

PROBABILITY AND STATISTICS, SEMESTER B

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:

- ❖ Calculate probabilities and apply probability concepts to establish independence and make decisions.
- ❖ Construct and analyze fair decisions and strategies based on probability concepts and methods.
- ❖ Identify and compare discrete and continuous random variables.
- ❖ Analyze cumulative binomial probability distributions.
- ❖ Calculate normal distributions and z-scores.
- ❖ Evaluate confidence intervals to determine the margin of error in sample means and proportions.

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	10%
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>	3	5%
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>	18	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	43	100%

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

UNIT 1: INTRODUCTION TO PROBABILITY

In this unit, you will calculate probabilities and determine how the result of a calculation can affect the probability of another result.

Lesson and Duration	Activities	Objectives
Random Outcomes, Sample Spaces, and Events 1 hour, 55 minutes	<i>Overview: Random Outcomes, Sample Spaces, and Events</i> <i>Study: Random Outcomes, Sample Spaces, and Events</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Random Outcomes, Sample Spaces, and Events</i>	- List the outcomes in a sample space and in an event. - List the outcomes of complements, unions, and intersections of events. - Calculate the probability of an event using the sample space. - Find the probabilities of complements, unions, and intersections of events. - Find geometric probabilities using area.
Permutations and Combinations 1 hour, 55 minutes	<i>Overview: Permutations and Combinations</i> <i>Study: Permutations and Combinations</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Permutations and Combinations</i>	- Simplify a factorial expression. - Recognize the multiplication rule for probability. - Find the number of permutations in a given situation. - Find the number of combinations in a given situation. - Identify a situation as involving a combination or a permutation. - Find probabilities to solve problems involving permutations or combinations.
Independent and Dependent Events 1 hour, 55 minutes	<i>Overview: Independent and Dependent Events</i> <i>Study: Independent and Dependent Events</i> <i>Checkup: Practice Problems</i>	- Find the probability of the union of two events. - Define <i>mutually exclusive events</i>. - Interpret the probabilities of the union and intersection of two events.

Lesson and Duration	Activities	Objectives
	<i>Mastery Test: Independent and Dependent Events</i>	- Recognize independent and dependent events in everyday language. - Determine whether two events are independent using probabilities. - Identify $P(A \text{ and } B)$, given that the two events are independent.
Conditional Probability 1 hour, 55 minutes	<i>Overview: Conditional Probability</i> <i>Study: Conditional Probability</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Conditional Probability</i>	- Identify a conditional probability stated in everyday language. - Define <i>conditional probability</i>. - Solve $P(A B)$, given a Venn diagram. - Interpret a conditional probability using a Venn diagram. - Apply the formula $P(A B) = P(A \text{ and } B) / P(B)$ to find a conditional probability. - Find $P(A B)$, given that A and B are independent events and given $P(A)$ and $P(B)$. - Apply conditional probability to decide whether two events are independent. - Apply conditional probability to find the probability of the intersection of two events.
Wrap-Up: Introduction to Probability 2 hours, 40 minutes	<i>Practice: Introduction to Probability</i> <i>Review: Introduction to Probability</i> <i>Posttest: Introduction to Probability</i> <i>Teacher-Graded Posttest: Introduction to Probability</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.

Lesson and Duration	Activities	Objectives
		Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 2: APPLICATIONS OF PROBABILITY

In this unit, you will apply probability to make decisions and design simulations.

Lesson and Duration	Activities	Objectives
Using Two-Way Frequency Tables <i>1 hour, 55 minutes</i>	<i>Overview: Using Two-Way Frequency Tables</i> <i>Study: Using Two-Way Frequency Tables</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Using Two-Way Frequency Tables</i>	- Find probabilities using a two-way frequency table. - Find conditional probabilities using a two-way frequency table. - Determine whether events are independent using a two-way frequency table. - Create associations and draw conclusions using a two-way frequency table.
Using Probability to Make Decisions <i>1 hour, 55 minutes</i>	<i>Overview: Using Probability to Make Decisions</i> <i>Study: Using Probability to Make Decisions</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Using Probability to Make Decisions</i>	- Analyze decisions and strategies using probability concepts. - Apply probability to evaluate outcomes of decisions. - Apply probability to make fair decisions.
Simulations <i>2 hours, 20 minutes</i>	<i>Overview: Simulations</i> <i>Study: Simulations</i> <i>Checkup: Practice Problems</i>	Identify a model that simulates an event, using tools such as random numbers and coin tosses.

