5.1 Randomness, Probability and Simulation

**Probability**

Probability is a measure of how likely an outcome is to occur. Match one of the probabilities that follow with each statement. Be prepared to explain.

0 0.01 0.3 0.6 .99 1

(a) The outcome is impossible. Will never happen.

(b) The outcome is certain. Will always happen.

(c) This outcome is very unlikely, but it will occur once in a while in a long sequence of trials.

(d) This outcome will occur more often than not.

Example #2

According to the “Book of Odds”, the probability that a randomly selected U.S. adult usually eats breakfast is 0.61.

1. Explain what a probability of .61 means in this situation.
2. Why doesn’t this probability say that if 100 US adults are chosen at random, exactly 61 of them eat breakfast?

**Simulation**

The imitation of chance behavior, based on a model that accurately reflects the situation, is called a **simulation**.

**Performing a Simulation**

1. **State:** What is the question of interest about some chance process?
2. **Plan:** Describe how to use a chance device to imitate one repetition of the process. Explain clearly how to identify the outcomes of the chance process and what variable to measure.
3. **Do:** Perform many repetitions of the simulation.
4. **Conclude:** Use the results of your simulation to answer the question of interest.

We can use physical devices, random numbers (e.g. Table D), and technology to perform simulations.

Example 1:

At a local high school, 95 students have permission to park on campus. Each month the student council holds a “golden ticket parking lottery” at a school assembly. The two lucky winners are given reserved parking spots next to the school’s main entrance. Last month, the winning tickets were drawn by a student council member for two students in the AP Statistics class. When both golden tickets went to members of that same class, some people thought the lottery had been rigged since the student council member was also in the class. There are 28 students in the AP Statistics class, all of whom are eligible to park on campus. Design and carry out a simulation to decide whether it’s plausible that the lottery was carried out fairly. Use line 139 in Table D.

Example 2:

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., Tony Stewart, Danica Patrick, or Jimmie Johnson. The company says that each of the cards is equally likely to appear in any box of cereal. A NASCAR fan decides to keep buying boxes of 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 decide what is the probability it would take at least 23 boxes to get all 5 cards. Use the randint function on your calculator.