El Monte Union High School District

Course Outline

High School District

Title: Statistics P

Transitional*_____(Eng. Dept. Only)

Sheltered (SDAIE)*____Bilingual*___

AP**_____Honors**_____

Department: Math

Grade Level (s): 11 – 12

Semester_____Year X

Based on Mathematics CCSS

This course meets graduation requirements:

( ) English
( ) Fine Arts
( ) Foreign Language
( ) Health & Safety
(X) Math
( ) Physical Education
( ) Science
( ) Social Science
( ) Elective

Department/Cluster Approval	Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*Instructional materials appropriate for English Language Learners are required.

**For AP/Honors course attach a page describing how this course is above and beyond a regular course. Also, explain why this course is the equivalent of a college level class.

1. **Prerequisite(s):** C- or better in Integrated Math 3 or equivalent.

2. **Short description of course which may also be used in the registration manual**:

This course provides an introduction to statistics and probability that will prepare students for a college-level statistics course and life in a world filled with data. Major topics include: analyzing distributions of univariate data; analyzing relationships in bivariate data; collecting data using sampling and experimentation; probability and random variables; sampling distributions; and confidence intervals and significance tests for means and proportions from one or two samples, along with chi-square tests and inference for the slope of a least-squares regression line. Use of technology, including online applets and the graphing calculator will be prominent in the course.

3. **Describe how this course integrates the schools ESLRs (Expected School-wide Learning Results): This section may be replaced with specific site ESLRS**

   All schools have ESLRS that refer to students as **academic achievers**, **critical thinkers**, and **effective communicators**. This course addresses the mentioned ESLRS.

4. **Describe the additional efforts/teaching techniques/methodology to be used to meet the needs of English Language Learners:**

   The special needs of English language learners are met throughout the course in a number of ways:
   - By using the Sheltered Instruction Observation Protocol (SIOP) or other researched based strategies that engage students in learning and communicating their thoughts in the four language domains.
   - By probing prior knowledge to connect existing knowledge with knowledge to be learned.
   - By teaching concepts for which English learners may not have a cultural reference, including obscure terms, and academic vocabulary.
   - By defining abstract concepts in concrete terms, and using specific examples.
   - By using graphic organizers and rubrics to set expectations and facilitate organization of thought.
   - By using a variety of other visual aids during instruction, such as pictures, films, and realia.
   - By encouraging students to express themselves in a variety of modalities.

   Further more, the textbook is written in a simple style that doesn't rely on idioms or other colloquial language. Definitions, How-To boxes, and Summary boxes are clearly set apart so students can quickly identify the major ideas in each lesson. Furthermore, for Spanish-speaking students, a Glosario is included.

5. **Describe the interdepartmental articulation process for this course:**

   The study of mathematics/statistics in each year of high school leads directly to preparedness for college and career readiness. The skills learned in statistics are applied to other courses of study including science, social science, and Career Technical Education (CTE). Problem solving, communicating reasoning, modeling and data analysis that are used in statistics prepare students to apply those same skills in all courses and in real-world scenarios.

6. **Describe how this course will integrate academic and vocational concepts, possibly through connecting activities. Describe how this course will address work-based learning/school to career concepts:**

   Students learn statistics best by *doing* statistics. Each chapter contains several activities that have students explore new content and investigate important concepts. In addition, students will complete real-world applications at the end of each lesson and the end of each chapter. Students will also complete at least one major project each semester where they design a study, collect data, and analyze the results.

   Learning targets are presented at the end of each lesson so students know what they are expected to learn. These targets are repeated at the end of each lesson in a grid that matches each target with a set of exercises and an example in the text.

   Example and exercise contexts are chosen to pique students' interest with statistical studies on popular topics. Each example is written in a problem/solution format with a model student response displayed in a special font. Step and comment bubbles guide students through the examples by mirroring the instructor's voice in

the classroom. Each example concludes with a link to an odd-numbered exercise, and these odd-numbered exercises include a reference back to the corresponding example, making it easy for students to use the textbook as a resource.

7. Materials of Instruction (Note: Materials of instruction for English Language Learners are required and should be listed below.)

