Microprocessor Principles and Applications
Final (Hands-on Exam)
Jan. 6, 2020

1. (10%) Mode Selector. Design an UI with two modes by UART
   - Input "mode2" to start problem 2, Breathing LED frequency controller.
   - Input "mode3" to start problem 3, count down clock.
   - Input "mode1" to go back to the select mode.

Note: If you cannot finish problem 1, you can demo problem 2 and problem 3 separately. (To get full score, you should only compile once to demo problem 1, 2 and 3)

2. Breathing LED frequency controller

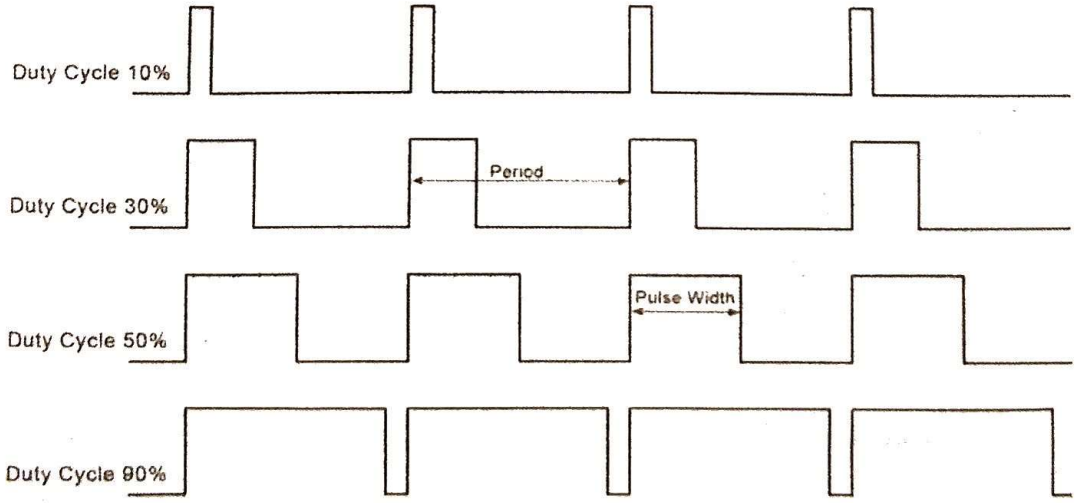
(a) (10%) Design the breathing LED by CCP Module (Refer to Breathing LED)

(b) (10%) Control the **duty cycle frequency** of breathing LED by Variable Resistor

Note : You should design the longest period equal to 2 second, and the shortest to 0.5 second.

Breathing LED: Through PWM technique, we can control the power delivered to the load by using ON-OFF signal. The PWM signals can be used to control the speed of DC motors and to change the intensity of the LED. Moreover, it can also be used to generate sine signals.

Pulse Width Modulated signals with different duty cycle are shown below



3. Count down clock

(a) (12%) Design a count down clock by server motor.

- Use a **button** to start the count down. (You should implement it by interrupt, so PIC will response immediately.)
- Each step of the clock has to be exactly **1 second**.
- Default : Count 3 seconds. That is, the clock will only move 3 steps.

(b) (2%) **Write a formula** to explain how you make each step exactly 1 second. All the configuration involved (oscillator rate, pre-scaler, TMRx, etc.) must be written. You have to write the formula clearly **before demo it to TAs**.

(c) (6%) TAs can input the number of seconds (range from 1 ~ 5) to count down from **UART**.

Note: Your clock should tick like an old clock, move the clock hand once a second, rather than make it move smoothly.