

PROBABILITY AND STATISTICS, SEMESTER A

COURSE OVERVIEW AND GOALS

Probability and Statistics provides a curriculum focused on understanding key data analysis and probabilistic concepts, calculations, and relevance to real-world applications. Students are challenged to work toward mastery of computational skills, apply calculators and other technology in data analysis, deepen their understanding of key ideas and solution strategies, and extend their knowledge through a variety of problem-solving applications.

Course topics include types of data, common methods used to collect data, and representations of data, including histograms, bar graphs, box plots, and scatterplots. Students learn to work with data by analyzing and employing methods of extending results, involving samples and populations, distributions, summary statistics, experimental design, regression analysis, simulations, and confidence intervals.

Ideas involving probability — including sample space, empirical and theoretical probability, expected value, and independent and compound events — are covered as students explore the relationship between probability and data analysis.

Projects allow for more open-ended, extended applications of concepts and skills. Students collect and analyze statistical data about a topic that interests them, and they apply probability concepts in a real-world context.

The content is based on the Common Core standards and is aligned with state standards.

By the end of this course, you will be able to do the following:

- ❖ Examine the methods of data collection and factors of experiment design.
- ❖ Differentiate between categorical and numerical data.
- ❖ Create and analyze two-way frequency tables.
- ❖ Represent univariate data with dot plots, box plots, and histograms.
- ❖ Compare distributions and data sets.
- ❖ Transform univariate and bivariate data.
- ❖ Represent data with scatterplots and apply mathematical models to solve problems with linear and nonlinear models.

COURSE COMPONENTS AND GRADING RUBRIC

The table gives a breakdown of the weight for each component in the course. Weight represents the percentage of the total score coming from each activity.

Course Components	Count	Weight
Pretest. <i>A pretest is an optional assessment, typically designed for credit recovery. If a student shows mastery of a lesson objective, the student may be automatically exempted from the upcoming activities associated with the mastered objective. Each passing pretest grade is entered into the gradebook.</i>	5	0%
Practice. <i>A practice activity provides instruction similar to that found in a study so that students can practice or review skills necessary to complete their assignment with mastery.</i>	5	5%
Discussion. <i>A discussion activity is an opportunity for students to collaborate with their peers. This activity gives students the opportunity to practice speaking and listening in a clear and logical manner and to receive feedback from peers.</i>	4	10%
Project. <i>A project is a hands-on investigation that extends over several weeks.</i>	1	5%
Mastery Test. <i>A mastery test is a computer-scored lesson-level summative assessment.</i>	19	25%
Posttest. <i>A posttest appears at the end of each unit.</i>	5	20%
End-Of-Semester Test. <i>An end-of-semester test (EOS) appears at the end of each course.</i>	1	15%
Teacher-Graded Posttest. <i>A posttest that prompts students for written responses appears at the end of each unit.</i>	5	20%
Total	45	100%

**Teachers may manually adjust these weights if desired, per district grading requirements.*

UNIT 1: INTRODUCTION TO STATISTICS

In this unit, you will identify a variety of techniques used to collect and accurately analyze data in the field of statistics.

Lesson and Duration	Activities	Objectives
What Is Statistics? 1 hour, 55 minutes	<i>Overview: What Is Statistics?</i> <i>Study: What Is Statistics?</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: What Is Statistics?</i>	- Identify the three steps in the data analysis process. - Recognize different types of data that can be collected and how to display them together. - Apply data to make a decision. - Differentiate between a population and a sample of the population. - Apply data and sampling variability in context to decide whether a sample is representative of a population.
Collecting Data 1 hour, 55 minutes	<i>Overview: Collecting Data</i> <i>Study: Collecting Data</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Collecting Data</i>	- Recognize the three primary ways to collect data: sample surveys, observational studies, and experiments. - Recognize the purposes of sample surveys, observational studies, and experiments. - Recognize the differences among sample surveys, observational studies, and experiments. - Recognize the importance of randomization in avoiding bias in the design of sample surveys, observational studies, and experiments. - Identify censuses, convenience samples, and simple random samples.

Lesson and Duration	Activities	Objectives
Random Sampling 1 hour, 55 minutes	<i>Overview: Random Sampling</i> <i>Study: Random Sampling</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Random Sampling</i>	- Identify and use different sampling methods — including simple random, stratified random, cluster, and systematic — and compare and contrast their benefits. - Identify types of biases that can be present in the data collection process, including response bias, nonresponse bias, and selection bias. - Determine why variability will decrease as sample size increases. - Determine why the sample estimate will better approximate the population parameter as random sample sizes increase.
Experimental Design 2 hours, 20 minutes	<i>Overview: Experimental Design</i> <i>Study: Experimental Design</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Experimental Design</i> <i>Discussion: Applying Experimental Design Concepts to Real-World Studies</i>	- Identify response variables, control variables, and treatments within an experiment. - Identify extraneous factors within an experiment. Then choose one of four methods (blocking, direct control, randomization, or replication) to address the identified extraneous factors. - Recognize the role of randomization in experiments and techniques that are used to assign treatments. - Determine why replication is necessary to validate results in experimental studies.
Wrap-Up: Introduction to Statistics	<i>Practice: Introduction to Statistics</i> <i>Review: Introduction to Statistics</i> <i>Posttest: Introduction to Statistics</i>	- Apply concepts and skills from the unit by completing a teacher-scored assignment. - Review key ideas presented in the unit.

