Course Outline for Mathematics 43

INTRODUCTION TO PROBABILITY AND STATISTICS

Catalog Description:

MTH 43 - Introduction to Probability and Statistics 4.00 units
Descriptive statistics, including measures of central tendency and dispersion; elements of probability; tests of statistical hypotheses (one and two populations); correlation and regression; ANOVA; applications in various fields. Introduction to the use of computer software package to compute both descriptive and inferential statistics problems. May not receive credit if Mathematics 35 has been completed.
Prerequisite: MTH 53 (completed with a grade of "C" or higher) or, MTH 53B (completed with a grade of "C" or higher) or, MTH 54 (completed with a grade of "C" or higher) or, MTH 54L (completed with a grade of "C" or higher) or, MTH 55 (completed with a grade of "C" or higher) or, MTH 55B (completed with a grade of "C" or higher) or, MTH 55L (completed with a grade of "C" or higher) or an appropriate skill level demonstrated through the Early Assessment Program or an appropriate skill level demonstrated through the Mathematics Assessment process.
Strongly Recommended: Eligibility for ENGL 1A

Grading Option: Letter Grade

Discipline:

<table>
<thead>
<tr>
<th>Type</th>
<th>Min Units</th>
<th>Inside of Class Hours</th>
<th>Outside of Class Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>4</td>
<td>72.00</td>
<td>144.00</td>
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<tr>
<td>Laboratory</td>
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</tr>
<tr>
<td>Clinical</td>
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<td>0</td>
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<tr>
<td>Work Exp (Non-Paid)</td>
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<td>0</td>
<td>0</td>
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<td>Work Exp (Paid)</td>
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<tr>
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<td>144.00</td>
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</table>

Prerequisite Skills:

Before entry into this course, the student should be able to:
1. describe data using concepts of frequency and measures of central tendency;
2. identify functions, find their domains and ranges, and use function notation in the context of real data;
3. find average rates of change;
4. graph and find the equations of linear functions in the context of real data;
5. solve problems involving direct and inverse proportionality;
6. find linear system models for data and interpret solutions to these linear systems;
7. find inverse functions and compose functions in the context of real data;
8. choose an appropriate model for a realistic situation given a choice of mathematical models.
9. apply the properties of and perform operations with radicals;
10. find the distance between two points;

Measurable Objectives:

Upon completion of this course, the student should be able to:
1. distinguish among different scales of measurement and their implications;
2. interpret data displayed in tables and graphically;
3. apply concepts of sample space and probability;
4. calculate the mean, median, mode, variance and standard deviation for a given data set;
5. identify the standard methods of obtaining data and identify advantages and disadvantages of each;
6. identify the sampler(s) and population(s) in a data set description;
7. describe the basic principles of experimental design;
8. calculate probabilities of various independent or dependent events;
9. calculate the mean and variance of a discrete distribution;
10. calculate probabilities using normal and t-distributions;
11. describe the nature of the binomial distribution and normal distribution, as well as properties of the normal probability curve;
12. distinguish the difference between sample and population distributions and analyze the role played by the Central Limit Theorem;
13. construct and interpret confidence intervals;
14. determine and interpret levels of statistical significance including p-values;
15. interpret the output of a technology-based statistical analysis;
16. identify the basic concept of hypothesis testing including Type I and II errors;
17. formulate hypothesis test involving samples from one and two populations;
18. select the appropriate technique for testing a hypothesis and interpret the result;
19. use linear regression and ANOVA analysis for estimation and inference, and interpret the associated statistics;
20. use appropriate statistical techniques to analyze and interpret applications based on data from disciplines including business, social sciences, psychology, life science, health science, physical science, engineering and education.

Course Content:
1. Summarizing and analyzing data graphically and numerically
   A. Types of Data
   B. Levels/scales of measurement
   C. Frequency and relative frequency distributions
   D. Frequency and relative frequency histograms
   E. Five-number summaries and boxplots
   F. Scatter plots
   G. Two-way tables
   H. Measures of central tendency
      a. Mean
      b. Median
   I. Measures of dispersion
      a. Range
      b. Standard deviation
      c. Interquartile range
   J. Percentiles
   K. Empirical rule

2. Experimental Design

3. Probability
   A. Events and sample spaces
   B. Probability laws
   C. Independent and dependent events

4. Random variables
   A. Expected value
   B. Distribution
      a. Uniform
      b. Binomial
      c. Normal
      d. Student t
      e. Chi-square

5. Sampling and sampling distributions

6. The Central Limit Theorem

7. Estimation and confidence intervals
   A. One proportion z-interval
   B. One mean t-interval

8. Hypotheses testing and inference
   A. One population proportion z-test
   B. One population mean t-test
   C. Two population mean difference of mean t-test
   D. Two population mean of difference t-test
   E. Chi-square tests

9. Correlation and linear regression and analysis of variance (ANOVA)

10. Applications using data from disciplines including business, social sciences, psychology, life science, physical sciences, engineering and education

11. Statistical analysis using technology such as SPSS, JMP, Minitab

Methods of Presentation
1. Lecture/Discussion
2. Problem solving
3. Student participation
4. Class and group discussions
5. Videos
6. Written assignments
7. Group Activities
8. Laboratory exercises
9. Presentation of audio-visual materials
10. Computer-based interactive curriculum
11. Simulations
12. Online Assignments
13. Group Presentations

Assignments and Methods of Evaluating Student Progress
1. Typical Assignments
   A. Enter the data on test scores into a Minitab worksheet. Create a histogram, stem-and-leaf diagram, and boxplot of the data. Calculate the mean, standard deviation, and five-number summary. Write a brief analysis of the data based on these graphical and numerical summaries.
   B. Determine the range and sample standard deviation of the tornado occurrence data in Exercise 3.43. Discuss one major drawback to the standard deviation as a measure of variation.

2. Methods of Evaluating Student Progress
   A. Quizzes
   B. Homework
   C. Midterm Examination
   D. Final Examination
   E. Laboratory exercises
   F. Projects
   G. Practical Examination

3. Student Learning Outcomes
   Upon the completion of this course, the student should be able to:
   A. Analyze mathematical problems critically using logical methodology.
   B. Communicate mathematical ideas, understand definitions, and interpret concepts.
   C. Increase confidence in understanding mathematical concepts, communicating ideas and thinking analytically.

Textbooks (Typical):

**Special Student Materials**

1. Graphing statistical calculator may be required.
2. Statistical software.

**Abbreviated Class Schedule Description:**

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