El Camino College

COURSE OUTLINE OF RECORD - Official

I. GENERAL COURSE INFORMATION

Subject and Number: **Mathematics 150H**
Descriptive Title: **Honors Elementary Statistics with Probability**

Course Disciplines: **Mathematics**

Division: **Mathematical Sciences**

Catalog Description: This honors course, intended for students in the Honors Transfer Program, will include practice of statistics, including descriptive statistics, inferential statistics, and the role probability plays in statistical analysis. Students will calculate and interpret various descriptive statistics using graphing calculators with statistical testing capabilities or statistical software, as well as by hand. Major topics include methods of data collection and simulation; measures of central tendency, variability, and relative position; graphical summaries of data; linear regression and correlation; distributions, including normal and binomial distributions; probability theory; and inferential statistical methods. Students will choose, justify, use, and interpret the results of inferential techniques, such as confidence intervals, hypothesis tests, goodness of fit, analysis of variance, and nonparametric tests. This course emphasizes extensive, rigorous demonstrations of understanding the concepts of statistics. Students will also complete at least one project demonstrating an application or synthesis of topics covered in the course.

*Note: Students may take either Mathematics 150 or Mathematics 150H. Duplicate credit will not be awarded for Mathematics 150 and Mathematics 150H.

*Note: The maximum UC credit allowed for students completing Mathematics 150 and Psychology 9A or Mathematics 150 and Sociology 109 is one course.

Conditions of Enrollment:

Prerequisite

Mathematics 67 or

Mathematics 73 or

Mathematics 80
with a minimum grade of C in prerequisite
or

qualification by testing (El Camino College Mathematics Placement Test) and assessment

Course Length: ☒ Full Term ☐ Other (Specify number of weeks):

Hours Lecture:	4.00 hours per week ☐TBA
Hours Laboratory:	0 hours per week ☐TBA
Course Units:	4.00

| Grading Method: | **Letter** |
| Credit Status | **Associate Degree Credit** |

| Transfer CSU: | ☒ **Effective Date: 2/21/2017** |
| Transfer UC: | ☒ **Effective Date: Proposed** |

General Education:

| El Camino College: | **6 – Mathematics Competency** |

Term: Fall 2017   Other:

| CSU GE: | **B4 - Mathematics/Quantitative Thinking** |

Term: Other:

| IGETC: | **2A - Mathematical Concepts and Quantitative Reasoning** |

Term: Other:

II. OUTCOMES AND OBJECTIVES

A. COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)

1. From data or bivariate data, compute statistics and develop display of the data that illustrate the measures of central tendency, variation, relative position, levels of scale/measurement and correlation. Interpret the displays and statistics in context.

2. Compute the probability of an event by applying the basic assumptions in classical probability (including sample space) and use the addition rule and multiplication rule for contingency.

3. Use the Central Limit Theorem to compute probabilities concerning the distribution of the sample mean and compare these to the probabilities of the related random variable.

4. Compute confidence intervals and conduct hypothesis testing for a variety of parameters (for 1 and 2 populations) in applied settings. Make statistical conclusions using analytic and/or graphical techniques, including critical regions.

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at http://www.elcamino.edu/academics/slo/.

B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)

1. Identify, compare and contrast various types of data and sampling techniques.

   Homework Problems

2. Summarize data both graphically (including histograms, frequency distributions, stem and leaf plots, box plots, bar graphs and pie charts) and numerically.

   Homework Problems

3. Calculate appropriate measures of central tendency, variation, relative position and scale/levels of measurement. Use the measures to interpret and answer questions in the context of data. Describe methods of calculating outliers. Define and determine outliers for given sets of data.

   Other (specify)

   Objective Exams and/or Open Response Assessments

4. Calculate the probability of a given event using elementary probability techniques and the definition of sample space. Use the probability to answer questions in the context of data.

   Other (specify)

   Objective Exams and/or Open Response Assessments

5. Define, construct, and interpret random variables and apply these concepts to expected values.

   Written homework

6. Understand the difference between discrete and continuous probability distributions. Construct and use discrete probability distributions (including the binomial distribution) and continuous probability distributions (including the normal distribution).

   Objective Exams

7. Define the Central Limit Theorem and use it to understand the relationship between population and sampling distributions.