A. Textbook(s) and Core Reading(s):
- *Statistics and Probability with Applications* 3e, by Starnes and Tabor; Bedford, Freeman, and Worth Publishers

B. Supplemental Materials and Resources:
- Glosario for EL Learners
- Textbook online resources (Applets)
- Teacher made resources
- Overhead transparencies or documents for projection
- Extra practice worksheets
- Manipulatives
- Materials found on-line: projects; performance tasks, problems of the week...

C. Tools, Equipment, Technology, Manipulatives, Audio-Visual:
- Examview worksheet Generator
- Illuminate Item Bank
- Graphing Calculators (TI-83/84)
- Projectors
- Document Readers

8. (See below and attached)

- **Objectives of Course:**
  Most four-year colleges and universities require that students take a statistics course, in part due to the wide use of data and analytics in a variety of fields. Adding a statistics course will help meet the needs for all students who are college-bound, especially those students who are planning to study in a field that doesn't require mathematics above Algebra 2.

  A statistics course will also be valuable for students who may not be planning to pursue a college education. The results of statistical studies—good and bad—are constantly being reported in the media. A statistically literate citizen needs to understand how to think critically about claims made by researchers, marketers, and politicians.

  This course also allows a fresh start for students who may struggle in the traditional mathematics curriculum and a source of enrichment for strong students who are interested applying math in a real-world context.

  Below are some course goals and major student outcomes:

  - Students are able to formulate statistical questions and identify statistical claims made by others.
  - Students can collect appropriate data to answer statistical questions, using surveys, observational studies, and experiments.

- Students can use a wide variety of tools to analyze and summarize distributions of data and relationships between variables.
- Students understand the role of variability in the data collection process and incorporate this understanding when drawing conclusions about statistical questions.
- Students can describe, explain, and interpret the results of a statistical study in context.
- Students critically reflect on their own conclusions and conclusions made by others, including the limitations of these conclusions.

- **Unit detail including projects and activities including duration of units**

  SEE ATTACHED DOCUMENT

- **Indicate references to state framework(s)/standards (If state standard is not applicable then national standard should be used)**

  SEE ATTACHED DOCUMENT

- **Student performance standards**

  Guidelines for grading are:

  A 90 – 100%
  B 80 – 89%
  C 70 – 79%
  D 60 – 69%
  F 59% and below

  - Make sense of problems and persevere in solving them.
  - Reason abstractly and quantitatively.
  - Construct viable arguments and critique the reasoning of others.
  - Model with mathematics.
  - Use appropriate tools strategically.
  - Attend to precision.
  - Look for and make use of structure.
  - Look for and express regularity in repeated reasoning.

- **Evaluation/assessment/rubrics**

  - Formative and Summative Assessments
    - Chapter Tests
    - Quizzes
    - Homework/Classwork Practice
  - Projects
  - Performance Tasks

- **Include minimal attainment for student to pass course**

  Students must attain at least 60% overall average for all assignments (Tests, Quizzes, Homework, Classwork, Notes, etc.) for the course.

Please see attachments for unit details and standards alignment

Chapter (Lesson) Details / Learning Targets

Chapter 1 Analyzing One-Variable Data (*4 weeks)*

Lesson 1.1 Statistics: The Science and Art of Data	• Identify the individuals and variables in a data set, then classify the variables as categorical or quantitative. • Summarize the distribution of a variable with a frequency table or a relative frequency table.
Lesson 1.2 Displaying Categorical Data	• Make and interpret bar charts of categorical data. • Interpret pie charts. • Identify what makes some graphs of categorical data deceptive.
Lesson 1.3 Displaying Quantitative Data: Dotplots	• Make and interpret dotplots of quantitative data. • Describe the shape of a distribution. • Compare distributions of quantitative data with dotplots.
Lesson 1.4 Displaying Quantitative Data: Stemplots	• Make stemplots of quantitative data. • Interpret stemplots. • Compare distributions of quantitative data with stemplots.
Lesson 1.5 Displaying Quantitative Data: Histograms	• Make histograms of quantitative data. • Interpret histograms. • Compare distributions of quantitative data with histograms.
Lesson 1.6 Measuring Center	• Find and interpret the median of a distribution of quantitative data. • Calculate the mean of a distribution of quantitative data. • Compare the mean and median of a distribution, and choose the more appropriate measure of center in a given setting.
Lesson 1.7 Measuring Variability	• Find the range of a distribution of quantitative data. • Find and interpret the interquartile range. • Calculate and interpret the standard deviation.
Lesson 1.8 Summarizing Quantitative Data: Boxplots and Outliers	• Use the 1.5 × *IQR* rule to identify outliers. • Make and interpret boxplots of quantitative data. • Compare distributions of quantitative data with boxplots.
Lesson 1.9 Describing Location in a Distribution	• Find and interpret a percentile in a distribution of quantitative data. • Estimate percentiles and individual values using a cumulative relative frequency graph. • Find and interpret a standardized score (*z*-score) in a distribution of quantitative data.
Bonus Lesson 1.9A *Transforming Data*	• *Describe the effect of adding or subtracting a constant on a distribution of quantitative data.* • *Describe the effect of multiplying or dividing by a*

