

Chapter 8: Probability: The Mathematics of Chance

Free-Response

Format: Short Answer

1. A spinner with regions numbered 1 to 4 is spun and a coin is tossed. Both the number spun and whether the coin lands heads or tails is recorded. Write the sample space.

Ans: $\{(1,H), (2,H), (3,H), (4,H), (1,T), (2,T), (3,T), (4,T)\}$

Format: Short Answer

2. Three coins are flipped simultaneously and it is recorded whether each coin lands heads or tails. List the sample space.

Ans: $\{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT\}$

Format: Short Answer

3. A pair of dice is rolled. Sam says there are 36 outcomes in the sample space for this procedure and Sally says there are 11 outcomes in the sample space. Explain how they could both be correct.

Ans: Sam counts 36 outcomes in the sample space by observing the number rolled on each die. Sally counts 11 outcomes by observing the sum rolled on the die.

Format: Short Answer

4. Exactly one of three contestants will win a game show. The probability that Terry wins is 0.25 and the probability that Chris wins is 0.65. What is the probability that Toni wins?

Ans: The probability Toni wins is 0.1.

Format: Short Answer

5. If the probability that Kerry gets an "A" in English class is 0.82, what is the probability that Kerry does not get an "A"?

Ans: The probability Kerry does not get an "A" is 0.18.

Format: Short Answer

6. Suppose three fair coins are tossed and the number of heads that appear is recorded. What is the probability of getting exactly two heads?

Ans: The probability of getting exactly two heads is $\frac{3}{8}$ or 0.375.

Format: Short Answer

7. A pair of fair dice is rolled and the sum of the faces showing is recorded. What is the probability of getting a sum greater than 9?

Ans: The probability of rolling a sum greater than 9 is $\frac{6}{36}$ or 0.167.

Format: Short Answer

8. We wish to make a spinner that will be numbered 1 to 4, but will have the probability of spinning a "1" be 0.5. Draw the face for such a spinner.

Ans: Answers may vary. Any spinner face which shows half the face labeled "1" is correct.

Format: Short Answer

9. Find the probability of drawing a three or a heart from a regular (bridge) deck of cards. (Such a deck consists of four suits of thirteen cards each. The suits are hearts, spades, diamonds, and clubs. The cards are 1 through 10, Jack, Queen, and King.)

Ans: The probability of drawing a three or a heart is $16/52$ or 0.308.

Format: Short Answer

10. We must create a license plate code that consists of two letters followed by three digits. The letters cannot repeat, but the digits may. How many such license plate codes can be formed?

Ans: 650,000

Format: Short Answer

11. A pizza can be made with any of the following toppings: cheese, pepperoni, sausage, mushrooms, anchovies, green peppers, or olives. How many different three-topping pizzas can be made? Doubling of any topping is not allowed.

Ans: 210

Format: Short Answer

12. A license plate code consists of two letters followed by three digits. The letters cannot repeat, but the digits can. What is the probability that a randomly chosen plate has all three digits the same?

Ans: $6500/650,000 = 1/100 = 0.01$

Format: Short Answer

13. A pizza can be made with any of the following toppings: cheese, pepperoni, sausage, mushrooms, anchovies, green peppers, or olives. Doubling of any topping is not allowed. What is the probability that a randomly created three-topping pizza will contain mushrooms?

Ans: $30/210 = 1/7 = 0.143$

Format: Short Answer

14. A student is taking a five-question True/False test. If the student chooses answers at random, what is the probability of getting all questions correct?

Ans: $1/32 = 0.03125$

Format: Short Answer

15. Below is a probability model for the number of automobiles owned by a randomly chosen family in a large town. What is the mean number of automobiles owned?

Number of automobiles	0	1	2	3
Probability	0.15	0.20	0.55	0.10

Ans: The mean number of automobiles owned is 1.6.

