Professional Graph

Part of the mission of the 3700 class is to learn to make a professional graph. Here is a few important points:

- Need x and y axis labels. Use one word to precisely describe what you are plotting, i.e. no ambiguity. Words such as “Number”, “Result”, “Outcome”, ”Possibility”, and “Value” are not useful since all results can be described as number, result, outcome, possibility, and value. Don’t label an axis as frequency unless the unit is Hertz. “Occurrence” is also not very scientific (penalty: 1 pt).
- The label must include unit if appropriate (penalty: 1 pt).
- No grid is needed.
- Do not connect data points with lines unless instructed (penalty: 1 pt).
- The font (including the numbers) must look ~12 points when PRINTED on paper (penalty: 1 pt).
- Whenever possible, plot the raw counts rather than the probability so that the reader can judge if the fluctuations in the data are consistent with the the statistics of the raw counts (penalty: vary).
- Starting with Lab 2, each data point must have an error bar (make sure it is visible) unless the lab instruction sheet explicitly states that it is not needed (penalty: vary).
- Insert the plot right after the paragraph that it is first referred. Appending the plot at the end of the lab report is not acceptable (penalty: 1 pts/plot).

Please review these rules before submitting each lab report.

Example Lab Report

Given that 3700 experiments are relatively simple, there is no need for a lengthy lab report. The following is an example lab report for an experiment on 10-sided dice:

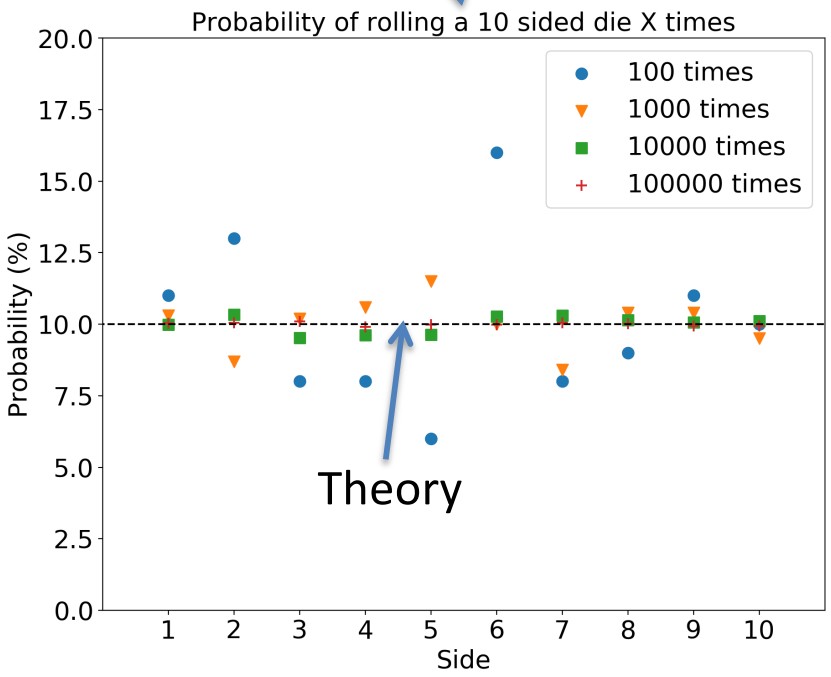
This is an experiment that measures the probability for obtaining certain face value for a 10-sided dice with various numbers of rolls. The result is shown in Fig. 1 for the 100 rolls by hand and 1,000, 10,000, and 100,000 rolls via simulations. There is large fluctuation around the theoretical probability of 10% for the 100 rolls but as the sample size increases, the measured probability becomes closer to the theoretical expectation as expected.

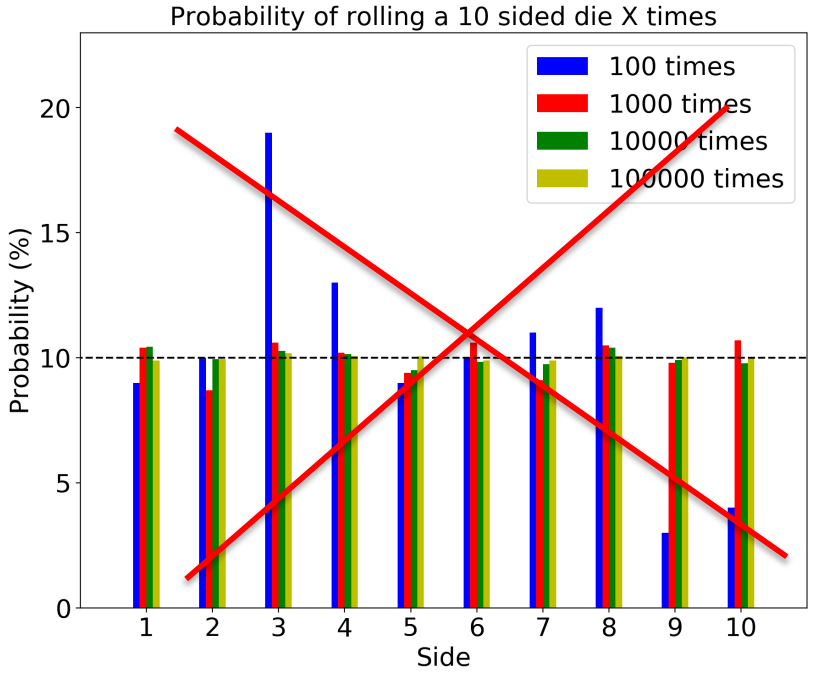
Insert your figure here, i.e. immediately after your conclusion.

