Physics 37100 Advanced Physics Laboratory I
Lab #5
(PART II: PID---The Controller)

1) Make a sketch using getPhoto() to control the LED using proportional control using Vset=V(128). Here is an outline:
   a. Set out=0;
   b. Loop for k=1 to 100
   c. Set analogWrite() to out
   d. Wait 100ms.
   e. Measure V using getPhoto
   f. Serial.println V
   g. Define err ie e=Vset-V;
   h. Define out=P*e;
   i. Make sure out is between [0 255].
   j. Serial.println e and out
   k. End loop
2) Find the largest value of P=Pmax that does not causes the V to oscillate. How does it compare to your estimate from part I?
3) What is the value of the error for the largest P that will not oscillate?
4) Plot V and out verses step k from above for Pmax, Pmax/2, and Pmax/10.
5) Add Integral control. Initialize es to 0 before the loop and after line g above add es=es+e; Then change line h to out=P*e+I*es.
6) Find values of P=P0 and I=I0 that give good control.
7) Plot V and out verses step k for (P0,I0), (P0,I0/10), (P0/10,I0), and (P0/10,I0/10). You may have to lengthen the k loop to see the full effects. Give a brief explanation of the plots.