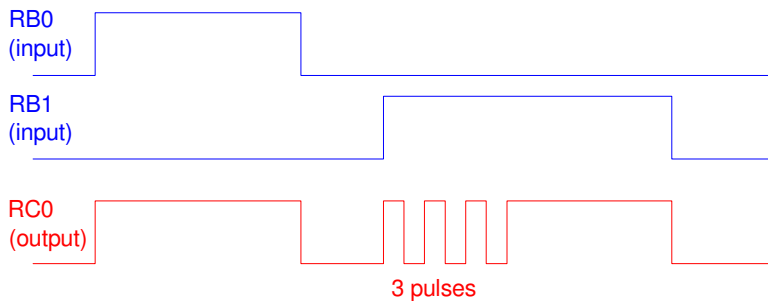# ECE 376 - Test #2: Name _____
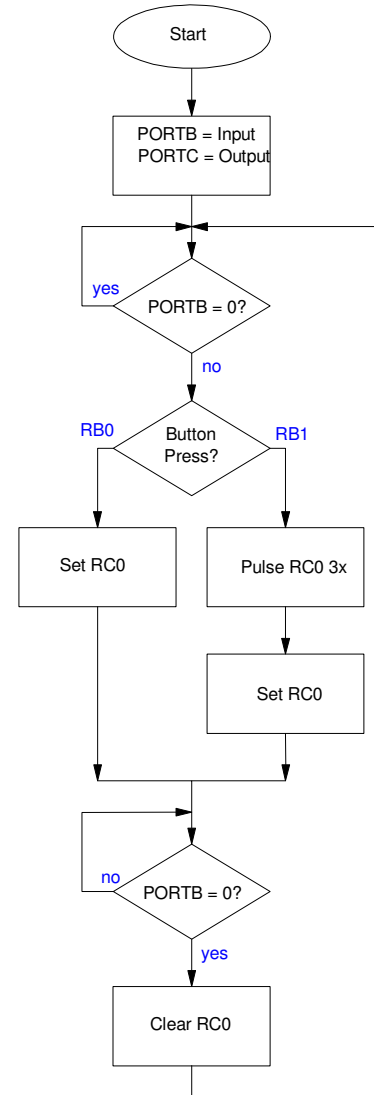
C-Programming on a PIC Processor

1) C Coding & Flow Charts (25 points)

Write the corresponding C code for the flow chart shown. This program

- Waits for RB0 or RB1 to go high
- If RB0 goes high, RC0 goes high.
- If RB1 goes high, RC0 goes high then low three times, with each pulse being 100ms high and 100ms low. After three pulses, RC0 remains high
- Once the button is released (RB0 or RB1), RC0 goes low.

RB0 (input)

RB1 (input)

RC0 (output)

3 pulses

```
void main(void) {

    ADCON1 = 0x0F;
```


Start

PORTB = Input
PORTC = Output

PORTB = 0? — yes

no

RB0   Button Press?   RB1

Set RC0   Pulse RC0 3x

Set RC0

PORTB = 0? — no

yes

Clear RC0

2) Subroutines & Bottom-Up Programming: (25 points)
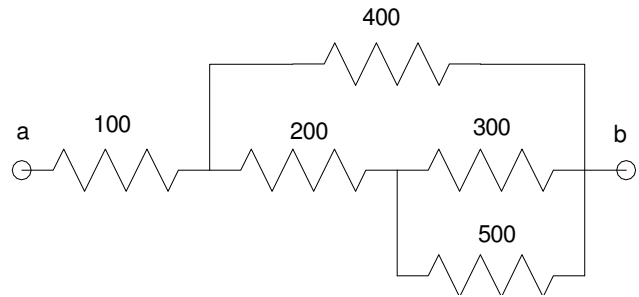
Write three subroutines

- y = Series(R1, R2);   returns the resistance of two resistors in series
- y = Parallel(R1, R2);   returns the resistance of two resistors in parallel
- y = Network();   returns the resistance Rab of the following network

```
float Series(R1, R2)
{
   }

float Parallel(R1, R2)
{
   }

float Network()
{
   }
```

