

Syllabus

Probability and Statistics

Course Overview

Probability and Statistics is a mathematics course that teaches two related, but distinguishable disciplines. Probability is the study of the likelihood that an event will occur. For example, what is the likelihood that you will win a writing contest if there are 3,000 entries? What are the chances that you will land that lead role in the school play if 30 students audition? In statistics, you will practice the science of collecting and analyzing numerical data in order to make decisions. The study of statistics upholds that of probability. You've likely worked with both disciplines to varying degrees during your math education.

In this course, you will represent and interpret data using dot plots, histograms, box plots, two-way frequency tables, and scatter plots. You will study normal distributions and distinguish between correlation and causation. You will also determine the conditional probability of two events or whether the events are independent. Using counting techniques and the rules of probability, you will calculate probabilities and use the results to make educated and fair decisions. You will evaluate several data collection techniques and statistical models, including simulations. The course closes with information on how you can use probability models to represent situations arising in everyday life that involve both payoff and risk.

Course Goals

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

- Summarize, represent, and interpret data on a single count or measurement variable.
- Summarize, represent, and interpret data on two categorical and quantitative variables.
- Interpret linear models.
- Understand independence and conditional probability and use them to interpret data.
- Use the rules of probability to compute probabilities of compound events in a uniform probability model.
- Use probability to evaluate outcomes of decisions.
- Understand and evaluate random processes underlying statistical experiments.
- Make inferences and justify conclusions from sample surveys, experiments, and observational studies.
- Calculate expected values and use them to solve problems.

Math Skills

Two semesters of Algebra 1 is a prerequisite for Probability and Statistics. Before beginning this course, you should be able to do the following:

- Represent linear relationships graphically and with equations.
- Graph functions using basic calculator skills.
- Understand that the probability of a chance event is a number between 0 and 1.

General Skills

To participate in this course, you should be able to do the following:

- Complete basic operations with word processing software, such as Microsoft Word or Google Docs.
- Understand the basics of spreadsheet software, such as Microsoft Excel or Google Spreadsheets, but having prior computing experience is not necessary.
- Perform online research using various search engines and library databases.
- Communicate through email and participate in discussion boards.

For a complete list of general skills that are required for participation in online courses, refer to the Prerequisites section of the Plato Student Orientation document, found at the beginning of this course.

Credit Value

Probability and Statistics is a 0.5-credit course.

Course Materials

- Notebook
- Computer with Internet connection and speakers or headphones
- Microsoft Word or equivalent
- Microsoft Excel or equivalent

Course Pacing Guide

This course description and pacing guide is intended to help you keep on schedule with your work. Note that your course instructor may modify the schedule to meet the specific needs of your class.

Unit 1: Representing and Interpreting Data

Summary

In this unit, you will learn how to represent data using dot plots, histograms, and box plots. You will also understand the importance of showing and interpreting the center and spread of data as you compare two or more data sets. Finally, you'll use the

concepts of center and spread to fit a data set to a normal distribution, also known as a bell curve.

Day	Activity/Objective	Type
1 day: 1	Syllabus and Plato Student Orientation <i>Review the Plato Student Orientation and Course Syllabus at the beginning of this course.</i>	Course Orientation
2 days: 2–3	Data Plots <i>Represent data with plots on the real number line using dot plots, histograms, and box plots.</i>	Lesson
2 days: 4–5	Showing Data Center and Spread <i>Use statistics appropriate to the shape of the data distribution to compare center and spread of two or more different data sets.</i>	Lesson
2 days: 6–7	Interpreting the Shape of Data Distributions <i>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</i>	Lesson
2 days: 8–9	Normal Distributions <i>Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages.</i>	Lesson
2 days: 10–11	Unit Activity and Discussion—Unit 1	Unit Activity Discussion
1 day: 12	Posttest—Unit 1	Assessment

Unit 2: Relating Data Sets

Summary

In this unit, you will investigate the relationships between sets of data using graphing techniques. For example, you will interpret the slope and intercept of a linear model and fit an algebraic function to data in a scatter plot. You will also compute the dependence or correlation of two variables in a linear plot and distinguish between correlation and causation.

Day	Activity / Objective	Type
2 days: 13–14	Relating Categorical Data <i>Summarize data for two categories in two-way frequency tables and interpret their relative frequencies in the context of the data.</i>	Lesson
2 days: 15–16	Interpreting Data as a Line <i>Interpret the slope and the intercept of a linear model in the context of the data.</i>	Lesson
2 days: 17–18	Relating Quantitative Data <i>Represent data of two quantitative variables using a scatter plot, describe and fit a function to the data, and solve problems in the context of the data.</i>	Lesson
2 days: 19–20	Making and Interpreting Correlations <i>Use technology to compute and interpret the correlation coefficient of a linear fit.</i>	Lesson
2 days: 21–22	Correlation Versus Causation <i>Distinguish between correlation and causation.</i>	Lesson
2 days: 23–24	Unit Activity and Discussion—Unit 2	Unit Activity Discussion
1 day: 25	Posttest—Unit 2	Assessment

Unit 3: Independent and Conditional Probability

Summary

In this unit, you will apply the addition and multiplication rules of probability to calculate probabilities using a uniform model. You will understand that an event is a set of outcomes that can be related to other events or can be independent of them. You will also use permutations and combinations to find the probabilities of compound events.

