SPC LAB WRITEUP GUIDELINE

Several elements are required to get a good grade on a report. In general excellent work, and a lousy report will get you a lousy grade because what you have done is useless unless someone else can understand it. Here are some basic pointers.

Be Brief. In a lab you are typically taking data, and making some calculations on it. I do not need ot read a novel, but there are a few basic sections that MUST be there:

INTRODUCTION: Give a brief introduction to the lab. What are you doing? It should be only like 2 or 3 sentences, and any one who picks it up and reads it should immediately understand what this document in their hand is.

CALCULATIONS: You are taking data and analyzing it, so you must show how you are doing it, what analytical methods are you using? What software? Are you simulating the actual part with a model? How did you make the model? What data did you take? How was it measured? What were the assumptions? Include pertinent calculations explaining how each one of them is used. Drawings are very useful in explaining complex assemblies.

CONCLUSIONS: At the end is it good to summarize the progress. Think about the initial goal, and where you are. The reader should not have unanswered questions as to what you are supposed to be doing:

Figures, tables of numbers and graphs are the most important things in your writeup. Few people actually read the bulk of the text of most long papers (though I will read every word!). Mostly they just look at the title, abstract, drawings, fotos and graphs. Make sure that these tell the whole story without having to resort to word-for-word reading of the text. If there is a foto showing an important test apparatus, label the individual parts.

THINGS TO BE AVOIDED:

Don’t “bulk up” the report with a long-winded introduction of a bunch of crap you downloaded from the internet.

Don’t include unlabeled fotos, graphs, or data. Give everything a label so that anyone can look at your pictures/data and know exactly what’s going on.

Don’t just cut and paste blocks of text from other sources. Paraphrase (read it, and then re-write it in your own words) and **always make sure you cite the source** of information. I’ll mention this again just so it is clear: YOU WILL LOSE POINTS IF YOU SIMPLY COPY AND PASTE!

THINGS TO INCLUDE:

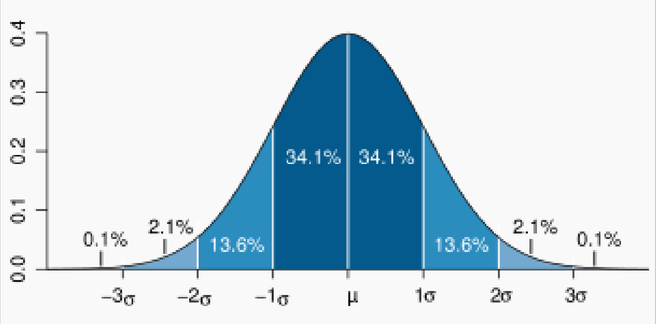
Anytime there are numbers they must have a label, and units. Also any calculations must be shown, at least show a sample calculation.

Additional write up notes:

- Lab reports are due 1 week from the lab date
- Hand in one report per group
- Graphs must be printed from a computer (ie. use XL or whatever graphing program you like). Please see guide (below) on graph preparation.
- **NOTE: COPYING = FAILURE !** I will be checking each and every report. If your report is a copy or another report, both groups fail.

This document can be found at: www.skyshorz.com under University/Resources for Students

Useful Data: Normal Distribution



Dark blue is less than one standard deviation from the mean. For the normal distribution, this accounts for about 68% of the set (dark blue) while two standard deviations from the mean (medium and dark blue) account for about 95% and three standard deviations (light, medium, and dark blue) account for about 99.7%.

The **normal distribution**, also called the **Gaussian distribution**, is an important family of continuous probability distributions, applicable in many fields. Each member of the family may be defined by two parameters, *location* and *scale*: the mean ("average", μ) and variance ("variability", σ^2), respectively. The **standard normal distribution** is the normal distribution with a mean of zero and a variance of one (the green curves in the plots to the right). Carl Friedrich Gauss became associated with this set of distributions when he analyzed astronomical data using them [1], and defined the equation of its probability density function. It is often called the **bell curve** because the graph of its probability density resembles a bell.

The importance of the normal distribution as a model of quantitative phenomena in the natural and behavioral sciences is due to the central limit theorem. Many psychological measurements and physical phenomena (like noise) can be approximated well by the normal distribution. While the mechanisms underlying these phenomena are often unknown, the use of the normal model can be theoretically justified by assuming that many small, independent effects are additively contributing to each observation.

