Probability of Repeated Independent Events

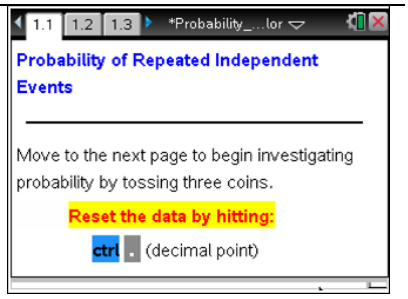
Student Activity

Name _____

Class _____

Open the TI-Nspire document
Probability_of_Repeated_Independent_Events.tns.

This activity investigates the probability of multiple independent events by simulating tossing a coin three times.



Press ctrl ◀ and ctrl ▶ to navigate through the lesson.

1. An experiment is a process, such as tossing a fair coin three times, that gives definite results, called outcomes of the experiment. The sample space, S, of an experiment is the set of all possible outcomes. An event is any subset of the sample space.

   a. If the results of the first two coin tosses are heads, are you more likely to toss a head or tail on your third toss? Explain.

   b. If an experiment consists of tossing a fair coin three times and recording the results in order, what is the sample space for this experiment? (Use *H* for heads and *T* for tails.) How many possible outcomes are there?

   c. What does it mean for a coin toss to be “fair”? Explain.

   d. When the occurrence of one event does not affect the probability of another event, the events are independent. Suppose you randomly choose a ball from a bag of 10 colored balls. The first ball is not replaced. Then, you choose another ball. Are your choices independent events or dependent events?

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2. A probability tree diagram is another way to represent the sample space of an experiment. From the trunk, on the left, the first pair of branches represents the possible results of the first coin flip. From each of those branches, two more branches represent the possible results of the second coin flip. Finally, from each of those four branches, two more branches represent the possible results of the third coin flip.

   a. Watch the tree diagram change as you click the arrow in the top left-hand corner. Looking at the path, what is the probability of getting tails on all three tosses?

   b. To find the probability of multiple independent events that occur in sequence, find the probability of each event occurring separately, and then multiply the probabilities. Here is the rule defined symbolically: $P(A \cap B) = P(A) \cdot P(B)$. Use the rule to algebraically find the probability of getting tails on all three tosses.

   c. In 2010, the New Orleans Saints won the Super Bowl coin toss to become the 13th straight NFC team to win the Super Bowl coin toss. That seems highly improbable. What is the probability of correctly guessing the outcome of each fair coin toss 13 times in a row?

Move to page 2.1 and then page 2.2.

3. A bar graph records the percentage of trials that have had exactly 0, 1, 2, or 3 heads showing each time the arrow in the top left-hand corner of the screen is clicked. Reset the number of trials to zero pressing ctrl [.]. After ten trials, record the percentages in the table below under the first Experimental column. Do twenty additional trials, and then record your data in the next column. Then, use the tree diagram to find the theoretical percentages and fill them in the correct column of the table.

# of Heads Showing	Experimental (% after 10 trials)	Experimental (% after 30 trials)	Theoretical (write as a %)
0			
1			
2			
3			

a. The event, "getting one head showing," is a compound event. This means that it includes more than one outcome, and the probability that it occurs is the sum of the probabilities of the three separate outcomes. What are all of the possible outcomes that show exactly one head? Use the outcomes to find the theoretical probability.

b. Do your percentages in the experimental columns match the percentages in the theoretical column? If not, why?

c. What do you think would happen to the data if you did thousands (or even millions) of trials?