Homework 3

Phys 1140, Fall 2012   Prof. Markus B. Raschke
Due: Tuesday, October 2, 4 pm, in your TA's hw box in G2B66

1) (4 points) You make five measurements of a particular wavelength, and you find you have some random noise. Your measurements are 244, 251, 248, 248, 246 all in nm. For the calculations below do not use the pre-programmed functions of your calculator – show explicitly the sums you are doing:

   a)   What is the mean value for your five measurements?

   b)   What is the standard deviation?

   c)   What is the standard error on the mean?

2) (8 points) You measure the earth magnetic field using the magnetometer app of your smart phone. Assume only random noise and no systematic errors. You make 12 measurements in total with values of H=45.3, 45.7, 45.2, 46.1, 44.7, 46.0, 45.2, 45.3, 45.0, 44.9, 45.4, 45.2 µT. (You can use these values, or take your own data with your phone).

a) Calculate the mean, the standard deviation, and the standard error of the mean (either by hand or other using corresponding function of calculator or software you are using).

b) Research in the internet for the value for the earth magnetic field in Boulder. Compare with your measurement or the result from the data above.

3) (8 points) You make 20 measurements of the time for a steel ball to fall through a vertical cylinder filled with oil. The following shows the time data arranged by increasing length and counts how often each value occurred (time in 0.01 s):

Time, t :	71	72	73	74	75	76	77	78	79	80
Occurrence	1	1	3	5	4	2	2	1	0	1

   a)   Draw a bin histogram of these results using bins of width 1, starting at 70.5.

   b)   Calculate the mean, and the standard deviation, and show them graphically in your histogram.

   c)   Redraw the histogram with a bin width of 2, and again with a bin width of 5, starting at 70.5 in both cases. Notice that with wider bins histograms get smoother. Note also that with increasing bin width information is lost and your histogram gets too wide.

Preferably you draw this graphs with a computer program. But if you do this nicely by hand on graph paper, we also accept that.