MATH 10: ELEMENTARY STATISTICS

Foothill College Course Outline of Record

Effective Term:	Summer 2025
Units:	5
Hours:	5 lecture per week (60 total per quarter)
Prerequisite:	Intermediate Algebra or equivalent.
Advisory:	Demonstrated proficiency in English by placement via multiple measures OR through an equivalent placement process OR completion of ESLL 125 & ESLL 249; UC will grant transfer credit for a maximum of one course from the following: PSYC 7, SOC 7, MATH 10 or 17—students are strongly encouraged to meet with a counselor for appropriate course selection.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Area 2: Mathematical Concepts & Quantitative Reasoning
Transferable:	CSU/UC
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Student Learning Outcomes

- Students will formulate conclusions about a population based on analysis of sample data.
- Students will develop conceptual understanding of descriptive and inferential statistics. They will demonstrate and communicate this understanding in a variety of ways, such as: reasoning with definitions and theorems, connecting concepts, and connecting multiple representations, as appropriate.
- Students will demonstrate the ability to compute descriptive statistics, calculate confidence

intervals, and carry out tests of hypotheses.

Description

An introduction to modern methods of descriptive statistics, including collection and presentation of data; measures of central tendency and dispersion; probability; sampling distributions; hypothesis testing and statistical inference; linear regression and correlation; analysis of variance; use of microcomputers for statistical calculations. Illustrations taken from the fields of business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science.

Course Objectives

The student will be able to:

1. distinguish between quantitative and qualitative data; levels/scales of measurement; sample and population; descriptive statistics and inferential statistics and their implications.
2. identify the standard methods of obtaining data and identify advantages and disadvantages of each.
3. read a graph and conclude what information the graph is conveying about the data.
4. calculate measures of central tendency, dispersion and relative standing and use these measures to solve application problems.
5. compute basic probabilities and apply concepts of sample space.
6. define discrete probability distributions; calculate the mean, variance and standard deviation of a discrete distribution; and use such distributions to solve application problems.
7. define continuous probability distributions; calculate probabilities using the normal and student t-distributions; and use such distributions to solve application problems.
8. define sampling distributions, state the central limit theorem and use sampling distributions and the central limit theorem to solve application problems.
9. use confidence intervals to estimate population parameters, or the difference between two population parameters, using the appropriate formula and then interpret the result.
10. determine the sample size required to estimate a population parameter.
11. design, set up, and evaluate the results of hypothesis tests; determine and interpret levels of

statistical significance, including p-values in hypothesis tests; and identify type I and type II errors.

12. compare and contrast the use of confidence intervals and hypothesis tests to make inferences about population parameters.
13. solve application problems utilizing techniques of regression and correlation.
14. use analysis of variance to make inferences about more than two population means.
15. solve application problems using categorical data analysis.
16. demonstrate statistical understanding of inference by participating in a cooperative project.
17. demonstrate proficiency in the use of the computer as a tool for doing statistics.
18. apply statistical methods to situations in a culturally diverse society, including applications from business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science.
19. discuss mathematical problems and write solutions in accurate mathematical language and notation.
20. interpret mathematical solutions.

Course Content

1. Organization of data
    a. Definitions
        i. Population
        ii. Sample
        iii. Variables
        iv. Descriptive statistics
        v. Inferential statistics
        vi. Levels/scales of measurement
        vii. Implications of levels/scales of measurement
    b. Frequency and relative frequency distributions
2. Identify the standard methods of obtaining data and identify advantages and disadvantages of each
    a. Sampling methods

i. Simple random
ii. Stratified
iii. Cluster
iv. Systematic
v. Convenience
vi. Advantages/disadvantages of different sampling methodologies

3. Graphs and charts
   a. Histograms
   b. Pie-charts
   c. Stem-and-leaf graphs
   d. Bar charts
   e. Pareto charts
   f. Box plots
   g. Dot plots
   h. Ogives
   i. Time-series
   j. Graph shapes
4. Measures of central tendency and dispersion
   a. Summation notion
   b. Measures of central tendency
      i. Mean
      ii. Median
      iii. Mode
   c. Measures of dispersion
      i. Range
      ii. Sample variance
      iii. Sample standard deviation
      iv. Coefficient of variation
   d. Chebyshev's theorem
   e. Percentiles and quartiles

5. Probability
    a. Empirical probability
    b. Sample spaces and events
        i. Addition rule
        ii. Mutually exclusive events
        iii. Complementary events
        iv. Applications
    c. Conditional probability
        i. Independent events
        ii. Multiplication rule
6. Discrete probability distributions
    a. Definition of random variables
    b. Discrete random variables
        i. Mean of a discrete distribution
        ii. Variance of a discrete distribution
        iii. Standard deviation of a discrete distribution
    c. Properties of a probability distribution function
    d. The binomial distribution
        i. The binomial probability distribution function
        ii. Mean
        iii. Variance
        iv. Standard deviation
        v. Applications taken from the fields of business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science
7. Continuous probability distributions
    a. Continuous random variables; equating area under a curve with probability
    b. Empirical rule
    c. The normal distribution
        i. Standardizing normal curves (z-scores)
        ii. Finding z-scores from areas under the standard normal curve

iii. Calculating probabilities using normal distribution

iv. Applications taken from the fields of business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science