3) Analog Inputs (25 points)

Assume the A/D input to a PIC processor has the following hardware connection where R is a light sensor where Lux is the brightness in lux

$$R = 2000 \cdot \left(\frac{1}{Lux}\right)^{0.6} \Omega$$
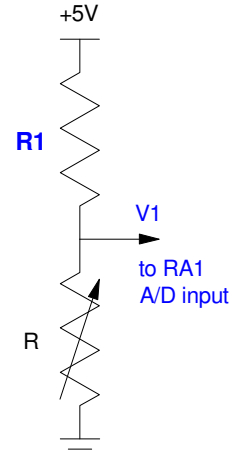
Let the R1 be your birthday

    R1 = 900 + 100*month + day
    May 15th would give R1 = 1415 Ohms

If the A/D reads 300, determine

- The lught level in Lux,
- The resistance, R, and
- The voltage, V1

+5V

R1

V1

to RA1
A/D input

R

R1 900 + 100*mo + day	Lux	R Sensor - Ohms	V1 Volts	A/D Reading
				300

4) chi-squared test (10 points)

It is conjectured that the time that a refrigerator door is held open has an exponential distribution wuth a mean of 10 seconds:

$$pdf = \frac{1}{10} \exp\left(\frac{-t}{10}\right) u(t)$$

To test this theory, the time that the door was left open was recorded 100 times with the result shown below. Use a chi-squared test to see if the data is consistent with an exponential distribution

Duration	p binomial distribution	np expected results: n=100	N actual results	Chi-Squared
0 - 5 seconds	0.39		30	
5 - 10 seconds	0.24		25	
10 - 15 seconds	0.14		20	
15 - 20 seconds	0.09		15	
> 20 seconds	0.14		10	
			Total	

Chi-Squared Table

Probability of rejecting the null hypothesis

dof	99%	95%	90%	80%	60%	40%	20%	10%	5%	1%
1	6.64	3.84	2.71	1.65	0.71	0.28	0.06	0.02	0	0
2	9.21	5.99	4.61	3.22	1.83	1.02	0.45	0.21	0.05	0.01
3	11.35	7.82	6.25	4.64	2.95	1.87	1.01	0.58	0.22	0.07
4	13.28	9.49	7.78	5.99	4.05	2.75	1.65	1.06	0.48	0.21
5	15.09	11.07	9.24	7.29	5.13	3.66	2.34	1.61	0.83	0.41
6	16.81	12.59	10.64	8.55	6.21	4.57	3.07	2.20	1.63	0.87
7	18.47	14.06	12.02	9.80	7.28	5.49	3.82	2.83	2.17	1.24

5) t-Tests (15 points)

Over the first five games, the Minnesota Vikings defense has given up {17, 7, 29, 17, 31} points:

- mean = 20.2 points
- standard deviation = 9.8590 points
- sample size = 5

a) How many points does the offense have to score to be 90% certain of winning their next game?

b) How many points does the offense have to score to be 99.9% certain of winning their next game?

Student t-Table (area of tail)

df \ p	0.001	0.0025	0.005	0.01	0.025	0.05	0.1	0.15	0.2
1	-636.619	-318.309	-63.6567	-31.8205	-12.7062	-6.3138	-3.0777	-1.9626	-1.3764
2	-31.5991	-22.3271	-9.9248	-6.9646	-4.3027	-2.92	-1.8856	-1.3862	-1.0607
3	-12.924	-10.2145	-5.8409	-4.5407	-3.1824	-2.3534	-1.6377	-1.2498	-0.9785
4	-8.6103	-7.1732	-4.6041	-3.7469	-2.7764	-2.1318	-1.5332	-1.1896	-0.941
5	-6.8688	-5.8934	-4.0321	-3.3649	-2.5706	-2.015	-1.4759	-1.1558	-0.9195