Day	Activity / Objective	Type
2 days: 26–27	Sample Space <i>Describe events as subsets of a sample space (the set of</i>	Lesson

	<i>outcomes).</i>	
2 days: 28–29	Applying the Addition Rule for Probability <i>Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.</i>	Lesson
2 days: 30–31	Applying the Multiplication Rule for Probability <i>Apply the general Multiplication Rule in a uniform probability model and interpret the answer in terms of the model.</i>	Lesson
2 days: 32–33	Independent Events <i>Understand how to determine whether two events are independent of each other.</i>	Lesson
2 days: 34–35	Using Counting Techniques to Determine Probabilities <i>Use permutations and combinations to compute probabilities of compound events and to solve problems.</i>	Lesson
2 days: 36–37	Conditional Probability <i>Understand the conditional probability of event A given event B and interpret the independence of events A and B.</i>	
2 days: 38–39	Unit Activity and Discussion—Unit 3	Unit Activity Discussion
1 day: 40	Posttest—Unit 3	Assessment

Unit 4: Applying Probability

Summary

In this unit, you will use probability models to assess situations that arise in the real world. You will apply counting rules to determine probabilities and use them to make fair decisions and analyze strategies. Finally, you will find and interpret the conditional probability of an event as it relates to other events.

Day	Activity / Objective	Type
2 days: 41–42	Interpreting Two-Way Frequency Tables <i>Use a two-way table as a sample space to decide whether events are independent and to approximate conditional probabilities.</i>	Lesson

2 days: 43–44	Using Probability to Make Fair Decisions <i>Apply counting rules to determine probabilities and use them to make fair decisions.</i>	Lesson
2 days: 45–46	Using Probability to Analyze Decisions and Strategies <i>Apply counting rules to analyze decisions and strategies using probability concepts.</i>	Lesson
2 days: 47–48	Applying Conditional Probability and Independence <i>Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.</i>	Lesson
2 days: 49–50	Interpreting Conditional Probability <i>Find the conditional probability of event A as it relates to event B and interpret the answer in terms of the model.</i>	Lesson
3 days: 51–53	Unit Activity and Discussion—Unit 4	Unit Activity Discussion
1 day: 54	Posttest—Unit 4	Assessment

Unit 5: Making Inferences and Conclusions

Summary

In this unit, you will form conjectures about populations based on a random sample of the population. You will work with simulations that imitate real-world data and judge their validity. You will study the differences in data gathering techniques in surveys, experiments, and observational studies, and you will analyze the data sets generated by each. You will complete the unit by evaluating reports based on data.

Day	Activity / Objective	Type
2 days: 55–56	Making Inferences Based on Statistics <i>Understand statistics as a process for making inferences about population parameters based on a random sample from that population.</i>	Lesson
2 days: 57–58	Evaluating the Validity of a Statistical Model <i>Decide if a specified model is consistent with results from a given</i>	Lesson

	<i>data-generating process (such as a simulation).</i>	
2 days: 59–60	Using Statistics in Surveys, Experiments, and Studies <i>Recognize the purposes of and differences among sample surveys, experiments, and observational studies.</i>	Lesson
2 days: 61–62	Analyzing a Survey <i>Use data from a sample survey to estimate a population mean or proportion and develop a margin of error through the use of simulation models for random sampling.</i>	Lesson
2 days: 63–64	Statistically Comparing Two Treatments <i>Use data from a randomized experiment to compare two treatments and use simulations to decide if differences between parameters are significant.</i>	Lesson
2 days: 65–66	Evaluating Reports Based on Data <i>Evaluate reports based on data.</i>	Lesson
3 days: 67–69	Unit Activity and Discussion—Unit 5	Unit Activity Discussion
1 day: 70	Posttest—Unit 5	Assessment

Unit 6: Using Probability to Make Decisions

Summary

Probability can help you weigh possible outcomes when faced with a difficult decision. In this unit, you will gain practical skills to use probabilities for decision making. You will develop and graph probability distributions by assigning random variables to quantities of interest. You will also make predictions using probability distributions and empirical data. You will determine the probability of a payoff value which defines the risks and rewards associated with a decision, and you will solve for probabilities that will help you make fair choices in more complex situations.

Day	Activity / Objective	Type
2 days: 71–72	Random Variables <i>Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space and graph the</i>	Lesson

	<i>corresponding probability distribution.</i>	
2 days: 73–74	Expected Value of a Random Variable <i>Calculate the expected value of a random variable and interpret it as the mean of the probability distribution.</i>	Lesson
2 days: 75–76	Making Predictions Based on Probabilities <i>Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated and find the expected value.</i>	Lesson
2 days: 77–78	Making Predictions Based on Empirical Data <i>Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically and find the expected value.</i>	Lesson
2 days: 79–80	Ins and Outs of Expected Value <i>Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.</i>	Lesson
2 days: 81–82	Fair Decisions with Random Variables <i>Solve for probabilities in complex situations that go beyond counting rules and use these probabilities to make fair decisions.</i>	Lesson
2 days: 83–84	Complex Decisions Using Probability <i>Analyze decisions and strategies in complex situations, using probability concepts that go beyond counting rules.</i>	Lesson
3 days: 85–87	Unit Activity and Discussion—Unit 6	Unit Activity Discussion
1 day: 88	Posttest—Unit 6	Assessment
1 day: 89	Semester Review	
1 day: 90	End-of-Semester Test	Assessment