Effective: Fall 2019
Last Reviewed: 05/13/2019

Course Outline

BASIC COURSE INFORMATION

Course Number: MATH 247
Course Title: INTRODUCTION TO STATISTICS
C-ID Number: C-ID MATH 110

Total Student Hours and Credit			
		Hours/Week	Hours/Term
Lecture Hours	in-class	4.00	72.00
	out-of-class	8.00	144
Lab Hours	in-class	0	0
	out-of-class	0	0
Activity Hours	in-class	0	0
	out-of-class	0	0
TBA Hours Per Term			0
Total Student Hours Per Term:			216.00
Hours-per-unit Divisor			54.00
Units of Credit:			4.00

Fall semester term is 18 weeks. Spring semester term is 17 weeks. The term length multiplier is 17.5 weeks. Curriculum is calculated based on 18 weeks.

Catalog Description:
Presents a study of basic descriptive and inferential statistics with applications using data from a broad range of disciplines and use of technology for statistical analysis.

Schedule Description:
Presents a study of basic descriptive and inferential statistics with applications using data from a broad range of disciplines and use of technology for statistical analysis. Prerequisite: MATH 128 or MATH 127 or MATH 126B with a minimum grade of C or better. Transfer: CSU; UC (For UC, 4 credit maximum between MATH 236 and 247). (Formerly MATH47)

Prerequisites:

- MATH 126B: TWO-SEMESTER INTERMEDIATE ALGEBRA-PART 2
  or
- MATH 128: APPLIED BEGINNING AND INTERMEDIATE ALGEBRA
  or
- MATH 127: INTERMEDIATE ALGEBRA

Division:	Mathematics
Department:	Mathematics
Minimal Qualification Discipline Designation (MQDD):	Mathematics
Degree Applicability:	Credit - Degree Applicable

Methods of Instruction:

- Lecture and/or discussion
- Distance Education

Grading Method:

- Letter Grade Only

Repeatability:	0
Course Cap:	40
Face-to-Face Modality Limit:	40
DE Modality Limit:	40

STUDENT LEARNING OUTCOMES

1. Calculate summary measures including point and interval estimators of population parameters and interpret them.
2. Calculate probabilities for various experiments including experiments where counting formulas are required.
3. Describe sampling variability and how it applies to a real-world estimation problem.
4. Perform a hypothesis test to answer a specific research question and interpret the results.
5. Calculate and interpret measures of association between two variables.

COURSE CONTENT

Objectives:
Upon completion of this course the student will be able to:

1. Distinguish between sample, population, types of data and data collection. Distinguish among different scales of measurement and their implications. Identify the standard methods of obtaining data and identify advantages and disadvantages of each.
    - Quizzes/Exams
    - Written/Typed Homework
2. Describe data graphically using frequency distributions, bar graphs and histograms and employ modern statistical computing technology and/or software to accomplish these tasks.
    - Quizzes/Exams
    - Written/Typed Homework
3. Calculate measures of central tendency and variation for a given data set. Interpret the mean and standard deviation of a distribution using the Empirical Rule and Chebyshev's Inequality.
    - Quizzes/Exams
    - Written/Typed Homework
4. Apply concepts of probability to sample spaces.
    - Quizzes/Exams
    - Written/Typed Homework
5. Distinguish between discrete and continuous random variables. Calculate the mean and variance of a discrete distribution.
    - Quizzes/Exams
    - Written/Typed Homework
6. Identify and apply binomials to discrete probability distributions.
    - Quizzes/Exams
    - Written/Typed Homework
7. Use probability density, normal curves, and student t-distributions to find probabilities and z-scores.
    - Quizzes/Exams
    - Written/Typed Homework
8. Distinguish the difference between sample and population distributions and analyze the role played by the Central Limit Theorem.
    - Quizzes/Exams
    - Written/Typed Homework
9. Analyze data by constructing a confidence interval and interpret the result.
    - Quizzes/Exams
    - Written/Typed Homework
10. Formulate and set-up a one sample hypothesis test including Type I and Type II errors, interpreting p-values, and testing with a z-statistic and a t-statistic.
    - Quizzes/Exams
    - Written/Typed Homework
11. Formulate hypothesis tests involving two sample populations.
    - Quizzes/Exams
    - Written/Typed Homework
12. Formulate hypothesis tests, including t-tests involving samples from one and two populations. Determine and interpret levels of statistical significance including p-values.

