

Experimental Probability vs. Theoretical Probability

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 5 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. Should she be surprised? Design and carry out a simulation to help answer this question.

State:

What is the probability that it takes 23 cards to get all 5 drivers?

Plan:

Do: 43414442335

Class Boxes of cereal
 15 20 9 26 27 10 5
 14 11 10 12 8 13 8
 7 $2/15 = 0.1331$

Conclude:

Based on our simulations, we found 2/15 trials to be above 23 boxes, which is 13%. Since this is above 5%, she would not be surprised that it took 23 boxes.

Example 1:

A couple plans to have children until they have a girl or until they have four children, whichever comes first. Simulate 15 repetitions of this childbearing strategy. Estimate the likelihood that they will have a girl.

Possible outcomes: Boy - 1

Girl - 2 RNG (1, 2)

*Independent

T1	7	12
2	8	13
3	9	14
4	10	15
5	11	
6		

Example 2:

In Bob's sock drawer, he has 2 blue socks and 4 black socks. One morning, his power goes out and he cannot see into his sock drawer, so he just chooses two at random. Simulate this situation 20 times. What is the likelihood of Bob choosing two matching socks?

Example 3:

Orders of frozen yogurt have the following relative frequencies: 38% chocolate, 42% vanilla, 20% strawberry. Simulate an order of 3 frozen treats. Repeat the simulation 12 times. What are the chances that an order will have one of each flavor?

Which is worse? A false positive or a false negative?

		Real Situation			
		Sick	Healthy	Antivirus detected it	Antivirus didn't detect it
Test	Sick	True result	False result	TRUE POSITIVE (caught the virus)	FALSE NEGATIVE (virus slipped past)
	Healthy	False result	True result	FALSE POSITIVE (quarantined a valid file)	TRUE NEGATIVE (left well enough alone)