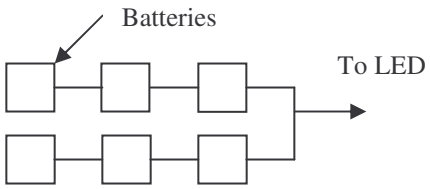
UNC Charlotte–ECGR4101/5101-Midterm Exam –10/10/07

Name: ___**SOLUTION**_____ Mosaic User ID _____**SOLUTION**_____

1. According the ECGR4101 programming standards, which of the following should be included in the header of a subroutine? **(5 points – all or nothing)**
   a. Subroutine name
   b. Assumptions
   c. Inputs/Outputs
   d. Interfaces
   e. All of the above

2. You have several 400mAh 1.5V batteries and a LED that has an average drain of 3.5mA at 4.5V. If you had the following battery configuration how long would the LED stay lit? (5 points)



   a. 557.1 hours
   b. 228.6 hours (5 points – all or nothing)
   c. 371.4 hours
   d. 209.3 hours
   e. None of the above **Batteries = 4.5v, 800mAhr/3.5 mA = 228.6 hr**

3. Vref+ = 3V, vref- = 0V, step size = 3v/1024 = 2.93mV **= 4 points, all or nothing**

   1100110010 = 0x332 = 818, 818 * 2.93mV = 2.40V **= 3pts formula, 3 points correct answer (note: the formula from the notes in class is also valid)**

4. Algorithm Solution:

```
// Name: James Conrad - 10/10/07
// Function: when sw1 is pressed, turn the green LEDs on
// If the thermister value is above 511 light the yellow LED
// If the light sensor value is above 511 light the red LED
// Inputs: sw1, 2 ADC;   Outputs: LEDs
Setup a switch (input)
Setup LEDs (output, turn off)
Setup thermister and light sensor ADC (sweep)
Start continually reading thermister, light sensor
While (1) {
      If (sw1 pressed) Turn on the green LED
            Else turn off green LED;
      If (thermister>511) Turn on the yellow LED;
            Else turn off yellow LED;
      If (light sensor>511) Turn on the red LED
            Else turn off red LED;
      }
```

Points:
5 points: header comments
5 points: set up switch and LEDs
5 points: set up ADCs
5 points: While loop with testing values inside (continuously)
5 points: Handle green LED on
5 points: Handle green LED off
5 points: Handle yellow LED on with condition
5 points: Handle yellow LED off with condition
5 points: Handle red LED on with condition
5 points: Handle red LED of with condition
No extra points for writing the entire code package. I only asked for the algorithm.

5. Code Solution:

```
adcon0=0x18;      // perform repeated A/D conversions - sweep
adcon1=0x28;      // sweep pins 0-3 (to get pins 0 and 1, but no more)
adcon2=0x01;      // sample and hold
adst=1;           // <- start measuring!
```

Points:

5 points: set up reg0 with correct values
5 points: set up reg1 with correct values
5 points: set up reg2 with correct values
5 points: start sampling (adst or adcon bit set)
No extra points for writing the entire code package. I only asked for a few lines.

FYI:

```
adcon0 = 0x18;
      /* x0011xxx;     /* AN0 input, 1 shot mode, soft trigger
         ||||||||______analog input select bit 0 - don't care
         |||||||_______analog input select bit 1 - don't care
         ||||||________analog input select bit 2 - don't care
         |||||_________A/D operation mode select bit 0 - sweep
         ||||__________A/D operation mode select bit 1 - sweep
         |||___________trigger select bit - software
         ||____________A/D conversion start flag - set any time
         |_____________frequency select bit 0 - don't care */

      adcon1 = 0x28;
/*      xx1x1000;       ** 10-bit mode, Vref connected
         ||||||||______A/D sweep pin select bit 0 - 1 for pins 0-1
         |||||||_______A/D sweep pin select bit 1 - 0 for pins 0-1
         ||||||________A/D operation mode select bit 1
         |||||_________8/10 bit mode select bit = 1 = 10-bit
         ||||__________Frequency select bit 1 - don't care
         |||___________Vref connect bit
         ||____________External op-amp connection mode bit 0
         |_____________External op-amp connection mode bit 1 */

      adcon2 = 0x01;
   /*    000x0001;      ** Sample and hold enabled
         ||||||||______AD conversion method select bit
         |||||||_______AD input group select bit 0 - port 10
         ||||||________AD input group select bit 1 - port 10
         |||||_________Reserved
         ||||__________Frequency select bit 2 - don't care
         |||___________Reserved
         ||____________Reserved
         |_____________Reserved */
```

6. Solution:

Assumptions:

Allocate 4 bytes (2 bytes each) for integers m and z for main. m is at –2[FB] and z is at –4[FB]. For factorial allocate 4 bytes again, 2 bytes for temp and 2 bytes for the incoming argument n. temp is at –2[FB] and n is at –4[FB].

(50 points, as below, for table, 10 points for assumptions and FP/SP. Note: I took more points away if you copied the solution from a previous semester, since you clearly did not read the problem and figure it out yourself.)