d. The normal approximation to the binomial distribution

i. Requirements

ii. Adjusting the interval of the variable from discrete to continuous

8. Sampling distributions

a. Sampling distribution of the mean

i. Mean

ii. Standard deviation

iii. Shape

iv. Central limit theorem

9. Estimation

a. Margin of error

b. Point estimation; biased and unbiased estimator

c. Confidence interval for the mean when the variance is known

i. Maximal margin of error

ii. Sample size for estimating the mean

d. Confidence interval for the mean when the population variance is unknown

i. Maximal margin of error

ii. Students t-distribution

iii. Degrees of freedom

e. Confidence interval for the population proportion

i. Maximal margin of error

ii. Sample size for estimating the proportion

f. Confidence interval for the difference between two means when population variances are known

i. Maximal margin of error

g. Confidence interval for the difference between two means when population variances are unknown, but assumed unequal

i. Maximal margin of error

h. Confidence interval for the difference between two means when population variances are unknown, but assumed equal
    i. Maximal margin of error
i. Confidence interval for the difference between two means when the samples are dependent
j. Confidence interval for the difference between population proportions
    i. Maximal margin of error
k. Applications taken from the fields of business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science

10. Sample size
    a. Sample size for estimating the mean
    b. Sample size for estimating the binomial probability of success
11. Hypothesis testing
    a. Vocabulary
        i. Null hypothesis
        ii. Alternate hypothesis
        iii. Right-, left-, and two-tailed tests
    b. Mechanics of hypothesis testing
        i. Type I error
        ii. Type II error
        iii. p-value
        iv. Calculating p-values using the normal distribution
        v. Calculating p-values using the students t-distribution
        vi. Interpreting p-values
        vii. Test statistic
        viii. Decision rule
        ix. Rejection and acceptance region
        x. Interpret levels of statistical significance including p-values
    c. Single-population hypothesis testing
        i. For the population mean when the variance is known
        ii. For the population mean when the variance is unknown

iii. Testing population proportion

d. Two-population hypothesis testing

i. Comparing two population means when the population variances are known

ii. Comparing two population means when the population variances are unknown, but assumed equal

iii. Comparing two population means when the population variances are unknown, but assumed unequal

iv. Dependent samples

v. Testing difference in population proportions

vi. Testing the variance

e. Applications taken from the fields of business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science

12. Comparison of hypothesis tests and confidence intervals

a. Connection between hypothesis testing and confidence intervals

b. Statistical significance in confidence intervals and hypothesis tests

13. Linear regression and linear correlation

a. Linear relations

b. Linear regression

i. Scatter diagrams

ii. Method of least squares

iii. Regression analysis

iv. Coefficient of determination

c. Linear correlation

d. Applications taken from the fields of business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science

14. One way analysis of variance (ANOVA)

a. Methodology

b. F-distribution

c. Tukey pairwise comparisons

d. Applications taken from the fields of business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science

15. Chi-square tests
    a. Contingency tables
    b. Chi-square distribution
    c. Tests for dependence of categorical variables
    d. Tests for homogeneity
    e. Goodness of fit
    f. Applications taken from the fields of business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science
16. Cooperative project
    a. Hypothesis testing
    b. Confidence intervals
    c. Graphs
    d. Statistical inference
    e. Sampling methods
    f. Data analysis
17. Computer as a tool for doing statistics
    a. Statistical analysis using technology, such as SPSS, Excel, Minitab, or graphing calculators
18. Apply statistical methods to situations in a culturally diverse society, including applications from business, economics, medicine, engineering, education, psychology, sociology, social sciences, life science, and health science
    a. Examples used will be from different societies and cultures
19. Discuss mathematical problems and write solutions in accurate mathematical language and notation
    a. Application problems from other disciplines
    b. Proper notation
20. Interpret mathematical solutions
    a. Explain the significance of solutions to application problems

Lab Content

Not applicable.

Special Facilities and/or Equipment

1. Graphing calculator
2. Access to Microsoft Excel software
3. When taught on Foothill Global Access: ongoing access to a computer with email software and email address

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Homework
Quizzes, mid-term exams
Computer lab assignments
Cooperative project
Proctored comprehensive final examination: the final exam must be taken in person at the Los Altos Hills campus or at another approved facility administered by a proctor deemed acceptable by the instructor

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture
Discussion
Cooperative learning exercises

Representative Text(s) and Other Materials

Martinez, Seelbach. Statistics: An Animated Journey, 1st ed.. 2021.

Navidi, W., and B. Monk. Elementary Statistics, 3rd ed.. 2019.

When taught on Foothill Global Access: lectures, handouts, and assignments are delivered via email and/or the internet.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

1. Homework problems covering subject matter from text and related material ranging from 30-60 problems per week. Students will need to employ critical thinking in order to complete assignments.
2. Five hours per week of lecture covering subject matter from text and related material. Reading and study of the textbook, related materials and notes.
3. Student projects covering subject matter from textbook and related materials. Projects will require students to discuss mathematical problems, write solutions in accurate mathematical language and notation and interpret mathematical solutions. Projects may require the use of Excel.
4. Worksheets: Problems and activities covering the subject matter. Such problems and activities will require students to think critically. Such worksheets may be completed both inside and/or outside of class.

Discipline(s)

Mathematics