\circ\text{C}$
- 3.3V for $T > 20^\circ\text{C}$
- No change for $15^\circ\text{C} < T < 20^\circ\text{C}$

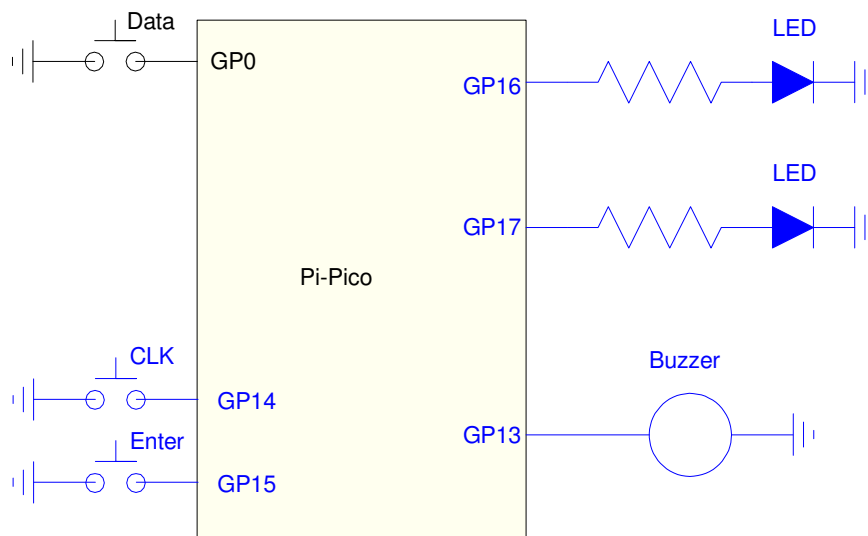
Serial Inputs & Combination Lock

3) (Hardware) Add a binary inputs to your Pico board connected to GP0

- You can also use other GPIO pins if you want
- The pins shown in blue are already connected on your Pico board (no additional connection needed)

Include a photo of your breadboard and Pico board for full credit.

Other pins also work



Hardware: Add four more binary inputs

4-10) (Software) Write a python program which lets you input a number from 00000 to 11111 using the push buttons with GP0 being the serial input pin.

- The number stored in a buffer starts at 0 (or an empty string)
- The value of each bit (0/1) is determined by GP0
- When GP14 is pressed, the number stored is shifted left (x2) and one bit is added to the buffer
- When GP15 is pressed, the number in the buffer is checked against the correct combination
 - If the combination is correct, GP16 turns on for one second
 - If the combination is incorrect, light GP15 turns on for one second
 - If you guess incorrectly three times in a row, the buzzer turns on for one second.
- After pressing GP15, the buffer is cleared and it waits for a new combination.

For example, to input the code 00110

- Hold down GP0 to input '0', Press and release GP14
 - The number store should be '0'
- Hold down GP0 to input '0', Press and release GP14
 - The number store should be '00'
- Release GP0 to input '1', Press and release GP14
 - The number store should be '001'
- Release GP0 to input '1', Press and release GP14
 - The number store should be '0011'
- Hold down GP0 to input '0', Press and release GP14
 - The number store should be '00110'
- Press and releast GP15 to test the code

Grading:

- 10pt You are able to input the number 00000 to 11111
- 10pt Pressing GP15 tests the code
- 10pt Light GP16 turns on if your guess is correct (your pick what the correct combination is)
- 10pt Light GP15 turns on for 1 second if your guess is incorrect
- 10pt Buzzer turns on for 1 second if you guess wrong three times in a row
- 10pt Demo. Demonstrate your combination lock (in-person or with a short video)