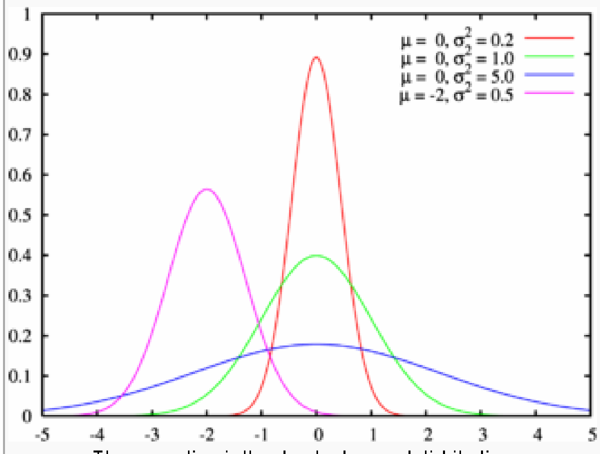
The normal distribution also arises in many areas of statistics. For example, the sampling distribution of the sample mean is approximately normal, even if the distribution of the population from which the sample is taken is not normal. In addition, the normal distribution maximizes information entropy among all distributions with known mean and variance, which makes it the natural choice of underlying distribution for data summarized in terms of sample mean and variance. The normal distribution is the most widely used family of distributions in statistics and many statistical tests are based on the assumption of normality. In probability theory, normal distributions arise as the limiting distributions of several continuous and discrete families of distributions.

You can plot the normal distribution for your data using just the mean (μ) and std. dev. ( ) Your data should overlay this distribution well.

You can find this page and more info at: http://en.wikipedia.org/wiki/Normal_distribution

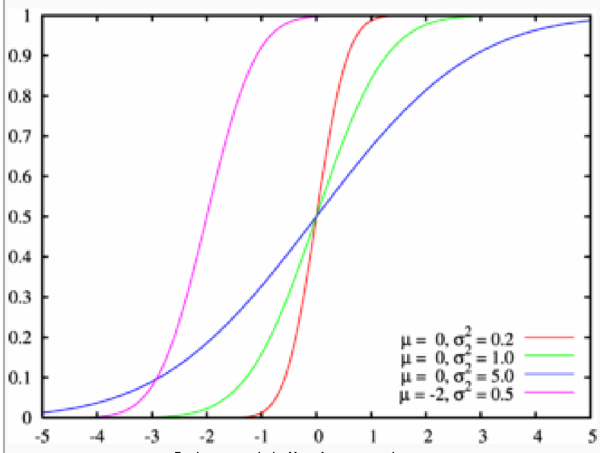
Normal

Probability density function



The green line is the standard normal distribution

Cumulative distribution function



Colors match the image above

Parameters	μ location (real) $\sigma^2 > 0$ squared scale (real)
Support	$x \in \mathbb{R}$
Probability density function (pdf)	$\frac{1}{\sigma\sqrt{2\pi}}\exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$
Cumulative distribution function (cdf)	$\frac{1}{2}\left(1+\mathrm{erf}\,\frac{x-\mu}{\sigma\sqrt{2}}\right)$
Mean	μ
Median	μ

Brief guide to good graphs for technical reports

Graphs are one of the best ways to communicate engineering data, so it is important you get it right! Here is a set of data, and good and bad examples of graphs made from it.

Sample Data Set:

Torque Nm	Speed rad/sec	Speed rpm
25.0	0.104667	1
51.9	0.157	1.5
87.1	0.209333	2
130.1	0.261667	2.5
453.0	0.523333	5
1577.4	1.046667	10

This first graph has several problems:

1) it is not an X-Y plot, it plots Y versys X catagories, so the horizontal axis is not constant. This is very misleading

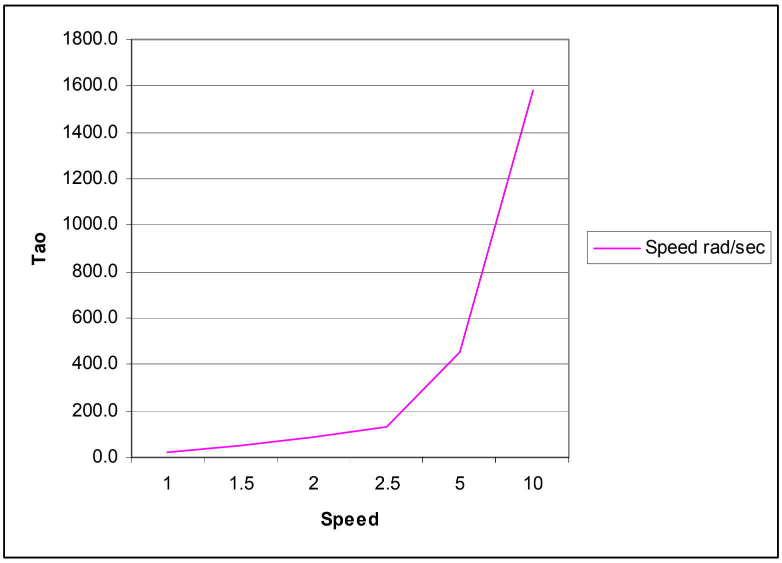
2) We don't need a legend is there is only 1 graph!

