CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

PSYCHOLOGY 215 – STATISTICS FOR THE BEHAVIORAL SCIENCES

3.5 hours lecture, 1.5 hours laboratory, 4 units

Catalog Description
Methods and experience in defining and solving quantitative problems in the behavioral sciences. Emphasis is on the design of experiments and the application of a variety of parametric and nonparametric techniques to the analysis of data.

Prerequisite
Appropriate placement or Intermediate Algebra

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Working with algebraic expressions:
    a. Understand essential algebraic terminology
    b. Evaluate and simplify equations written in notation
    c. Understand polynomials factoring, rational expressions, complex numbers, variables, radicals, matrices
    d. Add, subtract, multiply, divide and factor polynomials
    e. Understand exponents and absolute values
2) Graphing:
    a. Understand basic graphing terminology and practices
    b. Graph a line given basic data
3) Solving mathematical statements:
    a. Equations using basic terminology
    b. Problem-solving strategies and techniques
    c. Factor, group and graph linear and quadratic equations
    d. Factor polynomials
    e. Use equations to solve basic word problems
4) Sequences and series:
    a. Counting and probability
    b. Translate sigma notation and write out sum of terms
    c. Recognize an arithmetic or geometric sequence
5) Radicals and exponents:
    a. Simplify and evaluate expressions involving radical, integer and rational exponents
    b. Solve square roots
    c. Use scientific notation

Course Content
1) Introduction to the concepts of statistical theory applied to the analysis of data generated from experimental and non-experimental research designs
2) Data collection and description
    a. Descriptive statistics displaying data graphically and in numerical tables
    b. Produce samples from population through various methods
    c. Define sample spaces and random and controlled variables

    d. Measure differences between observed and expected values using z-scores
    e. Use of statistical software (SPSS, PSPP, EXCEL) to summarize and analyze data and produce and intemperate graphs and charts

3) Introduction to probability distributions
    a. Limitations of the Central Limit Theorem
    b. Assessment of simple probability calculations with known outcomes
    c. Assessment of normally distributed probability calculations
    d. Calculation of probably with multiple measures
    e. Application of probability to validation of hypotheses
    f. Differences between samples and populations as well as different sample distributions

4) Estimation and hypothesis testing
    a. Distribution, variance of means and other statistics
    b. Student's "t" distribution: single population, paired samples , two populations means
    c. Confidence limits and hypothesis testing
    d. Calculation of Power and effect size

5) Analysis of variance
    a. Variances of samples and their means, "F" distribution
    b. Null hypothesis, partitioning the total sum of squares and degrees of freedom
    c. Heterogeneity among sample means
    d. Identification of between subjects and within subjects variances

6) Single classification ANOVA
    a. LSD and Tuckey follow up t-testing
    b. A prioi and a posteriori testing

7) Two way ANOVA with and without replicating; significance testing
8) Assumptions of analysis of variance: nonparametric methods in lieu of ANOVA
9) Regression: basic computations, tests of significance, uses
    a. Calculation of proportionate reduction of error for simple regressions
    b. Calculation of weight of variables in regression equations
10) Correlation: product-moment correlation coefficient, significance tests, applications, nonparametric methods
11) Analysis of frequencies: tests for goodness of fit, e.g., Chi-Square

Course Objectives
Students will be able to:
1) Evaluate measures of central tendency displayed in graphs, charts and computer outputs to describing samples of data.
2) Identify benefits and limitations of different types of data used in the Social Sciences (scale, ordinal, nominal, continuous).
3) Produce and intemperate graphs and numerical tables to show descriptive statistics.
4) Calculate Means, Variances, and various error terms from different types of data from different sample distributions.
5) Collect data using various methods and input scores into statistical software (SPSS, PSPP, EXCEL, CALCULATOR) for analysis.
6) Calculate and interpret computer outputs showing correlations, proportionate reduction in error, and regression analysis.
7) Calculate and assess the mathematical formulas of probability and apply them to statistical hypothesis testing from different types of data including students' t distributions as well as normal distributions.
8) Determine the difference between sample and population data and the implications of the Central Limit Theorem on the analysis of data.
9) Evaluate a hypothesis and produce the relevant statistical hypotheses and determine the appropriate statistical method to evaluate a variety of types of variables using one or two populations.