Lesson and Duration	Activities	Objectives
2 hours, 40 minutes	Teacher-Graded Posttest: Introduction to Statistics	- Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 2: DESCRIBING DATA GRAPHICALLY

In this unit, you will differentiate between categorical and numerical data and analyze two-way frequency tables.

Lesson and Duration	Activities	Objectives
Categorical Data 1 hour, 55 minutes	Overview: Categorical Data Study: Categorical Data Checkup: Practice Problems Mastery Test: Categorical Data	- Distinguish between categorical and numerical data. - Represent and summarize data using frequency and relative frequency distributions. - Represent and summarize data using bar graphs and comparative bar graphs. - Represent and summarize data using pie charts. - Compare and contrast visual and graphical representations of data.
Numerical Data 1 hour, 55 minutes	Overview: Numerical Data Study: Numerical Data Checkup: Practice Problems Mastery Test: Numerical Data	- Identify numerical data and distinguish between discrete and continuous data. - Display univariate numerical data sets using dot plots. - Create frequency tables from univariate data in a list.

Lesson and Duration	Activities	Objectives
		- Group frequency data into classes and display the data set as a histogram. - Display univariate numerical data using stem-and-leaf plots. - Display numerical data collected from two different populations using comparative dot plots and stem-and-leaf plots.
Two-Way Frequency Tables 1 hour, 55 minutes	<i>Overview: Two-Way Frequency Tables</i> <i>Study: Two-Way Frequency Tables</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Two-Way Frequency Tables</i>	- Summarize categorical data in two-way frequency tables. - Interpret relative frequencies in the context of the data. - Interpret marginal relative and conditional relative frequencies in the context of the data. - Recognize possible trends and associations in the data.
Wrap-Up: Describing Data Graphically 2 hours, 40 minutes	<i>Practice: Describing Data Graphically</i> <i>Review: Describing Data Graphically</i> <i>Posttest: Describing Data Graphically</i> <i>Teacher-Graded Posttest: Describing Data Graphically</i>	- Apply concepts and skills from the unit by completing a teacher-scored assignment. - Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 3: MEASURES OF CENTER AND SPREAD

In this unit, you will determine how to measure the centers and spreads of given data sets, as well as create and analyze box plots.

Lesson and Duration	Activities	Objectives
Measures of Center 1 hour, 55 minutes	<i>Overview: Measures of Center</i> <i>Study: Measures of Center</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Measures of Center</i>	- Calculate the mean, median, and mode of sample data. - Apply the appropriate notation for population means and sample means. - Apply the sigma notation formula for mean. - Recognize how unusual and extreme data points can influence measures of center.
Measures of Spread 1 hour, 55 minutes	<i>Overview: Measures of Spread</i> <i>Study: Measures of Spread</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Measures of Spread</i>	- Calculate the range, variance, and standard deviation of population data. - Calculate the range, variance, and standard deviation of sample data. - Apply the appropriate notation for population mean, variance, and standard deviation. - Apply the appropriate notation for sample mean, variance, and standard deviation. - Determine how unusual and extreme data points can influence measures of spread.
Box Plots 1 hour, 55 minutes	<i>Overview: Box Plots</i> <i>Study: Box Plots</i> <i>Checkup: Practice Problems</i>	- Find the first quartile, median, and third quartile for given data sets. - Find the interquartile range (IQR) for given data sets.

Lesson and Duration	Activities	Objectives
	<i>Mastery Test: Box Plots</i>	- Find the five-number summary (minimum, maximum, first quartile, median, and third quartile) for given data sets. - Construct or label a box plot or a modified box plot. - Apply the definition of an outlier to determine whether a data set has outliers.
Project 2 hours, 5 minutes	<i>Overview: Project</i> <i>Project: Designing and Completing a Survey</i>	- Determine a statistical question that you want to explore and answer. - Apply your understanding of statistics in order to design and conduct a survey or observational study to collect data and answer your question. - Apply graphical, numerical, and analytical techniques to interpret and communicate the results of your study.
Wrap-Up: Measures of Center and Spread 2 hours, 40 minutes	<i>Practice: Measures of Center and Spread</i> <i>Review: Measures of Center and Spread</i> <i>Posttest: Measures of Center and Spread</i> <i>Teacher-Graded Posttest: Measures of Center and Spread</i>	- Apply concepts and skills from the unit by completing a teacher-scored assignment. - Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 4: DESCRIBING DATA SETS

In this unit, you will compare and contrast different types of distributions and transform univariate data.

