PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Introductory Statistics

Curriculum Writing Committee:

Jenelle France

Grade Level: 11/12

Date of Board Approval: _____

Course Weighting: Introductory Statistics

Gradebook Category - Points	Marking Period 1	Marking Period 2	Marking Period 3	Marking Period 4	Total Points
Tests	200	200	200	200	800
Quizzes	160	180	180	120	640
Project	50	30	0	75	155
HW/Participation	40	40	40	40	160
Total Points	450	450	420	435	1755

Curriculum Map

Overview: This elective course is designed to introduce students to the concepts of statistics as they apply to many other fields of study. Major topics will include elementary data analysis with both graphical and numerical approaches; the design of experiments, sampling, and surveys, probability, and methods of inference. The course may be taken concurrently with Algebra II and Trigonometry but not in lieu of that course.

Goals:

- **Marking Period 1 (45 days) -** Students will be able to understand the following:
  - **Unit 1: Analyzing One Variable Data (20 Days)**
    - Building graphs to display distributions of both categorical and quantitative data
    - Interpreting distributions of both categorical and quantitative data: pie charts, bar graphs, dot plots, stem plots and histograms
    - Calculate and interpret measures of central tendency: mean and median
    - Calculate and interpret the interquartile range and standard deviation
    - Create and interpret box plots
    - Identify outliers in a boxplot by the use of the outlier formula
  - **Unit 2: Modeling One-Variable Quantitative Data (17 Days)**
    - Calculating percentiles and interpret its meaning
    - Calculating z-scores and interpreting its meaning.
    - Transforming data
    - Setting up a normal distribution using a given mean and standard deviation.

        - Finding percentiles and areas under the normal curve using Desmos or stapplet calculator.
        - Interpreting z-scores and values on the normal curve given a percentile or area under the curve.
    - **Unit 3: Analyzing Two-Variable Data (8 days)**
        - Creating scatter plots and interpret correlations
        - Understanding explanatory and response variables
        - Reasons for relationships, including causation, confounding, and lurking variables
        - Interpreting the correlation coefficient
        - Finding the least-squares regression line for a given scatter plot.

- **Marking Period 2 (45 days)** - Students will be able to understand the following:
    - **Unit 3 Continued (10 days)**
        - Using the least-squares regression line to interpret scenarios and predict data points.
        - Interpreting the slope and y-intercept of the least squares regression line in a real life context
        - Creating residual plots
        - Interpreting the r-squared value
        - Identifying and understanding lurking variables
    - **Unit 4: Collecting Data (20 Days)**
        - Asking statistical questions
        - Looking at examples of populations and samples
        - Parameters and statistics in samples and populations
        - Identifying good and bad samples
        - Sources of bias in statistical studies - sampling and non-sampling errors
        - Inference in sampling
        - Comparing and contrasting observational studies and experiments
        - Learn how to experiment well
        - Inference for experiments
        - Using studies wisely and ethical implications

    - **Unit 5: Probability (15 Days)**
        - Understanding randomness, finding basic probabilities and simulating data.
        - The Law of Large Numbers
        - Basic probability rules
        - Probability models and sample space.
        - Two way tables and venn diagrams
        - Conditional probability and independence

- **Marking Period 3 (45 days**) - Students will be able to understand the following:
    - **Unit 5 Continued (13 days)**
        - The general multiplication rule and tree diagrams
        - The multiplication rule for independent and dependent events

        - The multiplication counting principal and factorials
        - Combination and permutations
    - **Unit 6: Random Variables (14 days)**
        - Two types of random variables
        - Analyzing discrete random variables - finding expected values
        - Binomial random variables
        - Analyzing binomial random variables
        - Normal approximation to binomial distributions
    - **Unit 7: Sampling Distributions (7 days)**
        - What is a sampling distribution
        - Sampling distributions: bias and variability
        - The sampling distribution of a sample proportion
        - The sampling distribution of a sample mean
        - The central limit theorem
    - **Unit 8: Estimating a Population Parameter (11 days)**
        - The concept of a confidence interval
        - What is the margin of error
        - What affects the margin of error
        - Estimating the population proportion

- **Marking Period 4 (45 days)** - Students will be able to understand the following:
    - **Unit 8 continued (10 days)**
        - Confidence intervals for a population proportion
        - Estimating the population mean
        - Confidence intervals for a population mean
    - **Unit 9: Testing a claim about a population parameter (19 days)**
        - The idea of a significance test
        - Significance tests and decision making
        - Testing a claim about a population proportion
        - Significance tests about a population proportion
        - Testing a claim about a population mean
        - Significance tests about a population mean
    - **Unit 10: Inference Distributions and Relationships between Two Variables / Final Project (16 days)**
        - Testing the distribution of a categorical variable in a population
        - Chi-Squares for Goodness of Fit
        - Testing the relationship between two categorical variables
        - Chi-Square Tests for Association
        - Final Project

Big Ideas:

- **VARIATION AND DISTRIBUTION (VAR)** -The distribution of measures for individuals within a sample or population describes variation. The value of a statistic varies from sample to sample. How can we determine whether differences between measures represent random variation or meaningful distinctions? Statistical methods based on probabilistic reasoning provide the basis for shared understandings about

variation and about the likelihood that variation between and among measures, samples, and populations is random or meaningful.

- **PATTERNS AND UNCERTAINTY (UNC)** - Statistical tools allow us to represent and describe patterns in data and to classify departures from patterns. Simulation and probabilistic reasoning allow us to anticipate patterns in data and to determine the likelihood of errors in inference.

- **DATA-BASED PREDICTIONS, DECISIONS, AND CONCLUSIONS (DAT)** - Data-based regression models describe relationships between variables and are a tool for making predictions for values of a response variable. Collecting data using random sampling or randomized experimental design means that findings may be generalized to the part of the population from which the selection was made. Statistical inference allows us to make data-based decisions.

Textbook and Supplemental Resources:

- **Statistics and Probability with Applications, Fifth Edition**
  - **Textbook ISBN:** 978-1-319-53590-2
  - **Textbook Publisher/Year of Publication:** Bedford, Freeman & Worth, 2025

- **Supplemental Resources:**
  - MathMedic.com
  - https://www.Desmos.com/calculator
  - https://www.stapplet.com/
  - https://www.rossmanchance.com/applets/
  - statcrunch.com
  - TI-84 Graphing Calculators

Curriculum Plan

Unit 1: Exploring One-Variable Data (20 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved.
    - 2.A Describe data presented numerically or graphically.
    - 2.B Construct numerical or graphical representations of distributions.
    - 2.C Calculate summary statistics, relative positions of points within a distribution, correlation, and predicted response.
    - 2.D Compare distributions or relative positions of points within a distribution.
    - 3.A Determine relative frequencies, proportions, or probabilities using simulation or calculations.
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.

