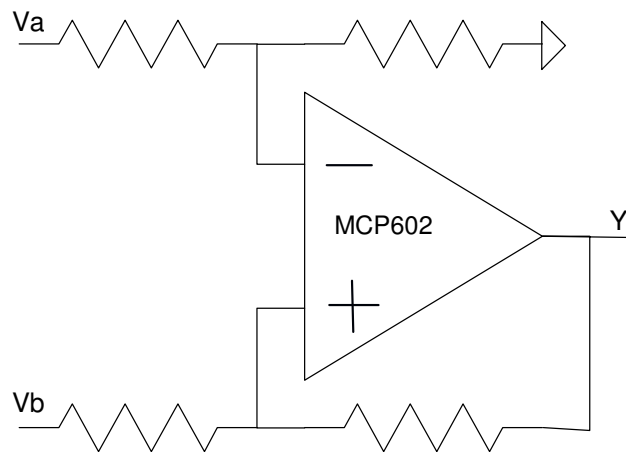
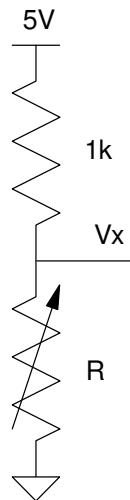


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Calculators Permitted.

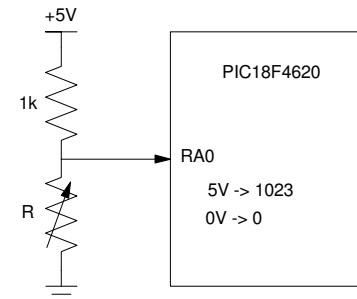
1) Binary Input: Schmitt Trigger. Design a circuit which outputs

- 0V when $R = 4000$ Ohms, and
- 5V when $R = 3500$ Ohms



2) Analog Input: A light sensor has the following resistance vs. light relationship

$$R = 10,000 \cdot \left(\frac{1}{Lux} \right)^{0.6} \Omega$$



2a) Determine the resistance, voltage, and A/D reading for the following circuit at 10 Lux and 1000 Lux

Lux	R	V	A/D
10			
1000			

2b) Give a calibration function to compute the light level based upon the A/D reading

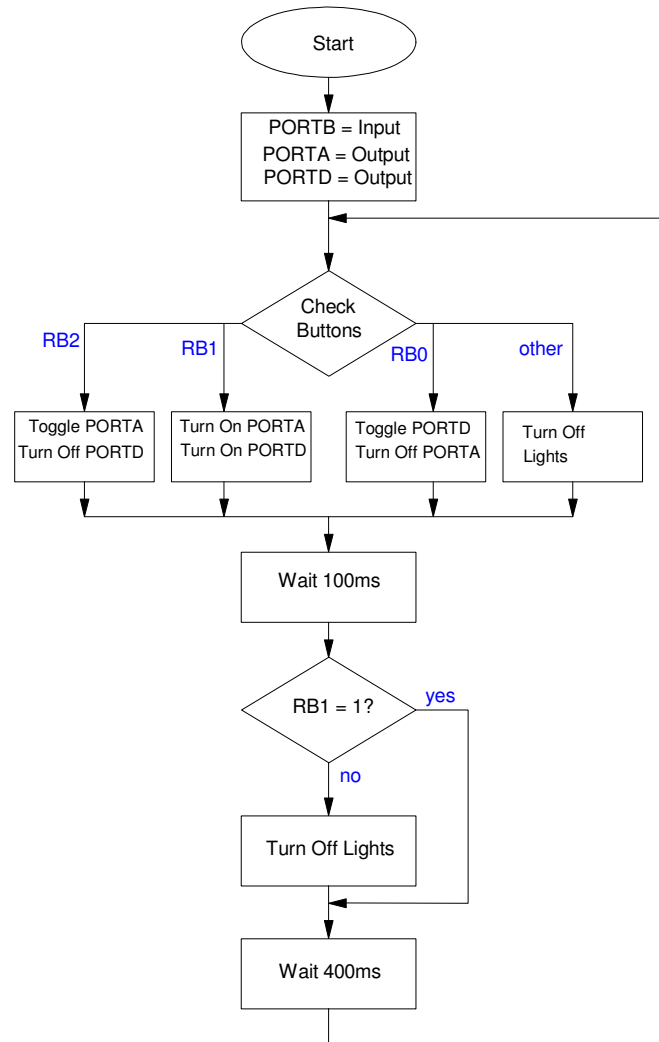
$$Lux = a \cdot A/D + b$$

3) C Coding: A PIC is to be used to control the tail lights of a car.

- When RB2 is pressed, the lights on PORTA blink (left turn)
- When RB0 is pressed, the lights on PORTD blink (right turn)
- When RB1 is pressed, both lights turn on (brake)
- When braking (RB1), the lights stay on for 500ms total. Otherwise, they're on for 100ms (dim)

Write the corresponding C code

```
void main(void) {.
```



4) C Subroutines Write subroutine which is passed two parameters and controls the tail lights of a car

- LEFT = 0: PORTA = 0000 0000
- LEFT = 1: PORTA = 0000 1111
- LEFT = 2: PORTA = 1111 1111
- RIGHT = 0: PORTD = 0000 0000
- RIGHT = 1: PORTD = 0000 1111
- RIGHT = 2: PORTD = 1111 1111

```
void TailLights(unsigned char LEFT, unsigned char RIGHT)
{
```

5) Interrupts: Write a program using interrupt to play a game of Hungry-Hungry Hippo where three players are playing with odds:

- Player A: Count every rising edge on RB0
- Player B: Count 90% of the rising edges on RB1
- Player C: Count 80% of the rising edges on RB2

a) Interrupt Set-Up

Specify which interrupt you're using and its initialization (pre-scalar, rising/falling edge, etc)

Interrupt	INT0	INT1	INT2	
Initialization				

b) Interrupt Service Routines

Specify the interrupt service routines

INT0 Player A counts every edge	INT1 Player B counts 90% of edges	INT2 Player C counts 80% of edges	
<code>if (INT0IF) {</code>	<code>if (INT1IF) {</code>	<code>if (INT2IF) {</code>	

6) Interrupts: A PIC is to be used to control the tail lights of a car. Use one or more interrupts to control the brightness of PORTA (left turn signal) and PORTD (right turn signal) using two global variables, LEFT and RIGHT

- LEFT = 0 to 100
 - 0 to 100% duty cycle on PORTA
- RIGHT = 0 to 100
 - 0 to 100% duty cycle on PORTD

a) Specify which interrupts you are using and how each is set-up (pre-scalar, etc)

Interrupt #1	Interrupt #2 (optional)
Set-Up (PS, A/B/C)	Set-Up

b) Specify the interrupt service routine(s) to control the brightness of PORTA and PORTD

Interrupt #1 Code	Interrupt #2 Code (optional)

