MATH 130 – ELEMENTS OF STATISTICS 1 – SYLLABUS

Department of Mathematics
Millersville University

Description

Derivation of basic formulas; measures of central tendency and variability; probability and normal curve; sampling and hypothesis testing; confidence intervals. No credit toward a math or four-year computer science major, or under block G2 for majors in the School of Science and Mathematics except for nursing majors and allied health technology majors. (3.0 credits)

This course may be taken for general education credit (G2) except for the majors mentioned above.

MATH 234 and MATH 235 are equivalent courses and thus credit will not be given for more than one of MATH 130, 234, and 235.

Prerequisites

Successful completion of any 100-level MATH course or math placement testing/evaluation before registration.

Course Objectives

Students will become proficient in applying the techniques of probability and statistics. Upon successful completion of MATH 130, students will be able to:

- solve problems in elementary probability and apply the concepts in appropriate situations,
- use basic methods of statistical analysis to describe data, including the shape, position and a variety of measures of center and spread,
- demonstrate an understanding of the properties of discrete and continuous probability distributions,
- recognize appropriate applications of the discrete and continuous probability distributions and solve problems using these distributions, including binomial and normal distributions,
- estimate means, proportions, differences of means, and differences of proportions using confidence intervals,
- interpret confidence intervals, confidence levels, p-values, and results of hypothesis tests,
- perform hypothesis tests to make inferences for means and proportions involving one and two populations,

- 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,
- use a basic statistical computing package (*e.g.*, Minitab or StatCrunch) to solve problems in probability and statistics.

Assessment

Assessment of student achievement of the course objectives will vary from one instructor to another. Typical assessment will be made through work in class, homework, and examinations administered in a traditional face-to-face classroom environment, in an online environment, or in a hybrid of face-to-face and online assessments.

Use of Technology

Students will be well served by a scientific calculator such as the Texas Instruments TI-30 or other scientific calculator.

Topics

1. Descriptive Analysis and Presentation of Data
   a) Role of Statistics in Research
   b) Observational studies and designed experiments
   c) Population vs. sample
   d) Random samples vs. non-random samples
   e) Central tendency measures - mean, median, mode
   f) Measures of variability - range, variance, standard deviation
   g) Graphic presentation of data
2. Basic Probability
   a) The Nature of Probability
   b) Probability of Events
   c) Simple Sample Spaces
   d) Rules of Probability
   e) Mutually Exclusive Events and the Addition Rule
   f) Independence, the Multiplication Rule, and Conditional Probability
   g) Counting Rules
3. Random Variables and Probability Distributions
   a) Random variables
      - Discrete
      - Continuous
   b) Mean, variance, and standard deviation of a discrete random variable
   c) Probability distributions
      - Binomial distribution
        o properties of binomial experiments

- o calculation of binomial probabilities
    - using formula
    - using binomial tables
  - o applications
- Normal distributions - standard and non-standard
  - o standard normal table use
  - o calculation of probabilities for any normal distribution
  - o central limit theorem
  - o applications using Central Limit Theorem
    - variation of sample mean
    - approximating binomial probabilities

4. Statistical Inferences - basic ideas
   a) Hypothesis Testing - introduction to concepts and terms
      - null and alternative hypothesis
      - type I and type II errors
      - level of significance
   b) Methodology of hypothesis testing
      - test statistics, critical values and decisions
      - p-values
   c) Testing of hypothesis involving one population
      - tests concerning a mean
      - tests concerning a proportion
   d) Estimation – point estimation and confidence interval limits
      - one population
        - o mean
        - o binomial proportion, large sample
      - two populations
        - o difference between means
        - o difference between binomial proportions, large samples
        - o dependent samples, mean difference (Optional)
   e) Testing Hypothesis - involving two populations
      - independent samples - tests comparing means
      - dependent samples, paired t-test (Optional)
      - tests concerning the difference between two proportions from binomial populations, large samples

Recently Used Textbooks

- *Fundamentals of Statistics*, 4th edition, Michael Sullivan, Pearson (2014).
- *Elementary Statistics*, 12th edition, Mario Triola, Pearson (2014).