Objectives:

- Identify categorical and quantitative variables. *(DOK 1)*
- Distinguish between different types of variables (discrete vs. continuous). *(DOK 2)*
- Classify variables within a given context and justify the classification. *(DOK 3)*
- Construct frequency tables and bar charts for categorical variables. *(DOK 2)*
- Interpret graphical displays to describe patterns and relationships in categorical data. *(DOK 2)*
- Evaluate whether a chosen graphical display appropriately represents the data context. *(DOK 3)*
- Create dotplots, stemplots, and histograms to represent quantitative data. *(DOK 2)*
- Describe the distribution of quantitative data using shape, center, and spread. *(DOK 2)*
- Compare distributions of quantitative variables using graphical and numerical summaries. *(DOK 3)*
- Select and justify the most appropriate display for a given data set and purpose. *(DOK 3)*
- Calculate measures of center (mean, median) and spread (range, IQR, standard deviation). *(DOK 1)*
- Interpret measures of center and spread in the context of the data. *(DOK 2)*
- Compare the effects of outliers on different measures of center and spread. *(DOK 3)*
- Design and justify a method to summarize data numerically and graphically for a given context. *(DOK 4)*
- Determine which measure of center and spread is most appropriate for skewed or symmetric distributions. *(DOK 2)*
- Analyze how changes in a data set affect summary statistics. *(DOK 3)*
- Critique summaries of data in media or research, identifying potential misrepresentations. *(DOK 4)*

Core Activities and Corresponding Instructional Methods:

- **Math Medic Activities for Unit 1**
    - **Activity: Can Joy Smell Parkinson's?** 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.
    - **Activity: What is Your Social Media of Choice?** Compare distributions of categorical data with bar charts. Identify what makes some graphs of categorical data deceptive. Make and interpret bar charts (or pie charts) of categorical data.
    - **Activity: How Many Hours a Week Do You Work?** Make and interpret dotplots of quantitative data. Describe the shape of a distribution. Describe or compare distributions of quantitative data with dotplots**.**
    - **Activity: How Many Pairs of Shoes Do You Own?** Make stemplots of quantitative data. Interpret or describe stemplots. Compare distributions of quantitative data with stemplots.
    - **Activity: How Many Text Messages Do You Send a Day?** Make histograms of quantitative data. Interpret or describe histograms. Compare distributions of quantitative data with histograms.
    - **Activity: How Many Hours Do You Work? Part 2** 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.
    - **Activity: How Many Colleges Are You Applying To?** Find the range of a distribution of quantitative data. Calculate and interpret the standard deviation. Find and interpret the interquartile range.
    - **Activity: How Many Concerts Have You Been To?** Use the 1.5 × IQR rule to identify outliers. Make and interpret boxplots of quantitative data. Compare distributions of quantitative data with boxplots.
- Use supplemental resources (i.e. Desmos, stapplet) for hands-on data experience for making categorical and quantitative graphs.
- Use bell ringers outlined in Unit 1 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.
- "Your Turn" lesson examples from textbook on pages 9, 19, 30, 40, 53, 65, 76, and 86.
- "Statistics Applied Resolved" activity on page 90 "Does Hand Sanitizer Work?"
- Unit 1 Project: The "Comparing Nutritional Values Project"
    - Part 1: Students will gather data on 3 fast food places: McDonalds, Wendys, and Burger King. They will record the calories of at least 10 burgers from each restaurant. Students will make 3 box plots for each restaurant to show the distribution of calories. Then they will do this again with chicken sandwiches. In total, students should have 6 box plots. This will all be done in stapplet.com. Students will consider the shape, center, and spread and determine the existence of any outliers. Students will write summaries synthesizing their findings and

using their data to determine which fast-food place is the “healthiest” choice based on calories (if someone was counting calories, which place would be the best choice).
    - Part 2 of the project consists of students finding a misleading graph on the internet. Students must provide the source of the image, explain what is misleading from the graph (using information from class) and then explain how they would fix the graph to make it more suitable for others to interpret.

Assessments:

- **Diagnostic:**
    - Teacher observations and questioning techniques
    - Warm up activities

- **Formative:**
    - Teacher observations and questioning techniques
    - Group activities and classwork observations
    - Homework assignments - example problems from textbook or teacher made
    - Teacher prepared quizzes

- **Summative:**
    - Unit 1 Common Assessment

- **Correctives:**
    - Conduct small-group reteaching on identifying variable types, describing distributions, and interpreting measures of center and spread.
    - Use visual aids and interactive simulations (Desmos or stapplet) to reinforce understanding of shape, center, spread, and the impact of outliers.
    - Provide guided practice with teacher feedback on creating and interpreting graphs (dotplots, histograms, boxplots).
    - Assign error analysis tasks where students diagnose and correct common mistakes in interpreting descriptive statistics or graphs.

- **Extensions:**
    - Extra practice questions and/or activities from Unit 1 in the textbook.
    - Graphical abuses and how to find them within all types of graphs.
    - Complete past AP Statistics Free Response Questions.

Unit 2: Modeling One-Variable Quantitative Data (17 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved.
    - 2.A Describe data presented numerically or graphically.
    - 2.B Construct numerical or graphical representations of distributions.
    - 2.C Calculate summary statistics, relative positions of points within a distribution, correlation, and predicted response.
    - 2.D Compare distributions or relative positions of points within a distribution.
    - 3.A Determine relative frequencies, proportions, or probabilities using simulation or calculations.
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.