   Homework Problems

8. Understand and describe sampling methods and construct sampling distributions.

   Written homework

9. Calculate and interpret confidence interval estimates of various parameters including singles means and proportions as well two population means and proportions. Justify the choice of confidence interval by demonstrating that the necessary criteria are met. Understand the effects of changing the confidence level of a confidence interval.

   Other (specify)

   Objective Exams and/or Open Response Assessments

10. Perform parametric and non-parametric hypothesis tests including t-tests for single and two population means, proportions, Chi-square tests, and ANOVA. Interpret these results in context and justify the choice of test by demonstrating that the necessary criteria are met. Understand the effects of changing the significance level of a hypothesis test.

    Objective Exams

11. Create appropriate scatterplots for a given set of bivariate data. Calculate the regression line and correlation coefficient, interpret the results and use the regression line to calculate predicted values.

    Other (specify)

    Objective Exams and/or Open Response Assessments

12. Use the above on data from disciplines including business, social sciences, psychology, life science, health science, and education.

    Homework Problems

13. Perform tasks corresponding to objectives 1 through 12 using statistical technology such as SPSS, EXCEL, Minitab, R, or graphing calculators.

Homework Problems

III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)

Lecture or Lab	Approximate Hours	Topic Number	Major Topic

Lecture	2	I	Overview of Statistics
			  A. Descriptive
			  B. Inferential

Lecture	2	II	Collection of Data and Sampling Techniques
			  A. Random Sampling
			  B. Survey Methods
			  C. Experimental Design

Lecture	8	III	Data Description
			  A. Frequency Distributions and Graphs
			  B. Measures of Center, Spread, Relative Position and Levels of Scale/Measurement

Lecture	8	IV	Probability
			  A. Sample Spaces
			  B. Empirical (Experimental) Probability
			  C. Classical (Theoretical) Probability
			  D. Addition and Multiplication Rule

Lecture	8	V	Probability Distributions
			  A. General Probability Distributions
			  B. Binomial Distributions
			  C. Mean and Variance of Discrete Distributions and Random Variables
			  D. Expected Value

Lecture	8	VI	Normal Distributions
			  A. The Standard Normal Distribution
			  B. Applications of Normal Distributions
			  C. Binomial Distributions Approximated by Normal Distributions

Lecture	6	VII	Central Limit Theorem
			  A. Define Central Limit Theorem
			  B. Difference between Population and Sampling Distributions
			  C. Sampling Distribution of the Sample Mean and Proportion

Lecture	6	VIII	Confidence Intervals for Parameters A. Estimating Population Proportion

			B. Estimating Population Mean
			C. Estimating Difference of Parameters (including 2 populations)

Lecture	8	IX	Hypothesis Testing for Parameters
			    A. Testing a Claim About a Proportion
			
			    B. Testing a Claim About a Mean
			
			    C. Testing a Claim About the Difference of Parameters (Including 2 populations)
			
			    D. Type I and Type II Errors

Lecture	8	X	Correlation and Regression
			    A. Scatterplots
			
			    B. Correlation Coefficient
			
			    C. Regression Lines
			
			    D. Predicted Values and Residuals

Lecture	8	XI	Other Statistical Tests
			    A. Chi - Square Tests including Tests of Independence and Goodness of Fit
			
			    B. Analysis of Variance (ANOVA)
			
			    C. Nonparametric Tests

Total Lecture Hours	72
Total Laboratory Hours	0
Total Hours	72

IV. PRIMARY METHOD OF EVALUATION AND SAMPLE ASSIGNMENTS

A. PRIMARY METHOD OF EVALUATION:

Problem solving demonstrations (computational or non-computational)

B. TYPICAL ASSIGNMENT USING PRIMARY METHOD OF EVALUATION:

A college statistics class conducted a survey of how students spend their money. They asked 25 students to estimate how much money they typically spend each week on fast food. They determined that the mean amount spent on fast food is $31.52 with a standard deviation of $21.60. Later they realized that a value entered as $3 should have been $30. They recalculate the mean and standard deviation. The mean is now $32.60.

Write a one-page description of how the standard deviation is affected by the entry error. The description should include: (1) the purpose of calculating the standard deviation; (2) calculations which illustrate the effect of the entry error on the standard deviation; (3) calculations which illustrate how the error should be corrected, and (4) graphs to illustrate the correct standard deviation vs. the standard deviation resulting from the entry error.

