

What is a **simulation**? A technique used to act out a problem by conducting experiments whose outcomes are analogous to the original problem.

Using simulations and random number generators, students can **estimate** probabilities rather than analytically determine them. Computers and some calculators can generate sets of random numbers. What is meant by a random number?

Random numbers are lists of digits selected at random, often by a computer or calculator.

You have a set of randomly generated digits using the digits 0 through 9. They are separated into groups of 5 and each row contains 50 digits, for ease in counting. So might we use such a table to help us simulate various problems? Let's see.

**Example 1:** We want to simulate the results of tossing a coin 25 times using the random number table. Since there are only two outcomes (heads or tails), we can divide the digits in the table into 2 categories to represent these 2 outcomes.

What should we choose for heads? \_\_\_\_\_ And tails? \_\_\_\_\_

Now using these choices, randomly pick a starting point and read across the table for 25 digits deciding whether each is either a head or a tail.

**sample line:**

78496 47197 37961 67568 14861

What is your "simulated probability" of tossing a head? \_\_\_\_\_

What is the "theoretical probability" of tossing a head? \_\_\_\_\_

**As the number of random digits chosen increases, the simulated probability should approach the theoretical probability.**

**Example 2:** Simulate the probability of a couple that plans to have 2 children actually having 2 girls. How should we divide up the digits 0 through 9 given that there are only 2 equally likely outcomes when having a baby (that is, a boy or a girl)?

GIRL? \_\_\_\_\_

BOY? \_\_\_\_\_

Since we are considering two children in the family, we need to look at pairs of digits in the table. So what would a pair (6,5) represent? \_\_\_\_\_

Block off a large group of pairs, say 50 pairs (this would be 100 digits). Then count the number of those pairs which consist of "2 girls" according to the above criteria.

07443 15346 40653 84238 24430 88834 77318 07486 33950 61598  
41347 86255 92715 96656 49693 99286 83447 20215 16040 41085

What is the "simulated probability" of having 2 girls? \_\_\_\_\_

Construct a tree diagram and find the "theoretical probability" of having 2 girls?

**Example 3:** Assume Carmen Smith, a basketball player, makes free throws with 80% probability of success and is placed in a one-and-one situation where she is given a second foul shot only if the first shot goes through the basket. Simulate 15 attempts from the foul line in one-and-one situations to determine how many times we would expect Carmen to score 0 points, 1 point, and 2 points.

First divide up the digits from 0 to 9 to represent a success: (80%) or failure (20%).

SUCCESS = \_\_\_\_\_ FAILURE = \_\_\_\_\_

**sample line:**

16825 27482 97868 05642 88047 68960

P(0 points) = \_\_\_\_\_ P(1 point) = \_\_\_\_\_ P(2 points) = \_\_\_\_\_

Using a tree diagram, determine the theoretical probability for Carmen to score 0 points, 1 point, and 2 points.

**Example 4:** What is the probability that in a group of 5 people chosen at random, at least 2 will have birthdays in the same month? **DESIGN AND DESCRIBE IN DETAIL** a simulation for this problem and then try your simulation 3 times.

07443	15346	40653	84238	24430	88834	77318	07486	33950	61598
41347	86255	92715	96656	49693	99286	83447	20215	16040	41085
03222	39951	12738	50303	25017	84207	52123	88637	19365	58289
09988	44203	53432	54538	16619	45444	17957	69187	98038	96508

**Example 5:** A school has 500 students. The principal is to pick 30 students at random to go on a special field trip. **DESIGN AND DESCRIBE IN DETAIL** a simulation for this problem.

**NOW LET'S USE SOMETHING OTHER THAN THE RANDOM NUMBER TABLE TO HELP US SIMULATE ACTUAL TRIALS.**

**Example 6:** Let's simulate guessing on a 10-item true-false quiz using a die and let's see how well you do. How should we do this? \_\_\_\_\_ = True and \_\_\_\_\_ = False. Now fill in your "guesses".

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Now "correct" your T/F quiz (get the key from me!).  
What is your score out of 10? \_\_\_\_\_

What is the "theoretical probability" of getting a 100% when guessing with a die on a T/F 10-item quiz?

What is the "theoretical probability" of getting a 0% when guessing with a die on a T/F 10-item quiz?

What is the "theoretical probability" of getting at least one wrong when guessing with a die on a T/F 10-item quiz?