Objectives:

- Calculate and interpret percentiles to compare values within a data set *(DOK 2)*
- Calculate and interpret z-scores to compare values from different distributions. *(DOK 2)*
- Compare and contrast a percentile and z-scores. *(DOK 3)*
- Students will analyze and justify how adding, subtracting, multiplying, or dividing a data set by a constant affects measures of center (mean, median) and measures of variability (range, interquartile range, standard deviation), explaining the reasoning behind each effect. *(DOK 3)*
- Evaluate the appropriateness of using z-scores in different contexts. *(DOK 3)*
- Identify key characteristics of normal distributions (shape, mean, standard deviation). *(DOK 1)*
- Use normal distribution notation and parameters to model data. *(DOK 2)*
- Compute and interpret areas (probabilities) under a normal curve using z-scores. *(DOK 2)*
- Apply normal models to solve real-world problems and justify the reasonableness of the model. *(DOK 3)*

Core Activities and Corresponding Instructional Methods:

- **<u>Math Medic Activities for Unit 2:</u>**
    - **Activity: How Did Marty Do On His Test? -** Find and interpret a percentile and a z-score in a distribution of quantitative data.
    - **Activity: Can You Curve the Test Scores? -** Analyze the effect of adding or subtracting a constant and multiplying or dividing by a constant on measures of center, location, and variability.
    - **Activity: Can You Predict Shape? -** Use a density curve to model a distribution of quantitative data. Activity will include finding distributions of dice rolls, a penny toss and a stop watch.

    - **Activity: Do You Have 5 Seconds? -** Use the empirical rule to estimate the proportion of values in a specified interval in a normal distribution. Students will use stop watch data from the previous lesson to investigate the empirical rule.
    - **Activity: Will Marty Make it Back to the Future? -** Find the proportion of values to the left, right and between values in a normal distribution.
    - **Activity: Will Marty Make it Back to the Future? Part 2 -** Find the value that corresponds to a given percentile in a normal distribution.
- Use supplemental resources (i.e. Desmos, stapplet) for hands-on data experience in creating normal distributions.
- Use bell ringers outlined in Unit 2 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.
- "Your Turn" lesson examples from textbook on pages 104, 115, 125, 135, 147, and 155
- "Statistics Applied Resolved" activity on page 158 "Do You Sudoku"?

Assessments:

- **Diagnostic:**
    - Teacher observations and questioning techniques
    - Warm up activities

- **Formative:**
    - Teacher observations and questioning techniques
    - Group activities and classwork observations
    - Homework assignments - example problems from textbook or teacher made
    - Teacher prepared quizzes

- **Summative:**
    - Unit 2 Common Assessment

- **Correctives:**
    - Conduct small-group instruction reviewing properties of the normal distribution, emphasizing mean, standard deviation, and symmetry.
    - Use visual simulations (e.g., Rossman/Chance Applets, Desmos, or GeoGebra) to help students visualize how area under the curve corresponds to probability.
    - Provide guided step-by-step practice for converting raw scores to z-scores and finding areas/probabilities using z-tables or technology.
    - Offer targeted mini-lessons on interpreting percentile ranks, standardized scores, and context-based probability statements.
    - Incorporate real-world applications (e.g., test scores, heights, or measurement errors) to strengthen contextual understanding of normal models.

- **Extensions**
    - Extra practice questions and/or activities from Unit 2 in the textbook.
    - Complete past AP Statistics Free Response Questions.

Unit 3: Analyzing Two Variable Data (18 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved.
    - 2.A Describe data presented numerically or graphically.
    - 2.B Construct numerical or graphical representations of distributions.
    - 2.C Calculate summary statistics, relative positions of points within a distribution, correlation, and predicted response.
    - 2.D Compare distributions or relative positions of points within a distribution.
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.

Objectives:

- Identify explanatory and response variables in a bivariate data set. *(DOK 1)*
- Recognize when a relationship is linear, nonlinear, or has no association. *(DOK 1)*
- Construct a scatterplot for two quantitative variables using technology or by hand. *(DOK 2)*
- Describe the direction, form, and strength of a relationship shown in a scatterplot. *(DOK 2)*
- Interpret the correlation coefficient (r) in the context of a data set. *(DOK 2)*
- Explain the difference between correlation and causation. *(DOK 2)*
- Calculate the least-squares regression line (LSRL) using technology or given summary statistics. *(DOK 2)*
- Interpret the slope and y-intercept of a regression line in context. *(DOK 2)*
- Use a regression equation to make predictions and interpret residuals. *(DOK 2)*
- Construct and interpret a residual plot to assess the appropriateness of a linear model. *(DOK 3)*
- Analyze the effect of outliers and influential points on correlation and regression. *(DOK 3)*
- Compare two regression models and determine which better fits a data set using statistical evidence. *(DOK 3)*
- Evaluate whether a linear model is appropriate based on graphical and numerical information. *(DOK 3)*
- Explain how transformations (e.g., logarithmic or reciprocal) can linearize nonlinear relationships. *(DOK 3)*
- Design a small-scale investigation to collect paired quantitative data, construct a scatterplot, and analyze the results using correlation and regression tools. *(DOK 4)*
- Justify the choice of a linear or nonlinear model for a given data set and defend the decision using statistical reasoning and visual evidence. *(DOK 4)*
- Critique a published graph or analysis that uses correlation or regression, identifying any misuse or misleading representation. *(DOK 4)*

- Integrate graphical, numerical, and contextual evidence to draw and defend conclusions about a relationship between two variables. *(DOK 4)*
- Develop and communicate a full analytical report (scatterplot, correlation, regression, residual analysis) to explain a real-world relationship. *(DOK 4)*

Core Activities and Corresponding Instructional Methods:

- **Math Medic Activities for Unit 3:**
    - **Activity: How are Your Favorite Classes Related? -** Distinguish between explanatory and response variables. Determine if there is an association between two categorical variables and describe the association if it exists.
    - **Activity: How Many Rubber Bands Does Barbie Need? -** 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.
    - **Activity: Can You Guess the Correlation? -** Estimate the correlation between two quantitative variables from a scatterplot and interpret the correlation. Use Rossman/Chance simulator.
    - **Activity: Will Barbie Be Safe? -** Calculate the correlation between two quantitative variables and describe how outliers affect the correlation.
    - **Activity: How Good are Predictions for Barbie Data? -** Interpret the slope and y intercept of a regression line using the Barbie Data. Make predictions using regression lines, keeping in mind the dangers of extrapolation. Calculate and interpret a residual.
    - **Activity: What is the Relationship Between GPA and ACT? -** Calculate the equation of the least-squares regression line using technology. Describe how outliers affect the least-squares regression line.
- Use supplemental resources (i.e. Desmos, stapplet) for hands-on data experience for making scatterplots and calculating the least squares regression line.
- Use bell ringers outlined in Unit 3 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.
- "Your Turn" lesson examples from textbook on pages 172, 182, 190, 201, 211, 224, and 236
- "Statistics Applied Resolved" activity on page 241 "When will the cherry trees blossom?"
- The Weight of the Nation: Poverty and Obesity (HBO Docs)
- Unit 3 Project: Real Estate/Zillow Analysis
    - Students will gather data of about 30 homes within a particular zip code of their choosing. Students will record the size of the home (square footage) and the price of the home. They will then take that data and use technology to create a scatterplot. Students will need to synthesize all the key ideas from Unit 3 such as

correlation coefficients, least-squares regression line, residuals, and r-squared to determine if there is an association between the size of a home and what it sells for. Students will use all required data to justify and draw conclusions.