13. Use ANOVA analysis for estimation and inference, and interpret the associated statistics.
    - Quizzes/Exams
    - Written/Typed Homework
14. Use regression analysis for estimation and inference, and interpret the associated statistics.
    - Quizzes/Exams
    - Written/Typed Homework
15. Perform a goodness-of-fit using a Chi-square hypothesis test and interpret the results.
    - Quizzes/Exams
    - Written/Typed Homework
16. Perform a Chi-square hypothesis test using a contingency table and interpret the results.
    - Quizzes/Exams
    - Written/Typed Homework
17. Use technology such as Minitab or graphing calculators to perform statistical analysis.
    - Quizzes/Exams
    - Written/Typed Homework
18. 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.
    - Quizzes/Exams
    - Written/Typed Homework

Topics & Scope:

1. Fundamental of statistics
   a. Descriptive statistics versus inferential statistics
   b. Sample versus population
   c. Variables
   d. Types of data
      (i) Qualitative data
      (ii) Quantitative data
      (iii) Levels of measurement
   e. Classifying data collection
      (i) Published source
      (ii) Designed experiment
      (iii) Observational study
   f. Scales of measurement and their implications
   (Obj 1)
2. Graphical summaries of data
   a. Qualitative data
      (i) Bar graph
      (ii) Frequency table
   b. Quantitative data
      (i) Dot plot
      (ii) Stem-and-leaf display
      (iii) Histogram
      (iv) Frequency table

(v) Box plot
(vi) Ogive (optional)
(Obj 2)

3. Numerical summaries of data
   a. Measures of center
      (i) Mean
      (ii) Median
      (iii) Mode
   b. Measures of variability:
      (i) Range
      (ii) Variance
      (iii) Standard deviation
      (iv) Empirical Rule
      (v) Chebyshev's Inequality
   c. Measures of position
      (i) z-score and percentiles
   (Obj 3)
4. Probability
   a. Construct sample spaces
   b. Compute probabilities of sample points
   c. Determine events and their probabilities
   d. Determine the probability of combined events
      (i) Unions
      (ii) Intersections
      (iii) Complementary events
      (iv) Mutually exclusive events
   e. Conditional probability and independent events
   f. Counting rules (optional)
   (Obj 4)
5. Random variables
   a. Discrete random variables
      (i) Construct discrete probability distribution
      (ii) Expected value
      (iii) Variance
      (iv) Standard deviation
      (v) Binomial distribution
   b. Continuous random variables
      (i) Uniform distribution: mean, standard deviation, probability function, probability function, and probabilities
      (ii) Normal distribution
   (Obj 5)
6. Binomial distribution
   a. Expected value
   b. Variance
   c. Standard deviation
   d. Computing probabilities
   e. Mean and variance of polynomials
   (Obj 6)

7. Normal distribution
   a. Standard normal curve
      (i) Probability density curve
      (ii) Normal distribution
      (iii) Area under the standard normal curve
      (iv) Finding a z-score
   b. Applications of the normal distribution
      (i) Converting normal values to z-scores
      (ii) Area under a normal curve
      (iiii) Value from a normal distribution corresponding to a given proportion
   (Obj 7)
8. Sampling distributions and the Central Limit Theorem
   a. Construct a sampling distribution for test statistics
   b. Biased/Unbiased estimate (optional)
   c. Central Limit Theorem
   (Obj 8)
9. Confidence intervals
   a. Confidence interval for a population mean
   b. Confidence interval for a population proportion
   c. Sample size and margin of error
   d. Confidence interval for a population standard deviation (optional)
   (Obj 9)
10. One sample hypothesis tests
   a. Null versus alternative hypothesis
   b. Test statistics
   c. Type I versus Type II errors
   d. Rejection region and p-value
   e. Formulating and setting up a hypothesis test
   f. Testing a population mean with a z-statistic and t-statistic
   g. Testing a population proportion with a z-statistic
   (Obj 10)
11. Two sample statistics
   a. Identify the parameter
   b. Compare two population means
      (i) Independent sampling
      (ii) Confidence intervals and hypothesis testing
      (iii) Paired means (optional)
   c. Compare two population proportions
      (i) Independent sampling
      (ii) Confidence intervals and hypothesis testing
   (Obj 11)
12. One-sample and two-sample tests
   a. Test a population mean when standard deviation is known
   b. Test a population mean when standard deviation in unknown
   c. Test a population proportion
   d. Test with independent samples by p-value method
   e. Test with paired samples by p-value method
   f. Interpret output of technology based statistical analysis