Lesson and Duration	Activities	Objectives
Describing Distributions 2 hours, 20 minutes	<i>Overview: Describing Distributions</i> <i>Study: Describing Distributions</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Describing Distributions</i> <i>Discussion: Displaying and Describing Real-World Data</i>	- Identify distribution shapes, including data that have skewed or symmetric distributions. - Write descriptions of data distributions using measures and definitions of center, shape, and spread. - Determine how outliers affect the shape of a distribution. - Determine how the shape of a distribution is related to its mean and median.
Comparing Distributions 1 hour, 55 minutes	<i>Overview: Comparing Distributions</i> <i>Study: Comparing Distributions</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Comparing Distributions</i>	- Compare the centers, shapes, and spreads of two distributions using histograms, dot plots, and box plots. - Identify the appropriate statistics for comparing distributions, given a data display. - Interpret the differences between distributions in the context of the data.
Transforming Univariate Data 1 hour, 55 minutes	<i>Overview: Transforming Univariate Data</i> <i>Study: Transforming Univariate Data</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Transforming Univariate Data</i>	- Transform univariate data using multiplication, division, addition, and subtraction. - Calculate descriptive statistics (mean, median, and standard deviation) on transformed data.

Lesson and Duration	Activities	Objectives
		Determine how transforming data affects the mean, median, and standard deviation without having to calculate the exact values.
Wrap-Up: Describing Data Sets 2 hours, 40 minutes	<i>Practice: Describing Data Sets</i> <i>Review: Describing Data Sets</i> <i>Posttest: Describing Data Sets</i> <i>Teacher-Graded Posttest: Describing Data Sets</i>	- Apply concepts and skills from the unit by completing a teacher-scored assignment. - Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 5: MODELING DATA

In this unit, you will identify patterns in data and model those patterns with linear and nonlinear functions.

Lesson and Duration	Activities	Objectives
Linear Models in Data 1 hour, 55 minutes	<i>Overview: Linear Models in Data</i> <i>Study: Linear Models in Data</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Linear Models in Data</i>	- Identify patterns and explanatory variables in scatterplots. - Create a line of best fit through a scatterplot that suggests a linear relationship, and informally determine how well it fits the data. - Find the equation for the line of best fit using two points on the line.

Lesson and Duration	Activities	Objectives
		- Apply the line of best fit to make predictions and solve problems. - Interpret the slope and y-intercept of a linear model in context.
Correlation 1 hour, 55 minutes	<i>Overview: Correlation</i> <i>Study: Correlation</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Correlation</i>	- Distinguish between positive, negative, and no correlation. - Distinguish between correlation and causation. - Determine how the strength of a correlation relates to the correlation coefficient. - Estimate the correlation coefficient from a scatterplot. - Calculate the correlation coefficient using appropriate technology.
Regression Methods 1 hour, 55 minutes	<i>Overview: Regression Methods</i> <i>Study: Regression Methods</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Regression Methods</i>	- Identify the least squares regression method. - Calculate a regression equation using appropriate technology. - Solve problems and interpret the slope and y-intercept of a linear model in the context of the data.
Assessing Data Models 1 hour, 55 minutes	<i>Overview: Assessing Data Models</i> <i>Study: Assessing Data Models</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Assessing Data Models</i>	- Calculate the residual when given the equation for a line of best fit and a point on the line. - Informally assess the fit of a function by plotting and analyzing residuals. - Identify the meaning of the coefficient of determination (r^2). - Calculate the coefficient of determination using appropriate technology.

Lesson and Duration	Activities	Objectives
Nonlinear Models 2 hours, 20 minutes	<i>Overview: Nonlinear Models</i> <i>Study: Nonlinear Models</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Nonlinear Models</i> <i>Discussion: Nonlinear Models</i>	- Identify the regression model that best represents given data from a real-world application. - Model a function, and make predictions using exponential and quadratic regression techniques. - Determine an appropriate regression model based on a scatterplot or residual plot.
Transforming Bivariate Data 2 hours, 20 minutes	<i>Overview: Transforming Bivariate Data</i> <i>Study: Transforming Bivariate Data</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Transforming Bivariate Data</i> <i>Discussion: Transforming Real-World Bivariate Data</i>	- Apply logarithms to linearize exponential data. - Find linear regression equations of transformed data. - Apply regression equations of transformed data to make predictions.
Wrap-Up: Modeling Data 2 hours, 40 minutes	<i>Practice: Modeling Data</i> <i>Review: Modeling Data</i> <i>Posttest: Modeling Data</i> <i>Teacher-Graded Posttest: Modeling Data</i>	- Apply concepts and skills from the unit by completing a teacher-scored assignment. - Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

SEMESTER WRAP-UP

In this unit, you will review the concepts and skills presented in the course and take a semester exam.

Lesson and Duration	Activities	Objectives
Semester Wrap-Up <i>1 hour, 50 minutes</i>	<i>Review: Semester Review</i> <i>End-of-Semester Test: Semester Exam</i>	- Review key ideas presented in the semester. - Demonstrate mastery of concepts and skills from the semester by completing a computer-scored assessment.