Assessments:

- **Diagnostic:**
  - Teacher observations and questioning techniques
  - Warm up activities

- **Formative:**
  - Teacher observations and questioning techniques
  - Group activities and classwork observations
  - Homework assignments - example problems from textbook or teacher made
  - Teacher prepared quizzes

- **Summative:**
  - Unit 3 Common Assessment

- **Correctives:**
  - Facilitate targeted reteaching sessions on interpreting scatterplots, distinguishing correlation from causation, and understanding residuals.
  - Use interactive graphing tools (Desmos, statcrunch, or graphing calculators) to visually explore how outliers and influential points affect regression lines.
  - Assign error analysis problems focusing on misinterpretations of slope, correlation, and residual plots.
  - Offer guided step-by-step practice on computing and interpreting the least-squares regression line (LSRL).

- **Extensions:**
  - Extra practice questions and/or activities from Unit 3 in the textbook.
  - Complete past AP Statistics Free Response Questions.

Unit 4: Collecting Data (20 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved.
    - 1.B Identify key and relevant information to answer a question or solve a problem
    - 1.C Describe an appropriate method for gathering and representing data
    - 4.A Make an appropriate claim or draw an appropriate conclusion
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.

Objectives:

- Define key terms related to data collection (population, sample, parameter, statistic, bias, lurking variable). *(DOK 1)*
- Identify different sampling methods (SRS, stratified, cluster, systematic, convenience). *(DOK 1)*
  Recognize forms of bias (nonresponse, undercoverage, response bias). *(DOK 1)*
  Describe components of an experiment (treatments, subjects, factors, levels, control, random assignment, replication). *(DOK 1)*
- List differences between observational studies and experiments. *(DOK 1)*
- Classify sampling methods when given a description. *(DOK 2)*
- Explain how a specific type of bias can affect the validity of collected data. *(DOK 2)*
- Distinguish between explanatory and response variables in a study description. *(DOK 2)*
- Describe whether a study design allows for generalization or cause-and-effect conclusions. *(DOK 2)*
- Sketch a basic plan for a simple randomized experiment. *(DOK 2)*
- Compare sampling designs in terms of efficiency and representativeness. *(DOK 2)*
- Evaluate whether a proposed sampling method yields a representative sample and justify your reasoning. *(DOK 3)*
- Critique an experimental design by identifying weaknesses and proposing improvements. *(DOK 3)*
- Determine whether confounding variables are present in a study and explain their impact. *(DOK 3)*
- Construct a complete experimental design including randomization, control, and replication, and justify each component. *(DOK 3)*
- Analyze how the structure of an observational study affects the conclusions that can be drawn. *(DOK 3)*
- Design a full real-world data collection plan (survey or experiment) including sampling method and bias mitigation. *(DOK 4)*
- Develop and defend a comparative or blocked experimental design with full justification. *(DOK 4)*
- Critique an existing study and propose a revised design that improves validity. *(DOK 4)*
- Integrate sampling and experimental design principles to propose a multi-part research investigation that supports generalizability and causal inference. *(DOK 4)*

Core Activities and Corresponding Instructional Methods:

- **Math Medic Activities for Unit 4:**
    - **Activity: Anchored Putting Intro.** Students will brainstorm ideas on how we can set up an experiment to do in class to answer this question. Introduction to Randomized Design Experiments.
    - **Activity: Introduction to Data Collection.** Distinguish statistical questions from other types of questions. Identify the population and sample in a statistical study. Distinguish between observational studies and experiments.
    - **Activity: Does Beyoncé Write Her Own Lyrics?** 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**.**
    - **Activity: What is Wrong With These 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.
    - **Activity: Does Beyoncé Write Her Own Lyrics? Part 2.** 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.
    - **Activity: Would You Fall for That?.** Explain the concept of confounding and how it limits the ability to make cause-and-effect conclusions. Identify the treatments in an experiment. Explain the purpose of a control group in an experiment.
    - **Activity: Is Anchored Putting Better? Part 2.** Describe how to randomly assign treatments in an experiment 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.
    - **Activity: Is Anchored Putting Better? Part 3.** 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 statistically significant.
    - **Activity: Using studies Wisely.** Identify the population to which inferences from a sample can be made. Determine 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.
- Use supplemental resources (i.e. Desmos,stapplet) for hands-on data experience for showing sampling variability and bias in samples.
- Use Rossman/Chance applet as a random number generator to generate simple random samples.

- Use bell ringers outlined in Unit 4 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.
- "Your Turn" lesson examples from textbook on pages 255, 263, 269, 279, 288, 296, 306 and 314
- "Statistics Applied Resolved" activity on page 318 "How can we prevent malaria?"
- **Anchored Putting Finale.** students will get the chance to conduct the anchored putting experiment, to find out if the long putter is actually better than the traditional short putter. Start class by randomly assigning students to the two treatment groups. You can use the "slips of paper" method by simply handing students a slip as they walk into the room. Data collection should start right away (1-2 students at a time) and students should record their distance from the hole on the front whiteboard.

Assessments:

- **Diagnostic:**
  - Teacher observations and questioning techniques
  - Warm up activities

- **Formative:**
  - Teacher observations and questioning techniques
  - Group activities and classwork observations
  - Homework assignments - example problems from textbook or teacher made
  - Teacher prepared quizzes

- **Summative:**
  - Unit 4 Common Assessment

- **Correctives:**
  - Facilitate targeted reteaching sessions on identifying sampling methods, distinguishing between random sampling and random assignment, and recognizing forms of bias in data collection.
  - Use interactive tools (Desmos or stapplet) to explore how different sampling methods produce varying sample distributions and potential biases.
  - Assign error-analysis problems where students diagnose flaws in survey questions, sampling procedures, or study descriptions, then rewrite them correctly.
  - Offer guided step-by-step practice on determining whether a study design allows generalization, causal inference, both, or neither.