	constant on a distribution of quantitative data. • *Analyze the effect of adding or subtracting a constant and multiplying or dividing by a constant on measures of center, location, and variability.*

Chapter 2 Analyzing Two-Variable Data *(4 Weeks)*

Lesson 2.1 Relationships between Two Categorical Variables	• Distinguish between explanatory and response variables for categorical data. • Make a segmented bar chart to display the relationship between two categorical variables. • Determine if there is an association between two categorical variables and describe the association if it exists.
Lesson 2.2 Relationships between Two Quantitative Variables	• Distinguish between explanatory and response variables for quantitative data. • Make a scatterplot to display the relationship between two quantitative variables. • Describe the direction, form, and strength of a relationship displayed in a scatterplot, and identify outliers.
Bonus Lesson 2.2A *Timeplots*	• *Construct a timeplot of a quantitative variable.* • *Describe a timeplot of a quantitative variable.* • *Construct a timeplot of a quantitative variable using a moving average.*
Lesson 2.3 Correlation	• Estimate the correlation between two quantitative variables from a scatterplot. • Interpret the correlation. • Distinguish correlation from causation.
Lesson 2.4 Calculating the Correlation	• Calculate the correlation between two quantitative variables. • Apply the properties of the correlation. • Describe how outliers influence the correlation.
Lesson 2.5 Regression Lines	• Make predictions using regression lines, keeping in mind the dangers of extrapolation. • Calculate and interpret a residual. • Interpret the slope and y intercept of a regression line.
Lesson 2.6 The Least-Squares Regression Line	• Calculate the equation of the least-squares regression line using technology. • Calculate the equation of the least-squares regression line using summary statistics. • Describe how outliers affect the least-squares regression line.
Lesson 2.7 Assessing a Regression Model	• Use a residual plot to determine whether a regression model is appropriate. • Interpret the standard deviation of the residuals. • Interpret r^2.
Lesson 2.8 Fitting Models to Curved	• Use technology to calculate quadratic models for curved relationships, then calculate and interpret

Relationships	residuals using the model. • Use technology to calculate exponential models for curved relationships, then calculate and interpret residuals using the model. • Use residual plots to determine the most appropriate model.

Chapter 3 Collecting Data *(4 Weeks)*

Lesson 3.1 Introduction to Data Collection	• Distinguish statistical questions from other types of questions. • Identify the population and sample in a statistical study. • Distinguish between an observational study and an experiment.
Lesson 3.2 Sampling: Good and Bad	• Describe how convenience sampling can lead to bias. • Describe how voluntary response sampling can lead to bias. • Explain how random sampling can help to avoid bias.
Lesson 3.3 Simple Random Samples	• Describe how to obtain a simple random sample using slips of paper or technology. • Explain the concept of sampling variability and the effect of increasing sample size. • Use simulation to test a claim about a population proportion.
Lesson 3.4 Estimating a Margin of Error	• Use simulation to approximate the margin of error for a sample proportion and interpret the margin of error. • Use simulation to approximate the margin of error for a sample mean and interpret the margin of error.
Lesson 3.5 Sampling and Surveys	• Explain how undercoverage can lead to bias. • Explain how nonresponse can lead to bias. • Explain how other aspects of a sample survey can lead to bias.
Bonus Lesson 3.5A *Other Random Sampling Methods*	• *Describe how to obtain a stratified random sample.* • *Describe how to obtain a cluster random sample.* • *Justify the choice of a particular random sampling method.*
Lesson 3.6 Observational Studies and Experiments	• Explain the concept of confounding and how it limits the ability to make cause-and-effect conclusions. • Explain the purpose of comparison in an experiment. • Describe the placebo effect and the purpose of blinding in an experiment.
Lesson 3.7 How to Experiment Well	• Describe how to randomly assign treatments using slips of paper or technology. • Explain the purpose of random assignment in an experiment. • Identify other sources of variability in an experiment and explain the benefits of keeping these variables the same for all experimental units.