g. Determine the level of statistical significance using a p-value
(Obj 12)

13. ANOVA
    a. Elements of a designed study
        (i) Response variable
        (ii) Factors and factor level
        (iii) Treatments
        (iv) Experimental unit
        (v) Designed versus observation study
    b. The completely randomized design: single factor
        (i) Single factor
        (ii) k treatment
        (iii) Hypothesis test using ANOVA
        (iv) Table componenets and looking up an F-statistic
    (Obj 13)
14. Simple linear regression
    a. Probabilistic models
        (i) Understanding deterministic versus probabilisitic relationships
        (ii) Response variable
        (iii) Predictor variable
    b. Fitting the model: The least squares approach
        (i) Least squares regression line
    (Obj 14)
15. Goodness-of-fit hypothesis test
    (Obj 15)
16. Hypothesis test using contigency tables
    (Obj 16)
17. Use Minitab or similar technology
    a. Bar graphs and histograms
    b. Mean, median, standard deviation, and variance
    c. Scatter plot and residual plot
    d. Correlation coefficient, r
    e. Least squares regression line
    f. Coefficient of determination
    g. Probability histogram
    h. Use statistical analysis to interpret the various results
    (Obj 17)
18. Applications in all of the previous topics using data from various disciplines
    (Obj 18)

Assignments:
Examples of independent assignments to fulfill 144 total hours of required out-of-class work:

1. Assignments will be primarily taken from problems in the class text or will involve analysis of data sets provided by the instructor. There will also be required readings assigned prior to lectures. (Obj 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18)
2. Computer assignments will require the student to solve assigned problems using

statistical computing software. At the discretion of the instructor, case studies may be assigned. These will be intended to place the student in the position of the data analyst who must solve a problem and then present a report. (Obj 17, 18)

Class participation and assignments require and develop critical thinking.

1. Hospital records show that 12% of all patients are admitted for surgical treatment, 16% are admitted for obstetrics, and 2% receive both obstetrics and surgical treatment. If a new patient is admitted to the hospital, what is the probability that the patient will be admitted for surgery, for obstetrics, or for both? (Obj 4, 18)
2. Suppose a poll of 20 voters is taken in a large city. The purpose is to determine x, the number who favor a certain candidate for mayor. Suppose that 60% of all the city's voters favor the candidate. a) Find the mean and standard deviation of x. b) Use a table to find the probability that x>12. c) Graph the probability distribution of x. (Obj 5, 6, 18)
3. Animal behaviorists have discovered that the more domestic chickens peck at objects placed in their environment, the healthier the chickens seem to be. White string has been found to be a particularly attractive pecking stimulus. Instead of white string, blue string was used. The number of pecks each chicken took at the blue string over a specified interval of time was recorded. Summary statistics for the 72 chickens were mean of 1.13 pecks and s = 2.21 pecks. Use a 99% confidence interval to estimate the population mean number of pecks made by chickens pecking at blue string. Interpret the results. (Obj 9, 18)

Methods of Evaluation:

- Written/Typed Homework
- Quizzes/Exams

Texts, Readings, and Materials:

- **Textbooks**
  Gould, Robert N. and Ryan, Colleen N. *Introductory Statistics (Second Edition)* Pearson Education Limited, (2016).

Cuesta General Education

D2 - Analytical Thinking

IGETC Area 2: Mathematical Concepts and Quantitative Reasoning

A - Mathematic

CSU GE Area B: Physical Universe and its Life Forms

B4 - Mathematics/Quantitative Reasoning

UC Transfer Course

University of California, Santa Barbara

CSU Transfer Course

California Polytechnic State University