- **Extensions:**
  - Extra practice questions and/or activities from Unit 4 in the textbook.
  - Complete past AP Statistics Free Response Questions.

Unit 5: Probability (28 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved.
    - 2.B Construct numerical or graphical representations of distributions
    - 3.A Determine relative frequencies, proportions, or probabilities using simulation or calculations.
    - 3.C Describe probability distributions.
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.

Objectives:

- Define key probability terms (sample space, event, complement, independence, mutually exclusive). *(DOK 1)*
- Identify whether two events are mutually exclusive or independent from descriptions. *(DOK 1)*
- Compute basic probabilities using fractions, decimals, or percentages. *(DOK 1)*
- Use probability rules (addition rule, complement rule, multiplication rule) to calculate event probabilities. *(DOK 2)*
- Interpret Venn diagrams and two-way tables to compute conditional probabilities. *(DOK 2)*
- Distinguish among independence, mutual exclusivity, and conditional probability in a real context. *(DOK 2)*
- Evaluate whether events are independent using contextual information and probability calculations. *(DOK 3)*
- Analyze scenarios to determine and justify appropriate probability rules or methods. *(DOK 3)*
- Critique faulty probability reasoning in real-world examples or student work. *(DOK 3)*
- Construct a multi-step probability model that integrates conditional probability, independence, and event structure. *(DOK 4)*
- Define permutations and combinations and identify the difference between them.*(DOK 1)*
- Recognize when order matters (permutations) versus when order does not matter (combinations). *(DOK 1)*
- Compute permutations and combinations using formulas or technology. *(DOK 2)*
- Select and apply the correct counting method (permutation or combination) for a given real-world scenario. *(DOK 2)*
- Interpret the meaning of the number of possible outcomes in context. *(DOK 2)*
- Analyze multi-step counting scenarios to determine appropriate counting strategies and justify the method used. *(DOK 3)*
- Evaluate student or sample solutions for misapplications of counting rules and correct the reasoning. *(DOK 3)*
- Decompose complex probability problems into counting steps that correctly use combinations, permutations, or the Fundamental Counting Principle. *(DOK 3)*

Core Activities and corresponding instructional methods:

- **Math Medic Activities for Unit 5:**
    - **Activity: Is Mrs. Gallas a Good Free Throw Shooter?** Interpret probability as a long-run relative frequency. Avoid common myths about randomness. Use simulation to model chance behavior.
    - **Activity: Who Will Win the Last Banana?** Give a probability model for a chance process with equally likely outcomes 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.
    - **Activity: Can You Taco Tongue and Evil Eyebrow?** Use a two-way table to find probabilities. Calculate probabilities with the general addition rule. Use a Venn diagram to find probabilities.
    - **Activity: Can You Taco Tongue and Evil Eyebrow? Day 2** Find and interpret conditional probabilities using two-way tables. Use the conditional probability formula to calculate probabilities. Determine whether two events are independent.
    - **Activity: Can You Get a Pair of Aces or Pair of Kings?** 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.
    - **Activity: Can We Predict Snow Days and Traffic Jams?** 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.
    - **Activity: How Do You Like Your Coffee?** Use the multiplication counting principle to 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 r at a time.
    - **Activity: How Many Ways Can You Order a Hamburger?** Compute the number of combinations of n individuals taken r at a time. Use combinations to calculate probabilities. Use the multiplication counting principle and combinations to calculate probabilities.
- Use supplemental resources like Rossman/Chance to determine probability simulations like Monty Hall or Random Babies.
- Coin Flip Simulator - Have students investigate the long term probability of flipping coins
- Use bell ringers outlined in Unit 5 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.

- "Your Turn" lesson examples from textbook on pages 334, 342, 351, 361, 371, 379, 387 and 396
- "Statistics Applied Resolved" activity on page 399 "How many ways can you set up a playlist?"

Assessments:

- **Diagnostic:**
  - Teacher observations and questioning techniques
  - Warm up activities

- **Formative:**
  - Teacher observations and questioning techniques
  - Group activities and classwork observations
  - Homework assignments - example problems from textbook or teacher made
  - Teacher prepared quizzes

- **Summative:**
  - Unit 5 Common Assessment

- **Correctives:**
  - Facilitate targeted reteaching sessions on foundational probability concepts, including distinguishing independent vs. dependent events and identifying mutually exclusive events.
  - Use interactive tools (Desmos, Rossman/Chance, or stapplet) to visually explore sample spaces, event intersections, and the effects of independence or dependence on probability.
  - Assign error-analysis problems where students critique incorrect applications of probability rules (addition rule, complement rule, multiplication rule) and explain the correct reasoning.
    Offer guided step-by-step practice on computing conditional probabilities using Venn diagrams, two-way tables, and tree diagrams.

- **Extensions:**
  - Extra practice questions and/or activities from Unit 5 in the textbook.
  - Complete past AP Statistics Free Response Questions.

Unit 6: Random Variables (14 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved.
    - 2.B Construct numerical or graphical representations of distributions
    - 3.A Determine relative frequencies, proportions, or probabilities using simulation or calculations.
    - 3.B. Determine parameters for probability distributions
    - 3.C Describe probability distributions.
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.

Objectives:

- Distinguish between discrete and continuous random variables. *(DOK 1)*
- Identify the probability distribution of a discrete random variable from a table or description. *(DOK 2)*
- Calculate and interpret probabilities for random variables in context. *(DOK 2)*
- Formulate and analyze random variable models to predict outcomes in applied situations. *(DOK 3)*
- Develop or evaluate a simulation or modeling process involving random variables. (*DOK 4)*
- Compute expected value (mean) and standard deviation of a discrete random variable. *(DOK 1)*
- Interpret expected value and variability in real-world settings. (*DOK 2)*
- Apply rules for combining random variables to calculate means and standard deviations. (*DOK 3)*
- Develop or assess a statistical model involving combined random variables and justify conclusions. *(DOK 4)*
- Identify binomial settings using the BINS criteria. (*DOK 1)*
- Calculate binomial probabilities using formulas or technology. (*DOK 2)*
- Use binomial models to solve multi-step or real-world decision-making problems. (*DOK* 3)
- Evaluate or design experiments or simulations that rely on binomial probability structures. (*DOK 4)*

Core Activities and corresponding instructional methods:

- **<u>Math Medic Activities for Unit 6:</u>**
    - **Activity: How Many Children Are in Your Family?** Calculate probabilities involving a discrete random variable. Classify a random variable as discrete or continuous. Calculate probabilities involving a continuous random variable.
    - **Activity: Who Will Win Skee Ball?** 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.