C. **COLLEGE-LEVEL CRITICAL THINKING ASSIGNMENTS:**

1.

The drug Prevnar is a vaccine meant to prevent certain types of bacterial meningitis. It is typically administered to infants starting around 2 months of age. In randomized double-blind clinical trials of Prevnar, infants were randomly divided into two groups. Subjects in group 1 received Prevnar, while subjects in group 2 received a control vaccine. After the second dose, 137 of 452 subjects in the experimental group (group 1) experienced drowsiness as a side effect. After the second dose, 31 of 99 subjects in the control group (group 2) experienced drowsiness as a side effect. Does the evidence suggest that a lower proportion of subjects in group 1 experienced drowsiness as a side effect than subjects in group 2? Write a well-organized paper (1-2 pages) detailing the steps taken to solve this problem. Include calculations and an explanation of the findings from this study.

2. Complete a project by collecting, analyzing, interpreting, and graphing statistical data using a graphing calculator or a software package such as Excel, Minitab, SPSS, SAS, etc. The project can be a semester-long project consisting of 5 - 7 pages typed or consisting of up to three smaller projects, each of which requires two typed pages (totaling 5 - 7 pages).

D. **OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:**

Objective Exams

Quizzes

Written homework

Homework Problems

Multiple Choice

True/False

Other (specify):

Open Response Assessments

Presentation

V. INSTRUCTIONAL METHODS

Discussion
Group Activities

Lecture
Simulation

Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.

VI. WORK OUTSIDE OF CLASS

Study

Answer questions

Skill practice

Required reading

Problem solving activities

Written work

Observation of or participation in an activity related to course content

Estimated Independent Study Hours per Week: 8

VII. TEXTS AND MATERIALS

A. **UP-TO-DATE REPRESENTATIVE TEXTBOOKS**
Richard D. De Veaux, Paul D. Velleman, David E. Bock. <u>Stats: Data and Models</u> . 4th ed.   Pearson, 2015.

B. **ALTERNATIVE TEXTBOOKS**
Moore, Notz, Fligner.. <u>The Basic Practice of Statistics</u>. 7th ed.   Freeman, 2015.

C. **REQUIRED SUPPLEMENTARY READINGS**

D. **OTHER REQUIRED MATERIALS**

VIII. CONDITIONS OF ENROLLMENT
A.   **Requisites (Course and Non-Course Prerequisites and Corequisites)**

Requisites	Category and Justification
Course Prerequisite Mathematics-67 or	Sequential
Course Prerequisite Mathematics-73 or	Sequential
Course Prerequisite Mathematics-80 or	Sequential
Course Prerequisite	

Non-Course Prerequisite	Placement assessment is an officially recognized mechanism for controlling enrollment in mathematics courses. Placement cut scores are periodically reviewed by faculty and ajusted to match success rates in the target courses. Students who do not meet the placement cut score for this class are statistically highly unlikely to succeed.

B. Requisite Skills

Requisite Skills
Solve algebraic equations. MATH 73 - Carry out numerical operations and manipulate algebraic expressions, including expressions with rational and negative exponents. MATH 80 - Carry out numerical operations and manipulate algebraic expressions, including expressions with rational and negative exponents, complex numbers, and logarithms. MATH 80 - Solve problems involving a variety of function types, including linear, quadratic, polynomial, rational, radical, exponential, and logarithmic functions. MATH 73 - Solve a variety of equations and inequalities, as well as systems of equations and inequalities, using algebraic and graphical methods. Types of equations include linear, quadratic, polynomial, rational and radical equations, as well as absolute value equations. MATH 80 - Solve a variety of equations and inequalities, as well as systems of equations and inequalities, using algebraic and graphical methods. Types of equations include linear, quadratic, polynomial, rational, radical, exponential and logarithmic equations. MATH 67 - Translate problems from a variety of contexts into a mathematical representation (symbolic, tabular, and graphic) and vice versa. MATH 67 - Construct and use equations and inequalities to represent relationships involving one or more unknown or variable quantities to solve problems.

C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification

D. Recommended Skills

Recommended Skills

E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact

Course created by Ambkia Silva on 09/01/2016.

BOARD APPROVAL DATE: 02/21/2017

LAST BOARD APPROVAL DATE: 02/21/2017

Last Reviewed and/or Revised by Jasmine Ng on 09/01/2016

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