Las Positas College
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Course Outline for MATH 40

STATISTICS AND PROBABILITY

Effective: Fall 2018

I. CATALOG DESCRIPTION:
MATH 40 — STATISTICS AND PROBABILITY — 4.00 units

Descriptive statistics, including measures of central tendency, dispersion and position; elements of probability; confidence intervals; hypothesis tests; two-population comparisons; correlation and regression; goodness of fit; analysis of variance; applications in various fields. Introduction to the use of a computer software package to complete both descriptive and inferential statistics problems.

4.00 Units Lecture

Prerequisite
MATH 55B - Intermediate Algebra for STEM B
with a minimum grade of C
or

MATH 55 - Intermediate Algebra for STEM
with a minimum grade of C
or

MATH 50 - Core Intermediate Algebra
with a minimum grade of C

Grading Methods:
Letter Grade

Discipline:
- Mathematics

	MIN
Lecture Hours:	72.00
No Unit Value Lab	18.00
Total Hours:	90.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. MATH55B
B. MATH55
1. Recognize and determine the distinctions between relations and functions, numerically, graphically, symbolically, and verbally;
2. Given a function, determine the domain and range and express them in interval notation;
3. Solve polynomial, rational, absolute value, radical, linear, exponential, and logarithmic equations;
4. Apply basic operations on functions, including composition of functions and finding inverse functions;
5. Develop and use equations or function models to analyze and solve applied problems involving linear, quadratic, rational, radical, exponential or logarithmic expressions. Topics should minimally include growth, decay, geometry, optimization and uniform motion.
6. Use the properties of radicals, complex numbers, exponents and logarithms;
7. Sketch the graphs of nonlinear relations, including parabolas and circles, and identify key components of the graphs;

C. MATH50
1. Explain and/or justify their solution process orally or in writing
2. Use algebraic operations to simplify polynomial, rational and radical expressions
3. Simplify radicals and use properties of exponents to simplify expressions with integer or rational exponents
4. Represent and solve equations graphically. (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions; by hand or using technology)
5. Solve a formula for a specified variable
6. Represent functions verbally, symbolically, numerically and graphically and use function notation
7. Analyze the behavior of a function (e.g., intercepts, intervals of increase/decrease) and sketch its graph with appropriate labels and scales (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and

logarithmic functions)
8. Apply transformations to the graphs of relations and functions (horizontal and vertical translation, reflection in the x - or y -axis, dilation and contraction) (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
9. Perform operations with functions, including composition of functions (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
10. Determine whether or not a function is one-to-one
11. Find the inverse of an invertible function, state its domain and range, and sketch its graph
12. Select and use the appropriate technology to represent and analyze graphs and functions
13. Solve applied problems with functions (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
14. Construct, use and interpret mathematical models (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
15. Compare linear, quadratic and exponential change
16. Construct and interpret data charts, tables and graphs with appropriate labels and scales
17. Apply linear regression to a scatter plot and interpret the result
18. Calculate the probability of an event using the equally likely probability formula, the properties of probability, the sum rule, the product rule or a tree diagram
19. Find and use a probability distribution

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

A. Define different types of statistics, how they are used and misused;
B. Identify the standard methods of obtaining data and identify the advantages and disadvantages of each;
C. Distinguish among different scales of measurement and their implications;
D. Distinguish between controlled experiments and observational studies, including identifying potential confounding factors, and explain why they are confounding;
E. Take real world raw data and organize it into tables, charts, and/or graphs both with and without the use of technology;
F. Interpret data displayed in tables and graphically;
G. Calculate and understand the meaning of the the measures of central tendency: mean, median, mode, and the measures of variation and position: range, variance, and standard deviation as they relate to a population, sample, or distribution;
H. Construct and interpret confidence intervals for single populations and two-populations comparisons;
I. Apply concepts of sample space and probability;
J. Determine the fundamentals concepts of probability and be able to calculate probabilities using some basic rules;
K. Apply concepts of and use linear regression and ANOVA analysis for estimation and inference, and interpret the assocatiated statistics;
L. Solve problems involving the binomial, normal, or chi-squared distribution;
M. Perform descriptive and inferential statistics, using a software package (technology).
N. Calculate probabilities using normal and t-distributions;
O. Formulating a hypothesis test by selecting the appropriate technique for testing the hypothesis and interpreting the result for one and two-populations comparisons;
P. Identify the baisic concept of hypothesis testing including Type I and II errors;
Q. Distinguish the difference between sample and population distributions and analyze the role played by the Central Limit Theorem;
R. Formulationg a hypothesis test by selecting the appropriate technique for testing the hypothesis and interpreting the result for one and two-populations comparisons;
S. Determine and interpret levels of statistical significance including p-values;
T. Use appropriate statistical techniques to analyze and interpret applications based on data from disciplines including business, social sciences, psychology, life science, health science, and education.

