Statistics, Math 121

Catalogue description: Descriptive and inferential statistics with the emphasis on drawing meaningful conclusions from sets of data. Topics include measures of central tendency and dispersion, the normal distribution, z-test, t-tests, linear regression, analysis of variance, Chi-Square tests, and other topics as time permits.

Learning objectives:

Critical Thinking and Context
Students will demonstrate the ability to:

- critically examine statistics reported in the media, identify questions that need to be answered before accepting a statistic at face value, and engage in research necessary to put a statistic in context and understand it more fully;
- identify the use of statistics in multiple applied and disciplinary contexts.

Exploring Data
Students will demonstrate the ability to:

- explore data in order to describe a distribution, elucidate patterns, and suggest questions for research;
- choose appropriate graphical and numerical summaries to describe a distribution and interpret the results including measures of central tendency and spread;
- find the proportion of a normal distribution above or below a given point and find the cut-offs for various percentiles.

Correlation and Regression
Students will demonstrate the ability to:

- create, describe, and interpret a scatter plot to show the relationship between two variables;
- calculate and interpret the correlation coefficient, r, demonstrating the strength and direction of the linear relationship between two variables;
- compute the least-squares regression line and use it to predict values of the response variable given a value of the explanatory variable;
- recognize the difference between correlation and cause and effect;
- use two-way tables to understand the relation between two categorical variables and recognize and explain Simpson's paradox.

Sampling and experimental design
Students will demonstrate the ability to:

- distinguish between observational studies and experiments;
- design experiments to test hypotheses using appropriate randomization;
- use the random number generator to assign subjects correctly to experimental groups;
- define, use, and know the vocabulary of sampling and study design.

Probability
Students will demonstrate the ability to:

- apply the basic laws of probability;
- find probability of events in a finite sample space;
- identify a sampling distribution and distinguish it from the parent distribution;
- apply the law of large numbers and the central limit theorem to the sampling distribution of the mean.

Inference
Students will demonstrate the ability to:

- use *t*-distributions to compute confidence intervals and carry out hypothesis tests for one and two population means including matched pairs;
- create two-way tables and carry out Chi-square tests to test whether there is a relation between two categorical variables;
- carry out a one-way ANOVA test to determine whether the means of more than two populations are all equal.

Approved: 7 March 2011