

MATH 230 – Data Analysis and Probability for the Middle Level Teacher – SYLLABUS

Department of Mathematics

Millersville University

Description

Designed for middle level (4-8) teaching candidates as an introduction to probability and statistics. Course will cover the following topics at an appropriate level: descriptive statistics, counting and basic probability, concept of random sampling, random variables and probability distributions, and statistical inference involving confidence intervals and hypothesis testing. (3 credits)

This course may be taken for general education credit (G2)

Prerequisites

MATH 104 (C or better) or department permission.

Course Objectives

the conclusion of this course the successful student will be able to:

- Apply basic concepts of statistics, including descriptive statistics to analyze and describe relevant data.
- Apply basic concepts of probability including counting principles, random variables and probability distributions.
- Use data to make decisions.
- Use course techniques to formulate a problem, collect data, conduct the analysis, and explain the solution.
- Use appropriate technology (graphing calculators and computers) to problem solve and facilitate a clear application of their understanding of the key concepts of statistics and probability in the classroom.
- Apply the Data Analysis and Probability Standards from the NCTM Principles and Standards for School Mathematics and the Pennsylvania Academic Standards for Teaching Mathematics.
- Connect the content of statistics and probability to appropriate pedagogy for Middle Level teaching.
- To provide enough statistical training so that students can read research articles, communicate with statisticians, and interpret computer outputs involving means, standard errors, significance levels, confidence limits and other fundamental measures.
- To introduce students to statistical computing packages and/or software and to use these 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.

Use of Technology

Technology use will vary by professor.

Topics

- 1) Introduction
 - a) Nature of Statistics
 - i) Role of Data
 - ii) Role of Probability
 - b) Nature of Data
- 2) Descriptive Statistics (Univariate & Bivariate)
 - a) Data Displays
 - i) Categorical Data – Bar Graphs, Circle Graphs, Pie Graphs
 - ii) Quantitative Data – Histograms, Stem-and-Leaf, Dot-plots, Scatter-plots
 - b) Numerical Summary Statistics
 - i) Measures of Center/Location – Mode, Median, Mean
 - ii) Measures of Spread/Variation – Range, Variance, Standard Deviation
 - iii) Measures of Position – Z-Score, Empirical Rule, 5- number Summary, Box-plots
 - iv) Measures of Association Between 2 Quantitative Data Variables – Correlation, Best Fit Line
- 3) Basic Probability
 - a) Random phenomena and random experiments
 - i) sample spaces and events
 - ii) combining events
 - iii) mutually exclusive events
 - b) Definitions of Probability
 - i) relative frequency probability
 - ii) equally likely outcomes probability
 - c) Fundamental Properties of Probability
 - i) additive property (mutually exclusive and non-mutually exclusive events)
 - ii) complement
 - iii) multiplicative property
 - (1) tree diagrams
 - (2) conditional probability
 - iv) independent events
 - d) Counting – Multiplication Rule
- 4) Random Variables And Probability Distributions
 - a) Random Variables
 - b) Mean And Standard Deviation Of Random Variables
 - c) Special Random Variables
 - i) Binomial Experiment, Binomial Random Variable, Binomial Distribution
 - ii) Normal Random Variable, Normal Distribution
 - d) Random Sampling and Sampling Distributions

- i) Data Collection
 - ii) Distribution Of Sample Means
 - (1) Central Limit Theorem
 - (2) t-Distribution
 - iii) Distribution Of Sample Proportions
- 5) Statistical Inference (Single Parameter) – Decisions Based Upon Data
- a) Estimating With Confidence
 - i) Nature of Point Estimation
 - ii) Nature of Confidence Intervals
 - (1) Confidence Intervals For Proportions, Sample Size
 - (2) Confidence Intervals For Means, Sample Size
 - b) Testing Hypotheses
 - i) Nature of Hypothesis Testing
 - (1) Hypotheses, Type 1 Error, Type 2 Error
 - (2) Summarize the Evidence
 - (3) Assess the Evidence (P-Value)
 - (4) Reach Conclusion
 - ii) Testing About Proportions
 - iii) Testing About Means
- Synthesis of Statistical Ideas and Pedagogy {through-out the course}