- **Activity: Is it Smart to Foul at the End of the Game?** Determine whether the conditions for a binomial setting are met. Calculate probabilities involving a single value of a binomial random variable.
- **Activity: How Will You Do on the Pop Quiz?** Determine whether the conditions for a binomial setting are met. Calculate probabilities involving a single value of a binomial random variable. Make a histogram to display a binomial distribution and describe its shape.
- **Activity: Will the Girls' Soccer Team Win?** Use a formula to find probabilities involving several values of a binomial random variable. Use technology to find probabilities involving several values of a binomial random variable.Calculate and interpret the mean and standard deviation of a binomial random variable.
- **Activity: Do You Like Green Skittles?** Determine if it is appropriate to use normal approximation to a binomial distribution. When appropriate, use normal approximation to a binomial distribution to calculate probabilities. Determine if it is appropriate to use normal approximation to a binomial distribution.

- Use supplemental resources like the Binomial Distribution Applet to determine probabilities of Binomial Distributions
- Use the Galton Board Simulator to introduce Binomial Distributions and BINS
- Use bell ringers outlined in Unit 6 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.
- "Your Turn" lesson examples from textbook on pages 414, 425, 436, 445, and 453
- "Statistics Applied Resolved" activity on page 456 "A jury of your peers?
- Jerry and Marge Go Large: 60 Minutes' original story on the Selbees' lottery loophole
- Breaking Vegas Documentary The True Story Of The Mit Blackjack Team.

Assessments:

- **Diagnostic:**
  - Teacher observations and questioning techniques
  - Warm up activities

- **Formative:**
  - Teacher observations and questioning techniques
  - Group activities and classwork observations
  - Homework assignments - example problems from textbook or teacher made
  - Teacher prepared quizzes

- **Summative:**
  - Unit 6 Common Assessment

- **Correctives:**
    - Offer guided practice on constructing probability distributions from verbal descriptions, tables, and experiment data, including step-by-step checks for probabilities summing to 1.
    - Use interactive probability simulators (Desmos, Rossman/Chance, or spreadsheet random draws) to let students build empirical distributions and compare them to the theoretical probability model.
    - Provide short, scaffolded lessons that walk students through computing expected value (mean) and standard deviation of a discrete random variable with annotated worked examples.
    - Create formative tasks where students interpret the meaning of expected value and variability in context and defend their interpretation in writing.

- **Extensions:**
    - Extra practice questions and/or activities from Unit 6 in the textbook.
    - Complete past AP Statistics Free Response Questions.

Unit 7: Sampling Distributions (7 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved.
    - 3.A Determine relative frequencies, proportions, or probabilities using simulation or calculations.
    - 3.B. Determine parameters for probability distributions
    - 3.C Describe probability distributions.
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.

Objectives:

- Define a sampling distribution and identify the statistic being described. **(***DOK 1)*
- Recognize the difference between parameter and statistic. **(***DOK 2)*
- Interpret sampling distributions from graphs, tables, or simulations and explain sample-to-sample variation. (*DOK 2)*
- Use simulations or models to construct sampling distributions and compare the behavior of different statistics. *(DOK 3)*
- Design or evaluate a scenario in which an appropriate sampling distribution is chosen to answer a statistical question. *(DOK 4)*
- Define bias and variability in the context of sampling distributions. **(***DOK 1)*
- Identify whether an estimator is biased or unbiased by examining the center of a sampling distribution. *(DOK 2)*
- Compare variability of different estimators and explain how sample size affects spread. *(DOK 2)*
- Analyze and critique sampling methods or estimators based on bias and variability characteristics. *(DOK 3)*
- Develop or justify a sampling strategy that minimizes bias and variability in a real or simulated setting. *(DOK 4)*
- Calculate the mean and standard deviation of the sampling distribution of a sample proportion. *(DOK 2)*
- Calculate the mean and standard deviation of the sampling distribution of a sample mean. *(DOK 2)*
- State the Central Limit Theorem (CLT) in words. *(DOK 1)*
- Apply the CLT to justify using a normal model for the sample mean in probability or inference problems. *(DOK 3)*

Core Activities and corresponding instructional methods:

- **<u>Math Medic Activities for Unit 7:</u>**
    - **Activity: What is the Average for the Chapter 6 Test?** 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.

- **Activity: How Many Popsicle Sticks are in a Bag?** Determine if a statistic is an unbiased estimator of a population parameter. Describe the relationship between sample size and the variability of a statistic.
- **Activity: Is This a Fair Coin?** Calculate the mean and standard deviation, the sampling distribution of a sample proportion and interpret the standard deviation. Determine if the sampling distribution of p-hat is approximately normal. If appropriate, use a normal distribution to calculate probabilities involving p-hat.
- **Activity: How Tall to be in the NBA? Part 1** Find the mean and standard deviation of the sampling distribution of a sample mean x-bar and interpret the standard deviation. Use a normal distribution to calculate probabilities involving x-bar when sampling from a normal population.
- **Activity: How Tall to be in the NBA? Part 2** Determine if the sampling distribution of x-bar is approximately normal when sampling from a non-normal population.If appropriate, use a normal distribution to calculate probabilities involving x-bar**.**
- **Activity: Reese's Pieces Review.** This review activity will help students to make connections between sampling distributions for sample proportions and sampling distributions for sample means. Use samples of Reese's pieces to collect data. Each student will need at least 30 pieces of candy. Distribute them to students in small disposable cups.

- Use supplemental resources like the Rossman/Chance simulator to determine the proportion of orange candies in a sampling distribution.
- Use the Central Limit Theorem Simulator to show students that if the sample is large enough, the sampling distribution of the sample means will be approximately normal.
- Use bell ringers outlined in Unit 7 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.
- "Your Turn" lesson examples from textbook on pages 469, 480, 489, 497, and 505
- "Statistics Applied Resolved" activity on page 508 "How can we build longer lasting batteries?"

