

4.1 Randomness, Probability, and Simulation: Simulation

We can model chance behavior and estimate probabilities with a **simulation**.

Simulation is the imitation of chance behavior, based on a model that accurately reflects the situation.

You already have some experience with simulations. The "1 in 6 wins" game in Lesson 1.1 had you roll a die several times to imitate buying 20-ounce sodas and looking under the cap. Lesson 3.3's Name-Brand Cookie activity asked you to use a spinner to simulate the choice of cookies. Lesson 3.7's Caffeine Experiment activity asked you to shuffle and deal piles of index cards to mimic the random assignment of subjects to treatments.

These simulations involved different "chance devices" - dice, spinner, index cards. But the same basic strategy was followed in each simulation.

How to Perform a Simulation

1. **STATE:** Ask a question about some chance process.
2. **PLAN:** Describe how to use a chance device to imitate one repetition of the process. Tell what you will record at the end of each repetition.
3. **DO:** Perform many repetitions.
4. **CONCLUDE:** Use the results of your simulation to help answer the question.

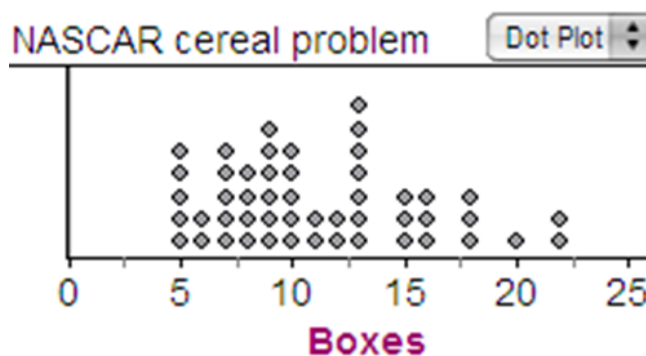
So far, we have used physical devices for our simulations. Technology provides another option: a random number generator.

Example: In an attempt to increase sales, a breakfast cereal company decides to offer a NASCAR promotion. Each box of cereal will contain a collectible card featuring one of these NASCAR drivers: Jeff Gordon, Dale Earnhardt Jr., Kasey Kahne, Danica Patrick, and Jimmie Johnson. The company claims that each of the 5 cards is equally likely to appear in any box of cereal. A NASCAR fan decides to keep buying boxes of the cereal until she has all 5 drivers' cards. She is surprised when it takes her 23 boxes to get the full set of cards. Design and carry out a simulation to estimate the probability that it would take 23 or more boxes to get all 5 drivers' cards if the company's claim is true. What conclusion should the fan draw?

STATE: How many boxes of cereal until we get all five cards?

Plan: * Let the numbers 1, 2, 3, 4, & 5 represent each driver individually.
* Use spinner, index cards, etc. to create a simulation

DO:



CONCLUDE: It is just as likely to get all 5 cards in about 23 boxes.