Simulations – Part 1

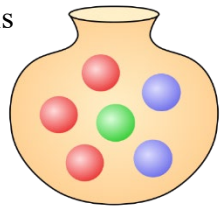
Types of Probabilities

1. Theoretical Probabilities
2. Experimental Probabilities

Theoretical Probabilities

Example: What is the probability of getting a head when flipping a coin?

Example: Suppose you have an urn with 6 marbles: 3 are red, 2 are blue, and 1 is green. Suppose you draw one marble at random from the urn, what is the probability that the marble is red?



Example: If you roll a fair six-sided die once, what is the probability that you get a 6?

Example: If you roll a fair six-sided die once, what is the probability that you get an even number?

How do we compute Theoretical Probabilities?

Experimental Probabilities

Example: Flip a coin 100 times and observe 32 heads. Find the probability of getting a head in a coin flip.

Coin Experiment

Experiment: Flip a coin 20 time and record your observations in every flip. Record your observations below, then compute the experimental probability of getting a head.

Flip	Outcome	Is it a Head? TRUE/FALSE
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Law of Large Numbers

Law of Large Numbers: In the long run, as the number of trials increases and increases, the proportion of the outcomes get closer to the theoretical probability values.

Number of Tosses	Number of Observed Heads	Percent of Observed Heads	Expected Percent of Heads
10	6	60%	50%
100	48	48%	50%
500	271	54.2%	50%
1000	461	46.1%	50%
5000	2533	50.66%	50%
10,000	5081	50.81%	50%

Sample Function

```
sample(vector, n)
```