Assessments:

- **Diagnostic:**
  - Teacher observations and questioning techniques
  - Warm up activities

- **Formative:**
  - Teacher observations and questioning techniques
  - Group activities and classwork observations
  - Homework assignments - example problems from textbook or teacher made
  - Teacher prepared quizzes

- **Summative:**
    - Unit 7 Common Assessment (Quiz)

- **Correctives:**
    - Provide a brief reteach lesson using simulations (Desmos, Rossman/Chance, or stapplet) to help students visualize how sampling distributions form from repeated samples.
    - Use side-by-side comparisons of population vs. sample vs. sampling distributions to correct misconceptions about what each represents.
    - Offer guided practice in computing the mean and standard deviation of sampling distributions for both proportions and means, using scaffolds such as labeled formula cards.
    - Provide a brief reteach using CLT demonstrations (physical simulations or applets) to help students see how non-normal populations produce nearly normal distributions of sample means for large sample sizes.

- **Extensions:**
    - Extra practice questions and/or activities from Unit 7 in the textbook.
    - Complete past AP Statistics Free Response Questions.

Unit 8: Estimating a Population Parameter (21 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved (not assessed).
    - 1.D identify an appropriate inference method for confidence intervals
    - 4.A Make an appropriate claim or draw an appropriate conclusion
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.
    - 4.C Verify that inference procedures apply in a given situation
    - 4.D Justify a claim based on a confidence interval

Objectives:

- Identify parameters and statistics related to population proportions. *(DOK 1)*
- Determine the point of estimate and margin of error from a confidence intervals *(DOK 2)*
- Check conditions (randomness, 10% condition, large counts) for constructing a confidence interval for a proportion. *(DOK 2)*
- Construct and interpret a confidence interval for a population proportion using appropriate formulas or technology. (*DOK 2)*
- Explain how confidence level and sample size affect margin of error. *(DOK 2)*
- Compare and critique interpretations of confidence intervals in context. (*DOK 3)*
- Determine the critical value for calculating a C% confidence interval using Table A or technology (*DOK 2)*
- Critique the Four-Step Practice for Confidence Intervals for a proportion. (*DOK 4)*

Core Activities and corresponding instructional methods:

- **<u>Math Medic Activities for Unit 8:</u>**
    - **Activity: Guess the Mystery Mean.** Interpret a confidence interval. Determine the point estimate and margin of error from a confidence interval.Use confidence intervals to make decisions.
    - **Activity: What Does "95% Confident" Mean?** Interpret a confidence level. 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.
    - **Activity: Which Way Will the Hershey Kiss Land?** 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.
    - **Activity: What Proportion of the Earth is Water?** 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.
    - **Activity: How Much YouTube Do You Watch Per Day?** 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.
    - **Activity: How Many States Can You Name?** 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.
- Use supplemental resources like the Confidence Interval Calculator to calculate a 95% confidence interval for a proportion.
- Use bell ringers outlined in Unit 8 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.
- "Your Turn" lesson examples from textbook on pages 520, 529, 537, 543, 555, and 562.
- "Statistics Applied Resolved" activity on page 565 "How long will I stay on Hold?"

Assessments:

- **Diagnostic:**
    - Teacher observations and questioning techniques
    - Warm up activities

- **Formative:**
    - Teacher observations and questioning techniques
    - Group activities and classwork observations
    - Homework assignments - example problems from textbook or teacher made
    - Teacher prepared quizzes

- **Summative:**
    - Unit 8 Common Assessment

- **Correctives:**
    - Provide a brief reteach lesson using a simulation (Desmos or an applet) that repeatedly samples from a population with a known proportion, allowing students to visualize how the sampling distribution of sample proportions centers at the true population proportion and narrows as sample size increases.
    - Use side-by-side comparisons of sample proportion, population proportion, and the sampling distribution of sample proportions to correct misconceptions—especially the idea that a single sample should resemble the entire sampling distribution.
    - Offer guided practice in verifying conditions for inference (randomness, 10% rule, large counts) using color-coded checklists and multiple sample scenarios, helping students recognize when inference for proportions is appropriate.
    - Provide a reteach using an interactive confidence-interval builder (e.g., Rossman/Chance applets) where students adjust sample size and confidence level to observe how the margin of error changes and why.

- **Extensions:**
    - Extra practice questions and/or activities from Unit 8 in the textbook.

- Complete past AP Statistics Free Response Questions.

Unit 9: Testing a Claim About a Population Parameter (19 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved (not assessed).
    - 1.D identify an appropriate inference method for confidence intervals
    - 1.F Identify null and alternative hypothesis
    - 1.E Identify an appropriate inference method for significance tests
    - 3.E Calculate a test statistic and find a p-value, provided conditions for inference are met
    - 4.A Make an appropriate claim or draw an appropriate conclusion
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.
    - 4.C Verify that inference procedures apply in a given situation
    - 4.D Justify a claim based on a confidence interval
    - 4.E Justify a claim using a decision based on significance tests

Objectives:

- Identify the parameters, statistics, and hypotheses used in one-proportion significance tests. *(DOK 1)*
- Recognize and state the null and alternative hypotheses for claims involving population proportions and population means. *(DOK 1)*
- Check required conditions (randomness, 10% condition, large counts) prior to conducting significance tests for proportions. (*DOK 2)*
- Calculate s p-values for one-proportion tests using technology. (*DOK 2)*
- Interpret p-values and draw conclusions in context, relating results back to the original claim. (*DOK 3)*
- Analyze scenarios to determine the risks and consequences of Type I and Type II errors in proportion-based hypothesis tests. (DOK 3)
- Construct and justify a complete significance-testing plan—including hypotheses, conditions, calculations, and conclusions—for real-world proportion data. (DOK 4)
- Design or critique studies that involve hypothesis testing for proportions, ensuring appropriate data collection and inference methods. (DOK 4)

Core Activities and corresponding instructional methods:

- **<u>Math Medic Activities for Unit 9:</u>**
    - **Activity: Is Mrs. Gallas a Good Free Throw Shooter?** 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.
    - **Activity: Should Flint Switch to Bottled Water?** Make an appropriate conclusion in a significance test. 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.
    - **Activity: Is Mrs. Gallas a Good FT Shooter Part 2.** 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.