Lesson 3.8 Inference for Experiments	• Outline an experiment that uses a completely randomized design. • Explain the concept of statistical significance in the context of an experiment. • Use simulation to determine if the difference between two means or two proportions in an experiment is significant.
Bonus Lesson 3.8A *Blocking*	• *Design an experiment that uses blocking.* • *Explain the benefits of using blocking in an experiment.* • *Design an experiment that uses matched pairs.*
Lesson 3.9 Using Studies Wisely	• Identify when it is appropriate to use information from a sample to make an inference about a population and when it is appropriate to make an inference about cause and effect. • Evaluate if a statistical study has been carried out in an ethical manner.

Chapter 4 Probability *(4 Weeks)*

Lesson 4.1 Randomness, Probability, and Simulation	• Interpret probability as a long-run relative frequency. • Dispel common myths about randomness. • Use simulation to model chance behavior.
Lesson 4.2 Basic Probability Rules	• Give a probability model for a chance process and use it to find the probability of an event. • Use the complement rule to find probabilities. • Use the addition rule for mutually exclusive events to find probabilities.
Lesson 4.3 Two-Way Tables and Venn Diagrams	• Use a two-way table to find probabilities. • Calculate probabilities with the general addition rule. • Use a Venn diagram to find probabilities.
Lesson 4.4 Conditional Probability and Independence	• Find and interpret conditional probabilities using two-way tables. • Use the conditional probability formula to calculate probabilities. • Determine whether two events are independent.
Lesson 4.5 The General Multiplication Rule and Tree Diagrams	• Use the general multiplication rule to calculate probabilities. • Use a tree diagram to model a chance process involving a sequence of outcomes. • Calculate conditional probabilities using tree diagrams.
Lesson 4.6 The Multiplication Rule for Independent Events	• Use the multiplication rule for independent events to calculate probabilities. • Calculate P(at least one) using the complement rule and the multiplication rule for independent events. • Determine if it is appropriate to use the multiplication rule for independent events in a given setting.
Lesson 4.7	• Use the multiplication counting principle to

The Multiplication Counting Principle and Permutations	determine the number of ways to complete a process involving several steps. • Use factorials to count the number of permutations of a group of individuals. • Compute the number of permutations of *n* individuals taken *k* at a time.
Lesson 4.8 Combinations and Probability	• Compute the number of combinations of *n* individuals taken *k* at a time. • Use combinations to calculate probabilities. • Use the multiplication counting principle and combinations to calculate probabilities.

Chapter 5 Random Variables *(4 Weeks)*

Lesson 5.1 Two Types of Random Variables	• Verify that the probability distribution of a discrete random variable is valid. • Calculate probabilities involving a discrete random variable. • Classify a random variable as discrete or continuous.
Lesson 5.2 Analyzing Discrete Random Variables	• Make a histogram to display the probability distribution of a discrete random variable and describe its shape. • Calculate and interpret the mean (expected value) of a discrete random variable. • Calculate and interpret the standard deviation of a discrete random variable.
Lesson 5.3 Binomial Random Variables	• Determine whether or not a given scenario is a binomial setting. • Calculate probabilities involving a single value of a binomial random variable. • Make a histogram to display a binomial distribution and describe its shape.
Lesson 5.4 Analyzing Binomial Random Variables	• Calculate and interpret the mean and standard deviation of a binomial distribution. • Find probabilities involving several values of a binomial random variable. • Use technology to calculate cumulative binomial probabilities.
Lesson 5.5 Continuous Random Variables	• Show that the probability distribution of a continuous random variable is valid and use the distribution to calculate probabilities. • Determine the relative locations of the mean and median of a continuous random variable from the shape of its probability distribution. • Draw a normal probability distribution with a given mean and standard deviation.
Lesson 5.6 The Standard Normal Distribution	• Use the 68–95–99.7 rule to find approximate probabilities in a normal distribution.