Format: Short Answer

16. Suppose a game has four outcomes, A, B, C, and D. The probability of outcome A is 0.4, the probabilities of each of the other outcomes is 0.2. A player receives \$2 if outcome A occurs, \$3 if outcome B occurs, \$1 if outcome C occurs, and must pay \$5 if outcome D occurs. What is the mean value of one trial of this game?

Ans: The mean value of one trial is \$0.60.

Format: Short Answer

17. The mean value of one trial of a carnival game is $-\$0.05$. Explain what this means.

Ans: The mean value gives the win or loss after a very large number of trials. In this case, a player would lose an average of 5 cents for each trial.

Format: Short Answer

18. Suppose a trial consists of rolling a single die and reporting the number that is rolled. What are the possible outcomes? Are they equally likely?

Ans: Possible outcomes are 1, 2, 3, 4, 5, 6. They are equally likely.

Format: Short Answer

19. Suppose a trial consists of rolling two dice and reporting the sum of the numbers rolled. What are the possible outcomes? Are they equally likely?

Ans: Possible outcomes are 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. They are not equally likely.

Format: Short Answer

20. Suppose a trial consists of rolling two dice and reporting the smaller of the two numbers rolled? What are the possible outcomes? Are they equally likely?

Ans: Possible outcomes are 1, 2, 3, 4, 5, 6. They are not equally likely.

Format: Short Answer

21. The mean weight of a collection of potatoes in a shipment to a fruit market is 1.3 lbs, with a standard deviation of 0.35 lbs. The distribution of weights is approximately normal. What is the probability that one potato chosen at random will weigh more than 1.65 lbs?

Ans: 0.16

Format: Short Answer

22. The mean weight of a collection of potatoes in a shipment to a fruit market is 1.3 lbs, with a standard deviation of 0.35 lbs. The distribution of weights is approximately normal. What fraction of the potatoes in the shipment will weigh between 0.25 and 2.35 lbs?

Ans: 99.7%

Format: Short Answer

23. In the manufacturing process for ball bearings, the mean diameter is 5 mm with a standard deviation of 0.002 mm. Between what two measurements will 95% of all diameters of ball bearings be found?

Ans: 95% of all diameters will be between 4.996 and 5.004 mm.

Format: Short Answer

24. In the manufacturing process for ball bearings, the mean diameter is 5 mm with a standard deviation of 0.002 mm. Each hour a sample of 20 bearings is drawn, measured, and the mean diameter of the sample found. What is the sample standard deviation of the sample mean?

Ans: 0.000447

Format: Short Answer

25. A publisher wishes to know what percent of book pages will need graphics editing. A random sample of 25 pages in a textbook finds that 58% of the pages had drawings or figures on them. The standard deviation for this percent is 9.9%. If the publisher wishes to reduce the standard deviation to 3.3%, how many pages should the publisher sample?

Ans: 225 pages

Format: Short Answer

26. A game consists of tossing a coin and rolling a six-sided die. The results can be recorded easily; for example, if heads shows on the coin and a 4 shows on the die, record this as H4. List the sample space for the results of this game.

Ans: H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6

Format: Short Answer

27. A game consists of tossing three coins. Find the probability model for the number of coins showing heads.

Ans: Number of heads	0	1	2	3
Probability	1/8 or .125	3/8 or .375	3/8 or .375	1/8 or .125

Format: Short Answer

28. A football stadium snack bar conducted a survey and found that 30 customers bought one item, 52 customers bought two items, 21 customers bought three items, and 12 customers bought four items. What is the mean number of items purchased per customer? Round your answer to the nearest tenth.

Ans: 2.1 items

Format: Short Answer

29. Suppose you use a spinner to choose a random number between 0 and 1. Which is more likely—choosing a number between $\frac{1}{3}$ and $\frac{2}{3}$, or between $\frac{1}{2}$ and $\frac{3}{4}$?

Ans: Choosing a number between $\frac{1}{3}$ and $\frac{2}{3}$

Format: Short Answer

30. According to the central limit theorem, how does the standard deviation of averages over four observations compare to the standard deviation of individual observations?

Ans: The standard deviation of the averages is half that of the individual observations.