MATH 17: INTEGRATED STATISTICS II

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2023
Units:	5
Hours:	5 lecture per week (60 total per quarter)
Prerequisite:	MATH 217.
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; not open to students with credit in MATH 57.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Area V: Communication & Analytical Thinking
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

The second of two in the Statway sequence. Covers concepts and methods of statistics with an emphasis on data analysis. Topics include methods for collecting data, graphical and numerical descriptive statistics, correlation, simple linear regression, basic concepts of probability, confidence intervals and hypothesis tests for means and proportions, chi-squared tests, and ANOVA. Application problems will be taken from the fields of business, economics, medicine, engineering, education, psychology, and sociology, and from culturally diverse situations. This sequence is recommended for students with majors that require no mathematics beyond freshman-level statistics.

Course Objectives

The student will be able to:

1. Examine statistical studies, methods of obtaining data, and advantages and disadvantages of data collection techniques, and discuss an overview of the data analysis process
2. Summarize and interpret data graphically and numerically
3. Calculate measures of central tendency and variation
4. Use correlation, regression, and modeling to examine and interpret bivariate data
5. Use and manipulate linear functions and expressions
6. Use and manipulate exponential functions and expressions
7. Apply concepts of probability and sample space
8. Calculate the mean, the variance, and probabilities of discrete and continuous probability distributions
9. Investigate statistical inference: sample and population distributions and the Central Limit Theorem
10. Apply techniques of statistical inference to a single proportion: confidence intervals and tests of hypotheses, including levels of statistical significance and p-values and Type I and Type II errors
11. Select and apply techniques of statistical inference to the difference between two population proportions: confidence intervals and tests of hypotheses and interpretation of results
12. Select and apply techniques of statistical inference to means: confidence intervals and tests of hypotheses and interpretation of results
13. Apply techniques of statistical inference to categorical data: chi-squared tests
14. Apply techniques of statistical inference to multiple means: ANOVA
15. Use and interpret technology-based statistical analyses
16. 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
17. Interpret mathematical solutions

Course Content

1. Examine statistical studies and discuss an overview of the data analysis process
    a. Types of statistical studies
        i. Observational
        ii. Experimental
    b. Sampling methodologies and bias
        i. Simple random sampling
        ii. Stratified sampling
        iii. Systematic sampling
        iv. Convenience sampling
    c. Experimental design
        i. Random assignment
        ii. Lurking variables
        iii. Confounding variables
    d. Data analysis process
        i. Formulate question
        ii. Identify appropriate data
        iii. Select an appropriate data collection strategy

iv. Collect, summarize, display data
v. Draw a conclusion
vi. Interpret in context

e. Vocabulary
i. Variables
ii. Population
iii. Sample
iv. Quantitative
v. Categorical
vi. Study
vii. Experiment

2. Summarize and interpret data graphically and numerically
a. Graphical displays
i. Bar charts
ii. Dot plots
iii. Histograms
iv. Box plots
b. Comparing distributions
i. Graphically
ii. Numerically
3. Calculate measures of central tendency and variation
a. Measures of central tendency
i. Mean
ii. Median
iii. Mode
b. Measures of variation
i. Range
ii. Variance
iii. Standard deviation
c. Measures of relative standing—quartiles
4. Use correlation, regression, and modeling to examine and interpret bivariate data
a. Scatter plots
i. Form
ii. Interpretations
iii. Residuals
b. Correlation
i. Strength
ii. Direction
c. Linear regression
i. Interpretations
ii. Extrapolation
iii. Interpolation
d. Linear and exponential models
i. Interpret parameters
ii. Make predictions
iii. Multiple representations
1. Tables
2. Graphs
3. Symbolic form
iv. Application problems
v. Comparing models
vi. Residual plots
5. Use and manipulate linear functions and expressions
a. 1-variable linear equations
i. Solve algebraically
b. 1-variable inequalities
i. Graphs
c. Linear functions
i. Slope
ii. y-intercept
iii. Equation of a line y=mx+b
iv. Interpretations
1. Slope
2. y-intercept
6. Use and manipulate exponential functions and expressions
a. Interpret exponential expressions
b. Apply properties of exponents
c. Interpret exponential equations graphically
7. Apply concepts of probability and sample space
a. Empirical probability
b. Contingency tables
i. Conditional probability
ii. Independence
iii. Dependence
c. Probability rules
d. Sample space
8. Calculate the mean, the variance, and probabilities of discrete and continuous probability distributions
a. Random variables and expected value
b. Discrete distributions
i. Mean
ii. Standard deviation
iii. Binomial
c. Continuous distributions
i. Equating areas with probabilities
ii. Empirical Rule
iii. Normal distribution
iv. T-distributions
v. Application problems from various disciplines
9. Investigate statistical inference: sample and population distributions and the Central Limit Theorem
a. Sampling and sampling distributions
i. Mean
ii. Standard deviation
iii. Central Limit Theorem
b. Logical reasoning
10. Apply techniques of statistical inference to a single proportion: confidence intervals and tests of hypotheses, including levels of statistical significance and p-values and Type I and Type II errors
a. Confidence intervals
i. Point estimate
ii. Interval estimate
iii. Margin of error
iv. Confidence level
v. Interpretation
b. Hypothesis tests
i. Null hypothesis
ii. Alternate hypothesis

iii. Test statistic
iv. P-value
v. Decision rule
vi. Interpretation
vii. Type I and Type II errors

c. Application problems from various disciplines

11. Select and apply techniques of statistical inference to the difference between two population proportions: confidence intervals and tests of hypotheses and interpretation of results
    a. Confidence intervals
    b. Hypothesis tests
    c. Application problems from various disciplines
12. Select and apply techniques of statistical inference to means: confidence intervals and tests of hypotheses and interpretation of results
    a. One-sample confidence interval
    b. Two-sample confidence interval
    c. One-sample T-test
    d. Two-sample T-test
    e. Paired T-test
    f. Application problems from various disciplines
13. Apply techniques of statistical inference to categorical data: chi-squared tests
    a. Chi-squared goodness of fit test
    b. Chi-squared test for independence
    c. Chi-squared test for homogeneity
14. Apply techniques of statistical inference to multiple means: ANOVA
    a. One-way analysis of variance
    b. Pair-wise comparisons
15. Use and interpret technology-based statistical analyses
    a. Use appropriate technology to approximate binomial probabilities
    b. Use appropriate technology to approximate normal probabilities
    c. Use appropriate technology to compute summary statistics
    d. Use appropriate technology to approximate critical values
    e. Use appropriate technology to approximate p-values
16. 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
    a. Application problems from various disciplines
    b. Proper notation
17. Interpret mathematical solutions
    a. Explain the significance of solutions to application problems

Lab Content

Not applicable.

Special Facilities and/or Equipment

Graphing calculator

Method(s) of Evaluation

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

Written homework
Quizzes
Midterms or module exams
Proctored comprehensive final examination
Project

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

Carnegie. Statway Core, XanEdu. 2019.

Carnegie Foundation. Carnegie Math Pathways: https://carnegiemathpathways.org/

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. 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 technology
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