V. CONTENT:

A. Introduction to Statistics
    1. Descriptive vs. inferential statistics
    2. Types of data
        a. Levels of measurement
    3. Basic concepts
        a. Populations and samples
        b. Parameters and statistics
    4. Sampling
        a. Methods
        b. Bias
    5. Misuse of statistics
B. Analysis of data
    1. Ungrouped data
        a. Measure of central tendency – mean median, mode
        b. Measure of dispersion – range, mean absolute deviation, variance, standard deviation
        c. Measure of position – percentiles, deciles, quartiles, z - score
        d. Graphs – stem and leaf, box plot
    2. Grouped data
        a. Frequency distributions
        b. Measures of central tendency – mean
        c. Measures of dispersion – variance and standard deviation
        d. Graphs – histograms, frequency polygons, ogives
C. Probability
    1. Counting techniques, permutations, combinations
    2. Finding sample spaces
    3. Solve by addition and multiplication rules
    4. Solve using complements and conditional probability
    5. Bayes Theorem
D. Random Variables
    1. Expected value
    2. Discrete probability distributions
        a. Find mean and standard deviation for a probability distribution in general
        b. Binomial distributions
            1. Basic concepts of binomial distribution
            2. Find probabilities using the binomial distribution
            3. Find mean and standard deviation for a binomial distribution
        c. Graph using histograms
    3. Sampling distributions

E. Normal distributions
    1. Basic concepts of normal distributions and the standard normal distribution
    2. Find probabilities using the standard normal distribution
    3. Central Limit Theorem
    4. Approximate binomials using the standard normal distribution
F. Estimation and confidence intervals
    1. Single population
    2. Two indedpendent populations
    3. Two dependent popluations
G. Hypothesis Testing and inference
    1. z and t-tests
        a. Single population
        b. Two independent populations
        c. Two dependent populations
    2. One-way analysis of variance (ANOVA)
    3. Chi-square test
        a. Goodness of fit
        b. Contingency tables
H. Applications using data from disciplines
    1. Business
    2. Social sciences
    3. Psychology
    4. Life science
    5. Education
I. Correlation and regression
    1. Scatter diagrams
    2. Find correlation coefficient and regression equation for a bivariate set of data
    3. Graph regression equation
    4. Predication using regression equation
    5. Hypothesis test for correlation coefficient
J. Statistical analysis using technology
    1. Excel
    2. Graphing calculator

VI. METHODS OF INSTRUCTION:

A. **Lecture** -
B. Demonstration in computer lab
C. Collaborative learning and class projects where applicable
D. Classroom discussion

VII. TYPICAL ASSIGNMENTS:

A. Homework
    1. Problems from the text should be assigned for each section covered. The number of problems assigned may vary from section to section and from instructor to instructor, but the homework assignments should include a sufficient number and variety of problems to develop both skill and conceptual understanding. A typical assignment should take an average student 1 to 2 hours for each hour in class.
    2. The majority of the problems assigned should be those for which answers are readily available (e.g., from the answer appendix in the text), so that students may obtain immediate feedback on their work.
    3. Homework assignments may include reading the text. Students may be asked to read sections in advance of the lecture and then to re-read them after the lecture, to reinforce important concepts and skills. An instructor may require written work in conjunction with the reading assignments (e.g., have students complete a Q & A sheet related to the assigned reading).
B. Lab Assignment
    1. Lab assignments can be used to reinforce fundamental concepts and skills or to explore certain concepts in more depth than is possible in-class.
    2. A typical lab assignment would be to look at real world data use technology to randomly generate a sample, perform specified statistical calculations (mean, median, mode, standard deviation, etc) and graphs (histogram, line graph, pie chart, etc), and analyze the results.
C. In Class Assignment
    1. Collaborative learning, done in small groups of 2-4 students, can be used to introduce new concepts, build skills, or teach problem solving. Students may be asked to present their results on the board.
    2. A typical in class assignment could be to look at real world data for purposes of analyzing correlation, and discussing causality.

VIII. EVALUATION:

A. **Methods**

    1. Exams/Tests
    2. Quizzes
    3. Projects
    4. Home Work
    5. Lab Activities
    6. Other:
        a. Lab final

B. **Frequency**

    1. Exams/Tests
        a. Minimum of 4 exams and a final exam
        b. Questions involving calculations should be open-ended and stress conceptual learning rather than just performing the calculations
    2. Quizzes
        a. Announced or unannounced (optional)
    3. Projects
        a. 1-2 term projects (optional)
    4. Home Work
        a. Daily for each section covered
    5. Lab Activities
        a. 5 to 15 computer lab or calculator assignments
    6. Lab final
        a. 1 (optional)

IX. TYPICAL TEXTS:

1. Bluman, A. *Elementary Statistics.* 9th ed., McGraw-Hall Education, 2014.
2. Sullivan III, Michael. *Statistics: Informed Decisions Using Data.* 5th ed., Pearson, 2017.
3. Triola, Mario. *Elementary Statistics.* 13th ed., Pearson, 2018.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Scientific or graphing calculator may be required.