Don’t quote any measurement to more than three significant digits (details in lecture 1, penalty: 1pt)

Scatter vs. Bargraph Plots

Graph title is not needed





- As stated above, bar graph is seldom used in scientific publications and hence not accepted unless authorized (minimum noncompliant penalty: 5 pts).
- For the scatter plot, it is easy to see visually that the blue dots for 100 rolls have large scatter around the expectation but the red crosses for 100,000 rolls coalescent closely around the expectation.

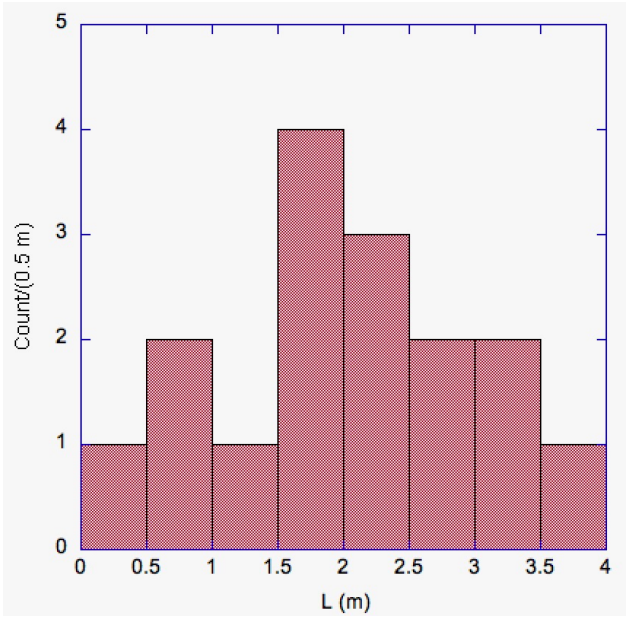
Histogram

A Histogram is a very useful and convenient way of presenting data. To make a histogram, you first divide the variable you measured into some number of equal intervals (bins) and then count the number of entries in each interval. You then plot the number of entries vs. the central value of each bin.

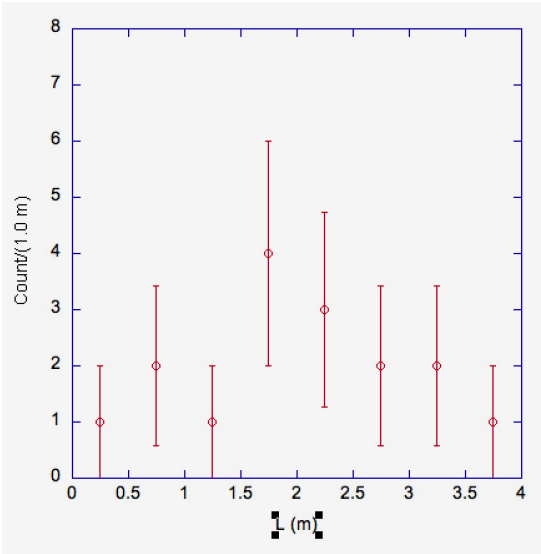
For example, suppose we measured the length (L) of 16 snakes (in meters): 0.7, 1.3, 1.5, 0.3, 2.4, 3.1, 2.6, 1.6, 3.3, 2.2, 2.7, 3.5, 0.6, 1.7, 1.6, 2.4. Let's choose a bin width of 0.5 m, then you have the following number of snakes in each bin:

Length (m)	#snakes
0.0 - 0.5	1
0.5 - 1.0	2
1.0 - 1.5	1
1.5 - 2.0	4
2.0 - 2.5	3
2.5 - 3.0	2
3.0 - 3.5	2
3.5 - 4.0	1

The histogram of the data looks like:



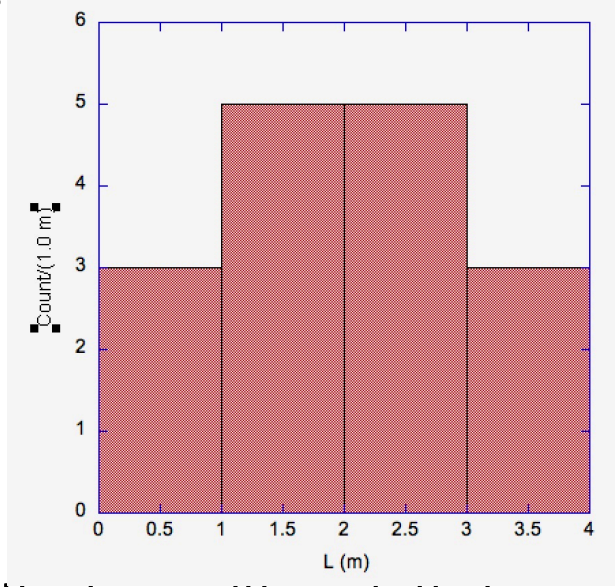
The problem with this graph is that I can't plot the error bars, which is the square root of the counts in each bin based on Poisson statistics. So a scalar plot is better:



The bin width is somewhat arbitrary. For example, we could use a bin width of 1 m:

Length (m)	#snakes
0.0 - 1.0	3
1.0 - 2.0	5
2.0 - 3.0	5
3.0 - 4.0	3

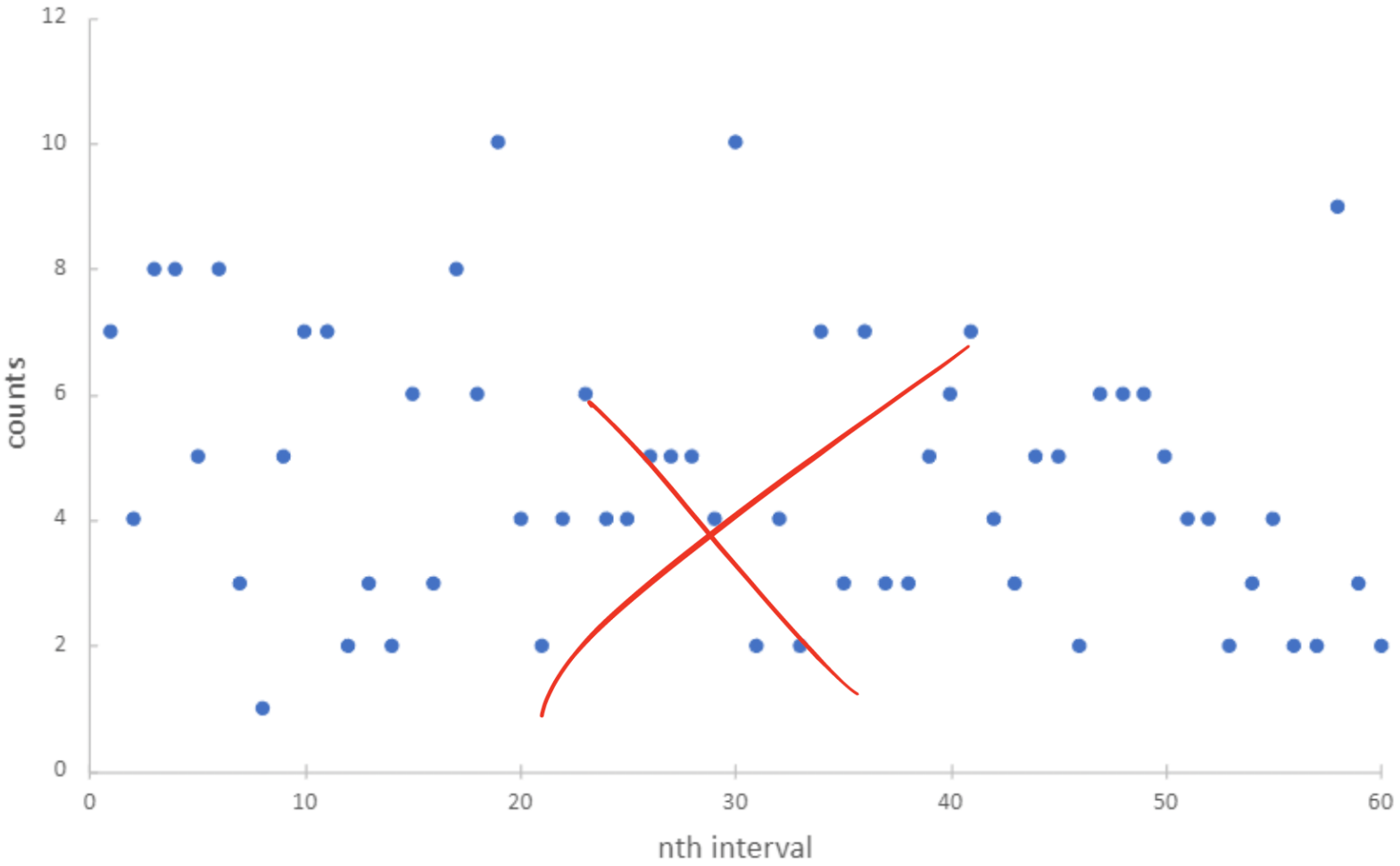
Then the histogram looks like:

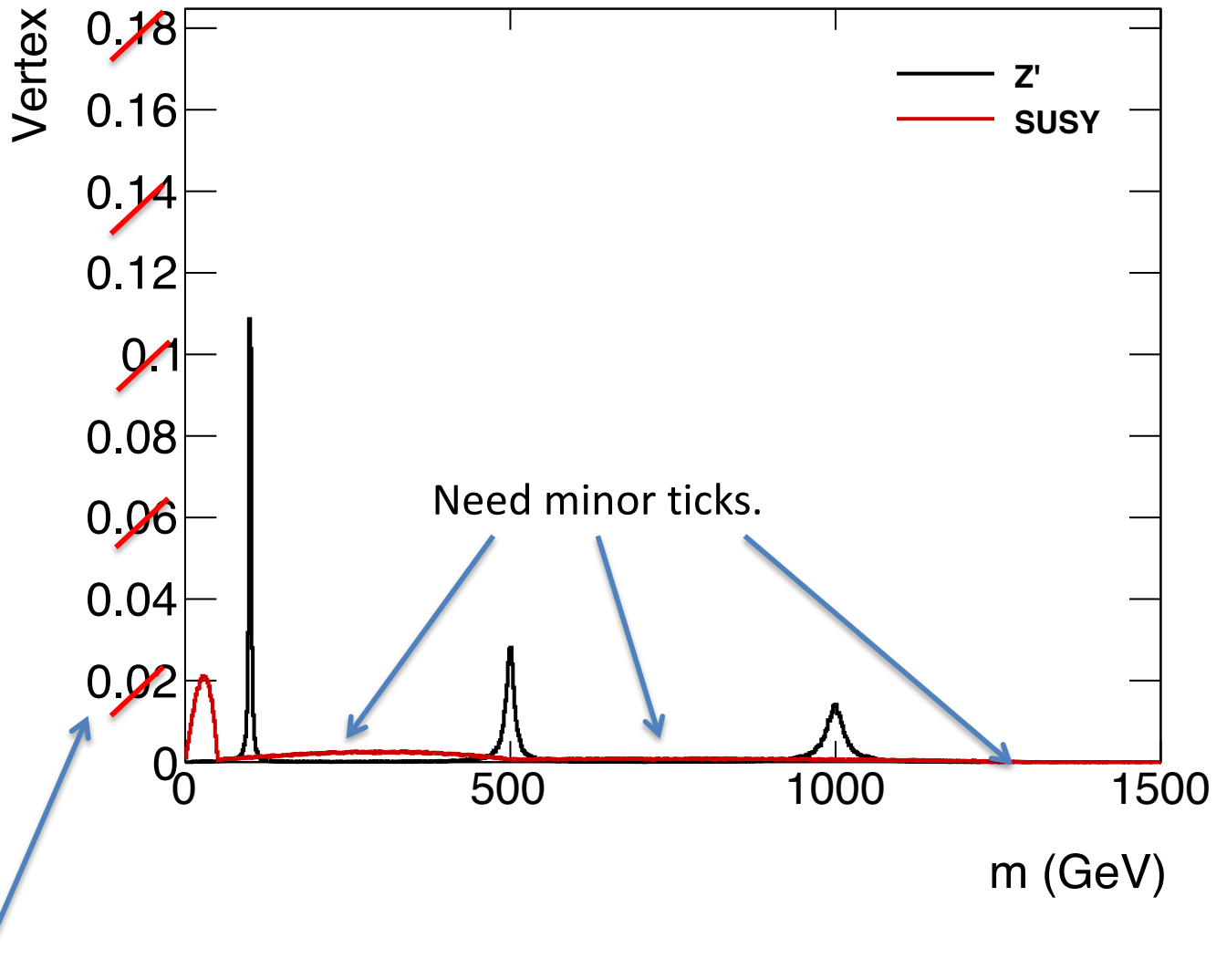


In general, we try to choose the bin width such that we can see the general sharp of the spectrum. If possible each bin should contain several entries if statistics is limited. So, for this example, a bin width of 0.05 m would be too small and a bin width of 5 m too large!

If the quantity you measure is an integer, choose a bin width that is an integer!

Not a Histogram!




Vertex
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
500
1000
1500
m (GeV)
Z'
SUSY
Need minor ticks.
Too many scale labels. Can eliminate some.