Lesson and Duration	Activities	Objectives
	<i>Mastery Test: Simulations</i> <i>Discussion: Using Simulations to Explore Real-World Concerns</i>	- Assign model outcomes to represent real-world outcomes and probabilities. - Calculate estimated probabilities using simulation results. - Recognize how the number of trials affects the confidence in simulation results.
Project 2 hours, 5 minutes	<i>Overview: Project</i> <i>Project: Designing a Board Game</i>	- Design a board game using probabilities, and model the game with a simulation. - Apply your knowledge, skills, and resources to make sense of problems. - Solve problems using perseverance. - Apply precise mathematical vocabulary to communicate your thinking and solutions.
Wrap-Up: Applications of Probability 2 hours, 40 minutes	<i>Practice: Applications of Probability</i> <i>Review: Applications of Probability</i> <i>Posttest: Applications of Probability</i> <i>Teacher-Graded Posttest: Applications of Probability</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: DISCRETE PROBABILITY DISTRIBUTIONS

In this unit, you will analyze probability distributions presented in multiple forms and apply probability to the real world.

Lesson and Duration	Activities	Objectives
Discrete Random Variables 1 hour, 55 minutes	<i>Overview: Discrete Random Variables</i> <i>Study: Discrete Random Variables</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Discrete Random Variables</i>	- Identify discrete random variables. - Develop sample spaces and probability distributions for discrete random variables. - Calculate the expected value of a random variable and interpret it as the mean of the probability distribution.
Binomial Probability 1 hour, 55 minutes	<i>Overview: Binomial Probability</i> <i>Study: Binomial Probability</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Binomial Probability</i>	- Identify binomial trials and binomial experiments. - Solve $P(x)$ for specific x-values using the binomial probability formula. - Apply appropriate technologies to assist in calculating binomial probabilities.
Cumulative Binomial Probability Distributions 1 hour, 55 minutes	<i>Overview: Cumulative Binomial Probability Distributions</i> <i>Study: Cumulative Binomial Probability Distributions</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Cumulative Binomial Probability Distributions</i>	- Calculate the mean (expected value) and standard deviation of a binomial probability distribution. - Identify various cumulative binomial probability contexts (<i>at most, at least, between</i>). - Apply knowledge of complements of events and cumulative binomial probabilities to find $P(x)$ for cumulative x-values. - Apply appropriate technologies to assist in calculating cumulative binomial probabilities.

Lesson and Duration	Activities	Objectives
Wrap-Up: Discrete Probability Distributions 2 hours, 40 minutes	<i>Practice: Discrete Probability Distributions</i> <i>Review: Discrete Probability Distributions</i> <i>Posttest: Discrete Probability Distributions</i> <i>Teacher-Graded Posttest: Discrete Probability Distributions</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: CONTINUOUS PROBABILITY DISTRIBUTIONS

In this unit, you will analyze continuous random variables as well as normal distributions and z-scores.

Lesson and Duration	Activities	Objectives
Continuous Random Variables 1 hour, 55 minutes	<i>Overview: Continuous Random Variables</i> <i>Study: Continuous Random Variables</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Continuous Random Variables</i>	• Identify continuous random variables. • Display the sample space of a continuous random variable using a density graph. • Calculate probabilities using density graphs.
Normal Distributions 2 hours, 20 minutes	<i>Overview: Normal Distributions</i> <i>Study: Normal Distributions</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Normal Distributions</i> <i>Discussion: Checking for Normal Probability Distributions</i>	• Identify a normal probability distribution and recognize its characteristics. • Analyze a normal distribution using the empirical rule.