	• Use Table A to find a probability (area) from a *z*-score in the standard normal distribution. • Use Table A to find a *z*-score from a probability (area) in the standard normal distribution.
Lesson 5.7 Normal Distribution Calculations	• Calculate the probability that a value falls within a given interval in a normal distribution. • Find a value corresponding to a given probability (area) in a normal distribution.
Bonus Lesson 5.7A *Assessing Normality*	• *Use graphical and numerical evidence to determine if a distribution of quantitative data is approximately normal.* • *Interpret a normal probability plot.*
Bonus Lesson 5.7B *Transforming Random Variables*	• *Describe the effect of adding or subtracting a constant on the probability distribution of a random variable.* • *Describe the effect of multiplying or dividing by a constant on the probability distribution of a random variable.* • *Analyze the effect of adding or subtracting a constant and multiplying or dividing by a constant on the mean and standard deviation of a random variable.*
Bonus Lesson 5.7C *Combining Random Variables*	• *Calculate and interpret the mean (expected value) of the sum or difference of two random variables.* • *Calculate and interpret the standard deviation of the sum or difference of two independent random variables.* • *Find probabilities involving the sum or difference of independent normal random variables.*

Chapter 6 Sampling Distributions *(4 Weeks)*

Lesson 6.1 What Is a Sampling Distribution?	• Distinguish between a parameter and a statistic. • Create a sampling distribution using all possible samples from a small population. • Use the sampling distribution of a statistic to evaluate a claim about a parameter.
Lesson 6.2 Sampling Distributions: Center and Variability	• Determine if a statistic is an unbiased estimator of a population parameter. • Describe the relationship between sample size and the variability of a statistic.
Lesson 6.3 The Sampling Distribution of a Sample Count (The Normal Approximation to the Binomial)	• Calculate the mean and the standard deviation of the sampling distribution of a sample count and interpret the standard deviation. • Determine if the sampling distribution of a sample count is approximately normal. • If appropriate, use the normal approximation to the binomial distribution to calculate probabilities involving a sample count.
Lesson 6.4	• Calculate the mean and standard deviation of the

The Sampling Distribution of a Sample Proportion	sampling distribution of a sample proportion $\hat{p}$ and interpret the standard deviation. • Determine if the sampling distribution of $\hat{p}$ is approximately normal. • If appropriate, use a normal distribution to calculate probabilities involving $\hat{p}$.
Lesson 6.5 The Sampling Distribution of a Sample Mean	• Find the mean and standard deviation of the sampling distribution of a sample mean $\bar{x}$ and interpret the standard deviation. • Use a normal distribution to calculate probabilities involving $\bar{x}$ when sampling from a normal population.
Lesson 6.6 The Central Limit Theorem	• Determine if the sampling distribution of $\bar{x}$ is approximately normal when sampling from a non-normal population. • If appropriate, use a normal distribution to calculate probabilities involving $\bar{x}$.

Chapter 7 Estimating a Parameter ***(4 Weeks)***

Lesson 7.1 The Idea of a Confidence Interval	• Interpret a confidence interval in context. • Determine the point estimate and margin of error from a confidence interval. • Use confidence intervals to make decisions.
Lesson 7.2 What Affects the Margin of Error?	• Interpret a confidence level in context. • Describe how the confidence level and sample size affect the margin of error. • Explain how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval.
Lesson 7.3 Estimating a Proportion	• Check the Random and Large Counts conditions for constructing a confidence interval for a population proportion. • Determine the critical value for calculating a *C*% confidence interval for a population proportion using Table A or technology. • Calculate a *C*% confidence interval for a population proportion.
Lesson 7.4 Confidence Intervals for a Proportion	• Use the four-step process to construct and interpret a confidence interval for a population proportion. • Determine the sample size required to obtain a *C*% confidence interval for a population proportion with a specified margin of error.
Lesson 7.5 Estimating a Mean	• State and check the Random and Normal/Large Sample conditions for constructing a confidence interval for a population mean. • Determine critical values for calculating a *C*% confidence interval for a population mean. • Calculate a *C*% confidence interval for a population

	mean.
Lesson 7.6 Confidence Intervals for a Mean	• Use sample data to check the Normal/Large Sample condition. • Use the four-step process to construct and interpret a confidence interval for a population mean.