3) What are the units and labels? They should be Speed (with appropriate units) and Torque (Nm).

4) The speed is in rad/sec. Use standard unites (ie. rpm for speed)

5) Why is there a box around the graph? This forces the graph into a smaller area, turn the box off.

6) The vertical axis should not have the ".0" digit on it.



Bad Graph #1

7) The horizontal axis should have a ".0" digit:

1.0, 1.5, 2.0, 2.5 etc.

8) The color of the line is too light to see. Assume that the viewer will always see the plot in black and white.

Some of the previous errors exits, some new ones are present. At least this plot is an X-Y graph.

1) Lose the legend.

2) Lose the box.

3) Lose the grey background

4) Data that is spread out might need a line to "connect the dots"

5) There are no labels or units

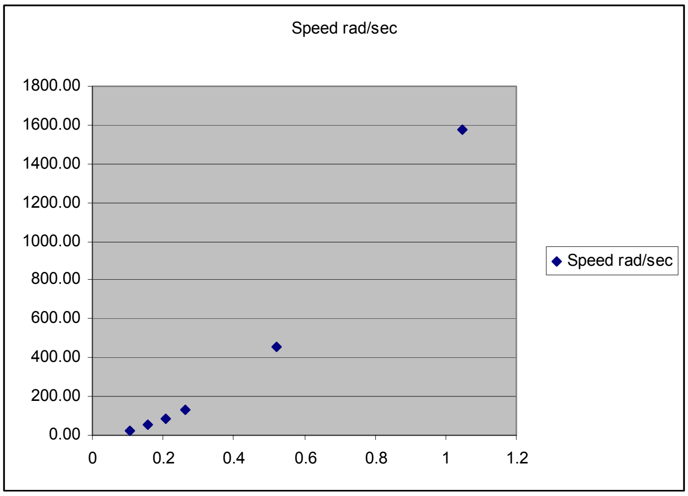
6) The over title is best done OUTSIDE the graph (ie in the body of the text of the report) to avoid encroaching on the graphs space

7) Extra ".00" on the vertical axis

8) Inconsistant digits on horizontal axis.

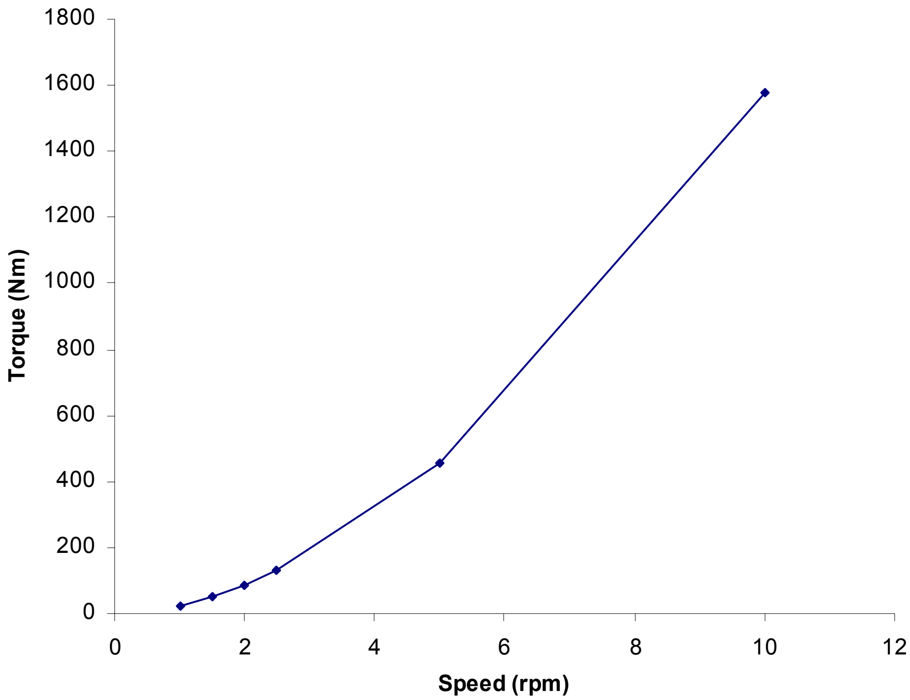
9) Rarely will we need grid lines

10) It is too small!



Bad Graph #2

This last plot is a much more professional and informative graph, even though the same data is presented. It does require a label, preferably with a caption explaining it:



Torque of the positioner versus Rotational Speed

All of these graphs take up the same space. Can you see the difference? Please try to make your graphics as clear as possible. This will help your reports immensely!