Final Topic List

Six Sigma and Lean Concepts:

- Be able to describe what quality is
- Be able to describe why variability in a product can lead to extra cost
- Define what Six Sigma is, and why it is called Six Sigma
- Be able to perform calculations to determine if a process is a six sigma process
- Describe why slow processes are expensive
- Describe the steps of the DMAIC process
- Be able to create/interpret SIPOC, FMEA and process maps
- Be able to create and interpret a Pareto Chart

Basic Statistics and Charts

- Be able to calculate the mean, median, lower and upper quartiles and standard deviation/variance of set of data, and describe what they mean
- Be able to construct a stem and leaf plot, box plot, normal probability plot and histogram given a set of data
- Assuming a normal distribution, calculate probabilities and/or find values given a probability, and sketch out what it is you are finding (must be comfortable with converting to z-values)
    - Hint: it would be helpful to go over the problems covered in HW2 to review these kind of probability problems
- Be able to describe when a binomial distribution is appropriate to use and also be able to calculate probability and/or find values given a probability using a sketch of a distribution

Hypothesis Testing

- Be able to select the correct type of hypothesis test to use
- Be able to describe (using a probability sketch) a 1 versus 2 sided hypotheses (and correctly select which to use)
- Follow the correct step by step process to do hypothesis tests
- Correctly phrase conclusions in a hypothesis test
- Correctly phrase what the p-value is (and when asked sketch it out on a probability plot)
- Sketch out what rejection criteria are, in relation to test statistic and alpha value using a probability plot
- Correctly phrase what confidence intervals are representing
- Be able to interpret a computer program output of hypothesis tests
- Be able to describe type I and type II error using probability plots and words, and why rejecting the null is strong versus not rejecting the null in the context of type I and type II error
- Be about to conduct the following tests:

Test	# of Populations	Variance Known?	Parameter of interest?	Reference Dist.
One-sample Z-test	1	Yes	Mean	Standard normal
Two-sample Z-test	2	Yes	Difference between means	Standard normal
One-sample t-test	1	No	Mean	t-distribution
Two-sample t-test (equal variance)	2	No	Means of two populations	t-distribution
Two-sample t-test (unequal variance)	2	No	Means of two populations	t-distribution
Paired t-test	2 (simplifies to 1)	No	Difference between paired means	t-distribution
1 Variance test	1	No	Variance of one population	chi-squared distribution
2 Variance test	2	No	Variance of two populations	F-distribution

ANOVA:

- how to conduct the test (by hand and interpret Minitab) and draw conclusionsions
- what situations ANOVA is used in (when to pick it as the statistical test)
- what, generally, the test statistic represents
- what the reference distribution is as related to the test statistic and when the test statistic follows the reference distribution (should be able to do this for other hypothesis tests as well)
- know how to check assumptions
- how and when to perform a posthoc test
- how and when to transform data

Linear Regression:

- know how to perform simple linear regression by hand (how to perform the hypothesis test – won't ask the regression terms by hand)
- how to set up the equations and hypothesis for multiple linear regression
- know how to interpret results from Minitab output on simple and multiple linear regression
- explain what R^2 is, and how to calculate by hand for simple linear regression
- know how to check assumptions
- how and when to transform data
- describe what the confidence intervals on the response are

Control Charts:

- Be able to explain what impact wide or narrow control limits have on type I and type II error, and be able to define type I and type II errors for control charts
- Be able to explain why it is important to control both process mean and variability by sketching out distributions
- Calculate control limits and warning limits for xbar and R charts
- Be able to identify and out of control process

Design of Experiments:

- Be able to perform the calculations to analyze two-factor factorial experiments (with more than two levels – see HW 8)
    - Includes hypothesis test, calculation of SS, Fo, and finding P-values (and/or critical values)
    - Be able to interpret and calculate items in computer program ANOVA output tables
    - Be able to state the hypotheses that are being tested
    - Be able to calculate and plot residuals to check assumptions
    - Be able to perform the calculations and construct plots for the main effects and interactions
    - Be able to check assumptions
- Be able to perform calculations to analyze 2^k experiments
    - Includes hypothesis test, calculation of main effects, interactions, SS terms, Fo, finding P-values (and/or critical values) as well as model coefficients
    - Be able to interpret and calculate computer program ANOVA output tables
    - Be able to state the hypothesis that are being tested
    - Be able to calculate and plot residuals to check assumptions
    - Be able to perform the calculations and construct plots for the main effects and interactions
    - Be able to check assumptions
    - Be able to suggest a model based on the results
    - Be able to analyze results when only one replicate is used
    - Be able to test for curvature (by using pooled error of center points and lower ordered terms)
    - Be able to suggest optimum settings based on suggested model or contour plots
    - Be able to describe the process for model trimming, and describe what happens to the estimate of error once terms are trimmed out of the model
    - Describe what to do if curvature is significant (and the implications)
    - Describe conceptually when and why fractional factorials might be useful, aliasing, and why aliasing may or may not be problematic
    - Find predicted values using your coded model