Lesson and Duration	Activities	Objectives
		Apply the empirical rule to determine the probability of a random value of x being within a given interval, given the mean and standard deviation for a normal distribution.
z-Scores 1 hour, 55 minutes	<i>Overview: z-Scores</i> <i>Study: z-Scores</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: z-Scores</i>	- Calculate the z-score for any x-value in a normal distribution for which the mean and standard deviation are known. - Convert any normal distribution to a standard normal distribution using z-scores. - Determine the percentage of data in a normal distribution that is less than or greater than a particular value, or between two particular values, using z scores as needed. - Apply appropriate technologies to assist in calculating normal probability percentages.
Wrap-Up: Continuous Probability Distributions 2 hours, 40 minutes	<i>Practice: Continuous Probability Distributions</i> <i>Review: Continuous Probability Distributions</i> <i>Posttest: Continuous Probability Distributions</i> <i>Teacher-Graded Posttest: Continuous Probability Distributions</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: SAMPLING AND CONFIDENCE INTERVALS

In this unit, you will calculate sample means and sample proportions to determine intervals and evaluate statistical studies.

Lesson and Duration	Activities	Objectives
Sample Means 1 hour, 55 minutes	<i>Overview: Sample Means</i> <i>Study: Sample Means</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Sample Means</i>	- Determine the difference between a population parameter and a point estimate. - Calculate a sample mean and understand the effect of sample size on it. - Recognize how the central limit theorem relates to the relationship between a population distribution and a sampling distribution. - Calculate the standard error of a sampling distribution.
Sample Proportions 1 hour, 55 minutes	<i>Overview: Sample Proportions</i> <i>Study: Sample Proportions</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Sample Proportions</i>	- Calculate a sample proportion, and understand the effect of sample size on how closely it approximates the population proportion. - Determine how the central limit theorem relates to the sampling distribution for a sample proportion. - Apply rules of thumb to confirm that a sample size is large enough to use a normal curve approximation. - Calculate the standard error of a sampling distribution for a proportion.
Confidence Intervals: Sample Means	<i>Overview: Confidence Intervals: Sample Means</i> <i>Study: Confidence Intervals: Sample Means</i>	Define confidence levels, confidence intervals, and margins of error.

Lesson and Duration	Activities	Objectives
1 hour, 55 minutes	<i>Checkpoint: Practice Problems</i> <i>Mastery Test: Confidence Intervals: Sample Means</i>	- Find a confidence interval for a given sample and confidence level. - Determine how changes in the sample size and confidence level affect the margin of error.
Confidence Intervals: Sample Proportions 1 hour, 55 minutes	<i>Overview: Confidence Intervals: Sample Proportions</i> <i>Study: Confidence Intervals: Sample Proportions</i> <i>Checkpoint: Practice Problems</i> <i>Mastery Test: Confidence Intervals: Sample Proportions</i>	- Define confidence levels, confidence intervals, and margins of error. - Find a confidence interval for a given sample proportion and confidence level. - Determine how changes in the sample size and confidence level affect the margin of error.
Evaluating Statistical Studies 2 hours, 20 minutes	<i>Overview: Evaluating Statistical Studies</i> <i>Study: Evaluating Statistical Studies</i> <i>Checkpoint: Practice Problems</i> <i>Mastery Test: Evaluating Statistical Studies</i> <i>Discussion: Analyzing Real-World Reports</i>	- Analyze study design and sampling methods. - Evaluate claims and conclusions based on data. - Interpret confidence intervals for a population parameter from a statistical report.
Wrap-Up: Sampling and Confidence Intervals 2 hours, 40 minutes	<i>Practice: Sampling and Confidence Intervals</i> <i>Review: Sampling and Confidence Intervals</i> <i>Posttest: Sampling and Confidence Intervals</i> <i>Teacher-Graded Posttest: Sampling and Confidence Intervals</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.