Unit at a Glance

When theoretical probability calculations become too complex, statisticians often use simulations instead. Simulations can also be used to check statistical computations, or they can be used in place of a study which is too expensive, time-consuming, or unethical. Simulations require random numbers or outcomes. In this unit the simulations are simple enough that students can use coins, dice, tables of random digits, or their calculators to generate required random numbers or outcomes.

Students learn that in many situations they require data from samples to estimate characteristics (parameters) of large populations. Sampling is performed to learn about populations when it is too time-consuming, expensive, or impractical to study the whole. Sometimes the act of collecting the data ruins the item being studied. Understandably, to get reliable results, one must minimize the sources of bias.

Two ways to gather information for statistical studies are observational studies and experiments. Observational studies seek to collect data about subjects without changing them, while experiments impose treatments (variables of interest) upon the subjects.

When the frequencies in a frequency table are divided by the total number of data points, the frequencies become ratios, and the frequency table becomes a relative frequency table. Histograms show the information from frequency tables and relative frequency histograms display information from relative frequency tables. There are many situations when a relative frequency histogram will closely resemble a bell-shaped curve. Data distributions can be represented graphically with histograms and boxplots. Two distributions of data can be compared by comparing their center, shape, spread, and outliers. The center, or “typical” value, of a data distribution can be described by the median. If the distribution is symmetric and has no outliers, the mean can be used to describe the center. The spread of a distribution can be described with the Interquartile Range (IQR), or the standard deviation. Since the standard deviation is based upon the mean, it should be used only to describe the spread of distributions that are symmetric and without outliers. An outlier is a data value that is far away from the bulk of the data. The following topics will be studied:

| Topic 5A: Probability | • Creating and interpreting tree and Venn diagrams, and two-way frequency tables  
| | • Identifying outcomes of a sample space as unions, intersections, or complements  
| | • Finding conditional probability  
| | • Designing and using simulations  
| | • Distinguishing between theoretical and experimental probability  
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<th>Length</th>
<th>5 (90-minute) periods</th>
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| Topic 5B: Randomization and Normal Distributions | • Conducting experiments and observational studies  
| | • Creating box and whisker plots, histograms, scatterplots, and dot plots  
| | • Using data to find mean, median, minimum, maximum, quartiles, and shape  
| | • Finding and applying standard deviation  
| | • Defining and determining bias  
| | • Applying the Empirical Rule (68-95-99.7)  
| Length | 4 (90-minute) periods |
Exploring Mathematics

Real World Connections

Probability is a mathematical concept that we use every day whether we realize it or not. Decisions we make on a daily basis may involve a certain amount of chance that takes affect either immediately or in the future.

Here are some examples of probability in the real world: Real Life Probability

Careers

Actuaries use statistics and probability to help understand and manage risks. They can work for insurance companies, weather forecasters, the government, and many other places. Actuaries are masters of statistical inferences. Learn more at the website BeAnActuary.org

Resource Toolkit

CPM Algebra 2 Textbook and eBook Resources

Topic 5A
Chapter 11 Simulating Sampling Variability, Lessons 11.1.1 – 11.2.4

Topic 5B
Chapter 9 Randomization and Normal Distributions, Lessons 9.1.1 – 9.3.1
Appendix C Comparing Single Variable Data, Lessons C.1.1 – C.1.3

Homework Help

Topic 5A
Go to CPM Homework Help, Chapter 11 and select the appropriate lesson for specific support on homework items.
Khan Academy: Conditional Probability and Independence

Topic 5B
Go to CPM Homework Help, Chapter 9 and Appendix C, and select the appropriate lesson for specific support on homework items.
Normal Distribution video
Khan Academy: Sample Standard Deviation and Bias
Normal Distribution Problems

“All successes begin with self-discipline. It starts with you.”
– Dwayne “The Rock” Johnson