

7.3 Exercises

Basic Concepts

1. What is the most significant property of the discrete uniform distribution?
2. Under what circumstances is the uniform distribution often used as an initial alternative?
3. Why is the discrete uniform probability model selected to estimate the number of German tanks being produced per month during WWII?
4. What parameter in the discrete uniform probability model is being estimated in the German tank problem?
5. Can a 60-sided die be used to simulate the probability distribution of a roulette wheel with 38 unique numbers? If yes, how?

Exercises

6. Tristen walks into class and states that he has an extra ticket to a concert on Friday night. He asks anyone interested in attending the concert to put their name on a piece of paper and put it in a basket. He plans to draw from the basket to choose the person who will attend the concert with him. If you and 16 other people in the class put your names in the basket what is the chance of being chosen to attend the concert with him?
7. Sharlene has just put a down payment on a lot in a small subdivision. There are 10 lots in the subdivision, and all are approximately 0.25 acres in size. Five builders have been contracted by the subdivision manager to each build two homes in order to finish the subdivision in 6 months. Jonathan is one of the builders contracted by the subdivision manager. What is the probability that Jonathan will be the builder that builds her house?
8. You are going to the casino tonight and plan on playing roulette.
 - a. Find the expected value and variance of betting \$1 on red.
 - b. What would be your betting strategy to maximize winnings?
9. An experiment consists of tossing a coin and rolling a six-sided die simultaneously.
 - a. List the sample space for the experiment.
 - b. What is the probability of getting a head on the coin and the number 3 on the die?
 - c. What is the probability of getting a tail on the coin and at least a 4 on the die?
10. Given the following discrete uniform probability distribution, find the expected value and standard deviation of the random variable.

x	0	1	2	3	4
$P(X = x)$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

Randomness and Statistics: Part 2

The roulette wheel features 36 red and black numbers from 1 to 36, along with two green slots labeled “0” and “00.” When the croupier spins the wheel and the ball eventually lands in one of the 38 slots, this outcome is typically viewed as a random event. The uniform distribution serves as a descriptive model of this randomness, reflecting our state of ignorance about where the ball will land. In this model, each number is equally likely to occur—with a $1/38$ probability—encapsulating our uncertainty about the outcome.

Claude Shannon and Edward Thorp (both at MIT) developed a system to model this seemingly random process. They used sensors and a timing mechanism to gather data on the ball’s speed and the wheel’s rotation, and they input this data into a model they implemented in a wearable computer—in their shoe! The computer then indicated the most likely winning number or section of numbers in which the ball would land. By using their model and data, they could place more accurate bets and increase their chances of winning. Essentially, they changed their level of ignorance about the random phenomena, which is the essence of effective modeling.