ECE 376 - Test #2: Name _____

C-Programming on a PIC Processor

Open book, open notes. Calculators and Matlab permitted. Individual effort (help from other people or web sites where other people help you solve the problems not permitted).

1) C Coding & Flow Charts. Write a C program for video game cheat:

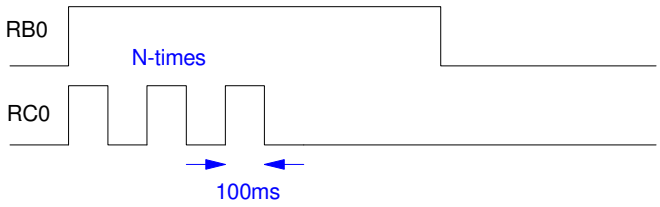
- Each time you press RB0 (rising edge)
- N pulses are output on RC0 (fire N times)
- Each pulse is on for 100ms, off for 100ms

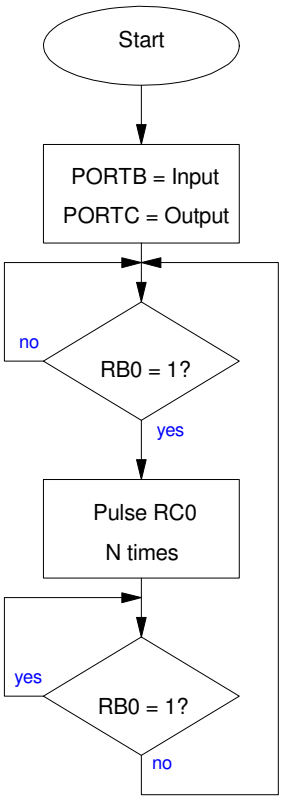
Let N be your birth month plus one (2..14)

N = _____ (month + 1)

```
#include <pic18.h>

void main(void) {
  ADCON1 = 0x0F;
```

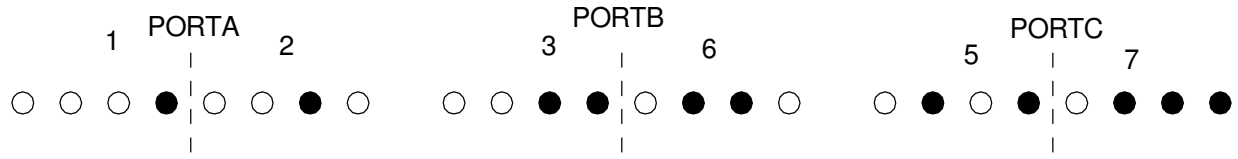




2) Binary Clock! Write a C subroutine to drive the display on a binary clock.

- Hours, Minutes, and Seconds are passed to the subroutine
- Hours are displayed on PORTA as (tens : ones)
- Minutes are displayed on PORTB as (tens : ones)
- Seconds are displayed on PORTC as (tens : ones)

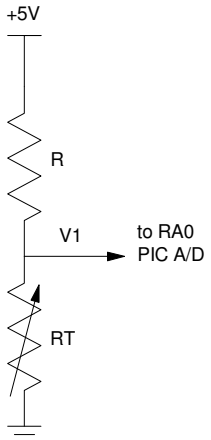
For example: 12:36:57 would display as




```
void Problem2(unsigned char Hr, Min, Sec);
{
```

Analog Inputs

3) Assume the A/D input to a PIC processor has the following hardware connection where R_T is a 3k thermistor where T is the temperature in degrees C



$$R_T = 2000 \cdot \exp\left(\frac{4200}{T+273} - \frac{4200}{298}\right)\Omega$$

Let R be a resistor

R = 900 + 100*(your birth month) + (your birth date).

If the A/D reading is 769, determine

- The voltage at V1
- The resistance, R_T,
- The temperature, T, in degrees C, and
- The smallest change in termperature you can detect

R 900 + 100*mo + day	A/D Reading	V1 volts	R_T Ohms	Temperature degrees C	Smallest change in T you can detect
	769				

chi-squared test

4) (10pt). The number of scores that fall into each region for NFL teams in 2021 (week 1-4) are:

0-9	10-19	20-29	30-39	40-49
11	33	48	30	6

Use a chi-squared test to determine the probability that points scored follows a Normal distribution with

- Mean = 23.5
- Standard Deviation = 9.66

Points Scored	probability p normal distribution	np n = 128 scores	N # scores in this region	chi-squared score
0 - 9	0.074	9.47	11	
10 - 19	0.3326	45.57	33	
20 - 29	0.393	50.30	48	
30 - 39	0.218	27.90	30	
40+	0.049	6.72	6	

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

t-Tests

5) (15pt) The current gain of four ZTX869 transistors were measured using the correct and incorrect polarity

polarity	Current gain	mean	st dev
correct	{ 605, 743, 564, 588}	625.0	80.44
incorrect	{507, 655. 452. 488 }	525.5	89.29

a) What is the 90% confidence interval for the gain of a ZTX869 transistor when used with the correct polarity?

b) What is the probability that the correct polarity has a higher gain than the incorrect polarity?

Student t-Table area of tail										
dof \ p	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0
1	1	1.38	1.96	3.08	6.31	12.71	31.82	63.66	318.31	636.62
2	0.82	1.06	1.39	1.89	2.92	4.3	6.97	9.93	22.33	31.6
3	0.77	0.98	1.25	1.64	2.35	3.18	4.54	5.84	10.22	12.92
4	0.74	0.94	1.19	1.53	2.13	2.78	3.75	4.6	7.17	8.61
5	0.73	0.92	1.16	1.48	2.02	2.57	3.37	4.03	5.89	6.87
infinity	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.29