Chapter 8 Testing a Claim *(4 Weeks)*

Lesson 8.1 The Idea of a Significance Test	• State appropriate hypotheses for a significance test about a population parameter. • Interpret a *P*-value in context. • Make an appropriate conclusion for a significance test based on a *P*-value.
Lesson 8.2 Significance Tests and Decision Making	• Determine if the results of a study are statistically significant and make an appropriate conclusion using a significance level. • Interpret a Type I error and a Type II error in context. • Give a consequence of a Type I error and a Type II error in a given setting.
Lesson 8.3 Testing a Claim about a Proportion	• Check the Random and Large Counts conditions for performing a significance test about a population proportion. • Calculate the standardized test statistic for a significance test about a population proportion. • Find the *P*-value for a one-sided significance test about a population proportion using Table A or technology.
Lesson 8.4 Significance Tests for a Proportion	• Use the four-step process to perform a one-sided significance test about a population proportion. • Calculate the *P*-value for a two-sided significance test about a population proportion using Table A or technology. • Use the four-step process to perform a two-sided significance test about a population proportion.
Lesson 8.5 Testing a Claim about a Mean	• Check the Random and Normal/Large Sample conditions for performing a significance test about a population mean. • Calculate the standardized test statistic for a significance test about a population mean. • Find the *P*-value for a significance test about a population mean using Table B.
Lesson 8.6 Significance Tests for a Mean	• Use the four-step process to perform a significance test about a population mean. • Use a confidence interval to draw a conclusion about a two-sided test for a population mean.
Bonus Lesson 8.6A *Power of a Test*	• *Interpret the power of a significance test in context.* • *Describe what factors affect the power of a test.*

Chapter 9 Comparing Two Populations or Treatments *(4 Weeks)*

Lesson 9.1 Estimating a Difference Between Two Proportions	• Describe the shape, center, and variability of the sampling distribution of a difference between two sample proportions. • Check the Random and Large Counts conditions for constructing a confidence interval for a difference between two proportions. • Use the four-step process to construct and interpret a confidence interval for the difference between two proportions.
Lesson 9.2 Testing a Claim about a Difference Between Two Proportions	• State hypotheses and check conditions for performing a significance test about a difference between two proportions. • Calculate the standardized test statistic and *P*-value for a significance test about a difference between two proportions. • Use the four-step process to perform a significance test about a difference between two proportions.
Lesson 9.3 Estimating a Difference Between Two Means	• Describe the shape, center, and variability of the sampling distribution of a difference between two sample means. • Check the Random and Normal/Large Sample conditions for constructing a confidence interval for a difference between two means. • Use the four-step process to construct and interpret a confidence interval for the difference between two means.
Lesson 9.4 Testing a Claim about a Difference Between Two Means	• State hypotheses and check conditions for performing a significance test about a difference between two means. • Calculate the standardized test statistic and *P*-value for a significance test about a difference between two means. • Use the four-step process to perform a significance test about a difference between two means.
Lesson 9.5 Analyzing Paired Data: Estimating a Mean Difference	• Use a graph to analyze the distribution of differences in a paired data set. • Calculate the mean and standard deviation of the differences in a paired data set, and interpret the mean difference in context. • Use the four-step process to construct and interpret a confidence interval for the true mean difference.
Lesson 9.6 Testing a Claim about a Mean Difference	• Use the four-step process to perform a significance test about a mean difference. • Determine whether you should use two-sample *t* procedures for inference about $\mu_1 - \mu_2$ or one-sample *t* procedures for inference about μ_{diff} in a given setting.