- **Activity: Can You Taste the Rainbow?** 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.
- **Activity: Should Flint Switch to Bottled Water? Day 2.** 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 or technology.
- **Activity: What is Normal Body Temperature?** Use the four-step process to perform a significance test about a population mean. Use a confidence interval to make a conclusion about a two-sided test for a population mean. Understand how to wisely use and interpret the results of significance tests.

- Use supplemental resources like the Significance Test Calculator (1-proportion Z Test) to calculate p-values for a proportion and the Significance Test Calculator for means (1 sample t-test)
- Use bell ringers outlined in Unit 9 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.
- "Your Turn" lesson examples from textbook on pages 581, 589, 599, 608, 618, and 627.
- "Statistics Applied Resolved" activity on page 631 "What is a normal body temperature?"

Assessments:

- **Diagnostic:**
  - Teacher observations and questioning techniques
  - Warm up activities

- **Formative:**
  - Teacher observations and questioning techniques
  - Group activities and classwork observations
  - Homework assignments - example problems from textbook or teacher made
  - Teacher prepared quizzes

- **Summative:**
  - Unit 9 Common Assessment

- **Correctives:**
  - Provide a brief reteach using real-world examples to help students distinguish between parameters and statistic**s** before writing hypotheses.
  - Provide guided examples from Unit 9 in textbook for extra reinforcement

    - Use a side-by-side organizer comparing the conditions for proportion tests vs. mean tests to reteach when each applies.

- **Extensions:**
    - Extra practice questions and/or activities from Unit 9 in the textbook.
    - Complete past AP Statistics Free Response Questions.

Unit 10: Inference for Distributions and Relationships (16 Days)

Standards:

- College Board Advanced Placement Statistics Skills
    - 1.A Identify the question to be answered or problem to be solved (not assessed).
    - 1.F Identify null and alternative hypothesis
    - 1.E Identify an appropriate inference method for significance tests
    - 3.A Determine relative frequencies, proportions or probabilities using simulation or calculations
    - 3.C Describe probability distributions
    - 3.E Calculate a test statistic and find a p-value, provided conditions for inference are met
    - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim.
    - 4.D Justify a claim based on a confidence interval

Objectives:

- Identify categorical variables, counts, and conditions appropriate for chi-square procedures. *(DOK 1)*
- Compute expected counts for a contingency table or distribution table. (*DOK 2)*
- Explain why chi-square procedures use counts rather than proportions. *(DOK 2)* Evaluate whether conditions for chi-square inference (randomness, large sample size, expected counts) are satisfied. (*DOK 3)*
- Justify the use of chi-square methods in a given scenario compared to alternative inference methods. (*DOK 4)*
- State hypotheses for a chi-square goodness-of-fit test. (*DOK 1)*
- Calculate chi-square test statistics and degrees of freedom for a given distribution. *(DOK 2)*
- Use technology or formulas to compute p-values for chi-square tests. *(DOK 2)*
- Interpret results of a goodness-of-fit test in context. *(DOK 3)*
- Distinguish between situations requiring a test for an association. (*DOK 1)*
- Set up and calculate a chi-square test for an association using a two-way table. (*DOK 2)* Verify conditions for conducting a chi-square test for an association. (*DOK 2)*

Core Activities and corresponding instructional methods:

- **<u>Math Medic Activities for Unit 11:</u>**
    - **Activity: Which Color M&M is the Most Common?** 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.
    - **Activity: Which Color M&M is the Most Common? Part 2.** 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.

- **Activity: Are Taco Tongue and Evil Eyebrow Associated?** 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.
- **Activity: Are Taco Tongue and Evil Eyebrow Associated? Part 2.** 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.

- Use bell ringers outlined in Unit 11 of "Statistics and Probability with Applications" textbook as warm ups to increase student engagement.
- "Your Turn" lesson examples from textbook on pages 728, 740, 750, 761, 776, and 790.
- "Statistics Applied Resolved" activity on page 794 "Does background music influence what customers buy?"
- Students will research a career that interests them after high school. They will look up the "average salary" for that career in the area where they will "live". Have them notice that where they live affects their standard of living. Have students look up various statistics on costs of living (rent, utilities, car insurance, car payments, etc.). Students build their own income/debt chart to see how they will balance the cost of living after they graduate college/trade school or start working immediately after high school. Students will then analyze where their income is going into "savings", "needs" and "wants"categories. They will make a pie chart and compare their earnings to the "50-20-30" budget rule. Students will write up summaries to discuss how ready they are to enter the real world and if their budget will work with their given career/salary.
- Watch enrichment movies to connect content to real-world situations/implications. Examples:
    - **Moneyball:** A movie based off the 2002 Oakland Athletics, who, led by GM Billy Beane, used sabermetrics (advanced statistical analysis) to find undervalued players, focusing on On-Base Percentage (OBP) and Slugging Percentage (SLG), not traditional stats like batting average, to build a winning team despite a tiny budget, famously achieving a 20-game winning streak and proving data-driven methods could compete with rich teams. They bought "wins" by finding players who got on base and hit for power cheaply, outperforming teams with much higher payrolls, like the Yankees, and revolutionizing baseball's talent evaluation.
    - **21:** The plot of the movie follows Ben Campbell, a brilliant but poor MIT student who joins a secret team led by Professor Micky Rosa to count cards in blackjack and win millions from Las Vegas casinos to pay for Harvard Medical School. The team uses complex math and hand signals to exploit the odds, but Ben gets drawn into a high-stakes world of greed and danger.

Assessments:

- **Diagnostic:**
    - Teacher observations and questioning techniques
    - Warm up activities

- **Formative:**
    - Teacher observations and questioning techniques
    - Group activities and classwork observations
    - Homework assignments - example problems from textbook or teacher made
    - Teacher prepared quizzes

- **Summative:**
    - Unit 11 Common Assessment (Quiz)
    - Final Project (Cumulative)

- **Correctives:**
    - Provide a brief reteach using real-world contingency tables (e.g., survey data by gender, grade level, or preference) to help students distinguish between observed counts and expected counts before calculating the chi-square statistic.
    - Use guided examples from the textbook's Chi-Square chapter to reinforce identifying when to use Goodness-of-Fit.
      Provide a short mini-lesson using real categorical data (such as color distributions in candy bags or school club participation) to reteach how to check expected count conditions and explain why they matter.

- **Extensions:**
    - Extra practice questions and/or activities from Unit 11 in the textbook.
    - Past AP Statistics Free Response Questions