May 2013

DEPARTMENT OF MATHEMATICS
MILLERSVILLE UNIVERSITY
Syllabus

I. MATH 130 - ELEMENTS OF STATISTICS - 3 credits

II. Catalog Description

Derivation of basic formulas; measures of central tendency and variability; probability and normal curve; sampling and hypothesis testing. No credit toward mathematics major. Prerequisite: A 100 level math course or math placement

III. Objectives

Students will become proficient in applying the techniques of probability and statistics. In light of this, students will be able to:

A. solve problems in elementary probability and apply the concepts to appropriate applications;

B. use basic methods of statistical analysis to describe data, including shape, position and a variety of measures of center and spread;

C. demonstrate an understanding of the properties of the discrete and continuous probability distributions;

D. recognize appropriate applications of the discrete and continuous probability distributions and solve problems using these distributions, including binomial and normal distributions;

E. estimate means, proportions, differences of means, and differences of proportions using confidence intervals;

F. interpret confidence intervals, confidence levels, p-values, and results of hypothesis tests;

G. perform hypothesis tests to make inferences for means, and proportions involving one and two populations;

H. interpret statistical results in research articles, effectively communicate with statisticians, and interpret computer output involving means, standard errors, significance levels, confidence limits and other fundamental measures;

I. use a basic statistical computing package (Minitab) to solve problems in probability and statistics.

III. Course Outline

A. Descriptive Analysis and Presentation of Data
1. Role of Statistics in Research
2. Observational studies and designed experiments
3. Population vs. sample
4. Random samples vs. non-random samples
5. Central tendency measures - mean, median, mode
6. Measures of variability - range, variance, standard deviation
7. Graphic presentation of data

B. Basic Probability
1. The Nature of Probability
2. Probability of Events
3. Simple Sample Space
4. Rules of Probability
5. Mutually Exclusive Events and the Addition Rule
6. Independence, the Multiplication Rule, and Conditional Probability
7. Counting Rules

C. Random Variables and probability distributions
1. Random variables
   a. discrete
   b. continuous
2. Mean, variance, and standard deviation of a discrete random variable
3. Probability distributions
   a. Binomial distribution
      1. properties of binomial experiments
      2. calculation of binomial probabilities
         a. using formula
         b. using binomial tables
      3. applications
   b. Normal distributions - standard and non-standard
      1. standard normal table use
      2. calculation of probabilities for any normal distribution
      3. central limit theorem
      4. applications using Central Limit Theorem
         a. variation of sample mean
         b. approximating binomial probabilities

D. Statistical Inferences - basic ideas
1. Hypothesis Testing - introduction to concepts and terms
   a. null and alternative hypothesis
   b. types I and type II errors
   c. level of significance
2. Methodology of hypothesis testing
   a. test statistics, critical values and decisions
   b. p-values

3. Testing of hypothesis involving one population
   a. tests concerning a mean
   b. test concerning a proportion
4. Estimation – point estimation and confidence interval limits
   a. one population
      1. mean
      2. binomial proportion, large sample
   b. two populations
      1. difference between means
      2. difference between binomial proportions, large samples
      3. dependent samples, mean difference (Optional)
5. Testing Hypothesis - involving two populations
   a. independent samples - tests comparing means
   b. dependent samples, paired t-test (Optional)
   c. Tests concerning the difference between two proportions from binomial populations, large samples

IV. Suggested Texts: Fundamentals of Statistics. 4th edition, by Michael Sullivan. Pearson, 2014.
Elementary Statistics, 12th edition by MarioTriola, Pearson, 2014.

VI. General Education Credit
This course may be taken for general education credit.

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