Bonus Lesson 9.6A *Alternate Methods for Testing a Claim about Paired Data (Nonparametric Tests)*	• *Use a sign test to test a claim about paired data.* • *Use simulation to test a claim about a mean difference.*

Chapter 10 Inference for Distributions and Relationships *(4 Weeks)*

Lesson 10.1 Testing the Distribution of a Categorical Variable	• State hypotheses for a test about the distribution of a categorical variable. • Calculate expected counts for a test about the distribution of a categorical variable. • Calculate the test statistic for a test about the distribution of a categorical variable.
Lesson 10.2 Chi-Square Tests for Goodness of Fit	• Check conditions for a test about the distribution of a categorical variable. • Calculate the *P*-value for a test about the distribution of a categorical variable. • Use the four-step process to perform a chi-square test for goodness of fit.
Lesson 10.3 Testing the Relationship between Two Categorical Variables	• State hypotheses for a test about the relationship between two categorical variables. • Calculate expected counts for a test about the relationship between two categorical variables. • Calculate the test statistic for a test about the relationship between two categorical variables.
Lesson 10.4 Chi-Square Tests for Association	• Check conditions for a test about the relationship between two categorical variables. • Calculate the *P*-value for a test about the relationship between two categorical variables. • Use the four-step process to perform a chi-square test for association.
Lesson 10.5 Testing the Relationship between Two Quantitative Variables	• State hypotheses for a test about the relationship between two quantitative variables. • Check conditions for a test about the relationship between two quantitative variables. • Calculate the test statistic and *P*-value for a test about the relationship between two quantitative variables given summary statistics.
Lesson 10.6 Inference for the Slope of a Least-Squares Regression Line	• Use technology to calculate the test statistic and *P*-value for a test about the relationship between two quantitative variables. • Use the four-step process to perform a test for the slope of a least-squares regression line. • Use the four-step process to calculate and interpret a confidence interval for the slope of a least-squares regression line.
Bonus Lesson 10.6A *Multiple Regression, part 1*	• *Use a multiple regression model to make predictions.* • *Use a multiple regression model to calculate and*

	interpret residuals. • *Interpret the standard deviation of the residuals and r^2 for a multiple regression model.*
Bonus Lesson 10.6A *Multiple Regression, part 2*	• *Use a multiple regression model with an indicator variable to make predictions, and calculate and interpret residuals.* • *Interpret the coefficients in a multiple regression model.* • *Explain how to choose which explanatory variables should be included in a multiple regression model.*

Alignment with Common Core State Standards for High School Statistics and Probability

Interpreting Categorical and Quantitative Data (S-ID)

Summarize, represent, and interpret data on a single count or measurement variable	**SPA 3e Chapter(s)**
1. Represent data with plots on the real number line (dot plots, histograms, and box plots).	1
2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	1
3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	1
4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	5
Summarize, represent, and interpret data on two categorical and quantitative variables	
5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	2
6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.	2
a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.*	2
b. Informally assess the fit of a function by plotting and analyzing residuals.	2
c. Fit a linear function for a scatter plot that suggests a linear association.	2
Interpret linear models	
7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	2
8. Compute (using technology) and interpret the correlation coefficient of a linear fit.	2
9. Distinguish between correlation and causation.	2, 3

Making Inferences and Justifying Conclusions (S-IC)

Understand and evaluate random processes underlying statistical experiments	**SPA 3e Chapter(s)**
1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	3
2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*	3, 4, 7–10
Make inferences and justify conclusions from sample surveys, experiments, and observational studies	
3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	3
4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.	3, 7
5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	3, 9
6. Evaluate reports based on data.	3

Conditional Probability and the Rules of Probability (S-CP)

Understand independence and conditional probability and use them to interpret data	**SPA 3e Chapter(s)**
1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").	4
2. Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	4
3. Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.	4
4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.	4
5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	4
Use the rules of probability to compute probabilities of compound events in a uniform probability model	
6. Find the conditional probability of *A* given *B* as the fraction of *B*'s	4

outcomes that also belong to *A,* and interpret the answer in terms of the model.	
7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.	4
8. Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.	4
9. Use permutations and combinations to compute probabilities of compound events and solve problems.	4

Using Probability to Make Decisions (S-MD)

Calculate expected values and use them to solve problems	**SPA 3e Chapter(s)**
1. Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.	5
2. Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.	5
3. Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.	5
4. Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.	5
Use probability to evaluate outcomes of decisions	
5. Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.	5
a. Find the expected payoff for a game of chance.	5
b. Evaluate and compare strategies on the basis of expected values.	5
6. Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	5
7. Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	5