10) Discuss the computation and use of statistical power, its implications with Type I and Type II errors, and relevance in determining statistical significance.
11) Explore the limitations and assumptions that underlie hypothesis testing and the calculation of p values from various types of data.
12) Correctly calculate t tests for dependent and independent means using statistical software or by reading computer generated outputs.
13) Compare and contrast the differences in the error terms of z scores, t tests and analysis of variance and their role in evaluating a statistical hypothesis.
14) Explain the basic components of the formula for the z score, F ratio, and t score.
15) Investigate a hypothesis through literature research, development of proper experimental methods and research protocol, analysis and a written conclusion.
16) Use a Multivariate Analysis of Variance to validate a hypothesis explaining all main effects and interaction effects found in the analysis.
17) Use linear regression to complete analysis and discus effects of various measures on a dependent variable.
18) Apply correct statistical method for analysis of data from diverse subjects such as Sociology, Social Work, Anthropology, Psychology, and other behavioral sciences.

Method of Evaluation
A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.
1) Quizzes and exams that measure students' ability to recognize, describe, explain, and provide examples of the theories pertaining to different statistical procedures.
2) Written analysis of computer-generated outputs in which students analyze, interpret and determine answers to statistical hypotheses.
3) Group or individual projects or research papers that require students to analyze data and then explain differences within and between data using graphs and relevant charts.
4) Interactive group activities in which students analyze and discuss the validity of research projects, and the critical analysis of data and research methods.

Special Materials Required of Student
Access to computer lab with SPSS software or equivalent

Minimum Instructional Facilities
Smart classroom computer lab for data analysis

Method of Instruction
1) Lecture and discussion
2) Group discussion, cooperative learning exercises
3) Individual and group projects, structured in-class exercises, demonstrations
4) Online instruction in software analysis techniques

Out-of-Class Assignments
1) Data entry and analysis
2) Written reports based on classroom data analysis
3) Online quiz and interactive discussion
4) Written reports based on outcomes of experiments

Texts and References
1) Required (representative examples):
    a. Larson & Farber. *Elementary Statistics: Picturing the World*. 7th edition. Pearson, 2022.

    b. Gravetter & Wallnau, *Essentials of Statistics for the Behavioral Sciences*. 8th edition. Cengage, 2014.
2) Supplemental: SPSS statistical software, PSPP software or similar statistical analysis programs

Exit Skills
Students having successfully completed this course exit with the following skills, competencies and/or knowledge:
1) Data Entry
    a. Enter data into a spreadsheet
    b. Organize data in meaningful columns
    c. Code variables according to the measures collected
    d. Label and categorize variables according to hypothesis
2) Graphing
    a. Produce histograms
    b. Produce error bar graphs
    c. Produce scatter plot graphs
    d. Produce pie charts
3) Analysis
    a. Evaluate hypothesis for statistical analysis
    b. Calculate z scores
    c. Conduct t tests
        1. Single population
        2. Dependent samples
        3. Independent
        4. Post hoc tests
    d. Conduct f tests
        1. One way ANOVA
        2. Multivariate ANOVA
        3. Interaction effects
    e. Conduct multiple regressions
        1. Single variable regressions
        2. Multiple variable regression
    f. Conduct Chi squared analysis
4) Conclusions
    a. Explain outliers
    b. Explain difference between groups
    c. Explain cause and effect relationships based on data analysis

Student Learning Outcomes
Upon successful completion of this course, students will be able to:
1) Apply and calculate the appropriate statistical test to validate a hypothesis, including mean, standard deviations z-scores, t tests, one way analysis of variance, chi-square and multivariate analysis of variance.
2) Interpret the relationship between variables using correlations, simple regressions and multivariate regression analysis and the implications of effect size on power calculations.
3) Use statistical procedures to make probability assessments based on various distributions of data.
4) Investigate a hypothesis through literature research to develop of proper experimental method and research protocol, produce analysis and a written conclusion, and discuss limitations inherent in tests of significance.