

Chapter 6

Discrete Probability Distributions

True/False

1. The Poisson probability distribution is always negatively skewed.

Answer:

2. A random variable is assigned numerical values based on the outcomes of an experiment.

Answer:

3. A random variable represents the outcomes of an experiment.

Answer:

4. The probability of a particular outcome, designated X , must always be between 0 and 100 inclusive.

Answer:

5. If we toss two coins and count the number of heads, there could be 0, 1 or 2 heads. Since the exact number of heads resulting from this experiment is due to chance, the number of heads appearing is a random variable.

Answer:

6. If Unique Buying Services has 100 employees, there might be 0, 1, 2, 3 up to 100 employees absent on Monday. In this case, the day of the week is the random variable.

Answer:

7. A discrete random variable can have only certain clearly separated values.

Answer:

8. A discrete variable may assume fractional or decimal values, but they must have distance between them.

Answer:

9. For a binomial distribution, each trial has a known number of successes. For example, a four question multiple-choice test can only have zero, one, two, three and four successes (number correct).

Answer:

10. The random variable for a Poisson probability distribution can assume an infinite number of values.

Answer:

11. A probability distribution is a mutually exclusive listing of experimental outcomes that can occur by chance and their corresponding probabilities.

Answer:

12. To construct a binomial probability distribution, the number of trials and the probability of success must be known.

Answer:

13. The Poisson probability distribution is a continuous probability distribution.

Answer:

14. If we measure the weight of a car, the variable is a discrete random variable.

Answer:

15. A binomial distribution has a characteristic that the trials are independent, which means that the outcome of one trial does not affect the outcome of any other trial.

Answer:

16. For a binomial distribution, outcomes of an experiment are classified into one of two mutually exclusive categories (a success or a failure).

Answer:

17. For a binomial distribution, the probability of a success stays the same for each trial, but the probability of a failure varies from trial to trial.

Answer:

18. For a binomial distribution, the data collected are the result of counts.

Answer:

19. When sampling is done without replacement and the outcomes are measured as either a success or failure, the hypergeometric distribution should be applied.

Answer:

20. A Poisson distribution is a discrete probability distribution. It has the same four characteristics as the binomial, but in addition, the probability of a success is small and the number of trials is relatively large.

Answer:

21. A random variable may be either discrete or continuous.

Answer:

22. The mean of a binomial probability distribution can be determined by multiplying the probability of a failure by the number of trials.

Answer:

23. A binomial distribution is a continuous probability distribution.

Answer:

24. The binomial and Poisson distributions are discrete probability distributions.

Answer:

25. To construct a binomial distribution, it is necessary to know the total number of trials and the probability of success on each trial.

Answer:

26. If the probability of success (π) remains the same, but n increases, the shape of the binomial distribution becomes more symmetrical.

Answer:

27. The mean of a probability distribution is called its expected value.

Answer:

28. The mean of a binomial distribution is the product of n and π .

Answer:

29. The variance of a binomial distribution is found by $n \pi (1 - \pi)$.

Answer:

30. As a general rule of thumb, if the items selected for a sample are not replaced and the sample size is less than 5 percent of the population, the binomial distribution can be used to approximate the hypergeometric distribution.

Answer:

31. In a Poisson distribution, the probability of success may vary from trial to trial.

Answer:

32. A mail-order house, advertising "same day" service, received a large number of complaints. A change in the handling of orders was made with less than 5 unfilled orders on hand (per picker) at the end of 95 out of every 100 working days. Frequent checks of unfilled orders at the end of the day revealed that the distribution of unfilled orders approximated a Poisson distribution; that is, most of the days there were no unfilled orders; some of the days there was one order, and so on. Since the average number of unfilled orders per picker was 2.0, the mail-order house lived up to its goal.

Answer:

33. The binomial probability distribution is always negatively skewed.

Answer:

34. The expected value of summing two random variables is the sum of their expected values.

Answer:

35. If the covariance between two random variables is zero, the two variables are related.

Answer:

36. The variance of the sum of two random variables is the sum of their variances plus two times the covariance.

Answer:

37. If the covariance between two random variables is zero, the two variables are not related.

Answer:

Multiple Choice

38. If the variance of a probability was computed to be 3.6 grams, what is the standard deviation?

- A) 0.6
- B) 1.9
- C) 6.0
- D) 12.96

Answer:

39. Sixty percent of the customers of a fast food chain order the Whopper, french fries and a drink. If a random sample of 15 cash register receipts is selected, what is the probability that 10 or more will show that the above three food items were ordered?

- A) 1,000
- B) 0.186
- C) 0.403
- D) 0.000

Answer:

40. Judging from recent experience, 5 percent of the computer keyboards produced by an automatic, high-speed machine are defective. What is the probability that out of six keyboards selected at random, exactly zero keyboards will be defective?

- A) 0.001
- B) 0.167
- C) 0.735
- D) 0.500

Answer:

41. The probabilities and the number of automobiles lined up at a Lakeside Olds at opening time (7:30

a.m.) for service are:

Number	Probability
1	0.05
2	0.30
3	0.40
4	0.25

On a typical day, how many automobiles should Lakeside Olds expect to be lined up at opening?

- A) 10.00
- B) 1.00
- C) 2.85
- D) 1.96

Answer:

42. On a very hot summer day, 5 percent of the production employees at Midland States Steel are absent from work. The production employees are randomly selected for a special in-depth study on absenteeism. What is the probability of randomly selecting 10 production employees on a hot summer day and finding that none of them are absent?

- A) 0.002
- B) 0.344
- C) 0.599
- D) 0.100

Answer:

43. The marketing department of a nationally known cereal maker plans to conduct a national survey to find out whether or not consumers of flake cereals can distinguish one of their favorite flake cereals. To test the questionnaire and procedure to be used, eight persons were asked to cooperate in an experiment. Five very small bowls of flake cereals were placed in front of a person. The bowls were labeled A, B, C, D and E. The person was informed that only one bowl contained his or her favorite flake cereal. Suppose that the eight persons in the experiment were unable to identify their favorite cereal and just guessed which bowl it was in. What is the probability that none of the eight guessed correctly?

- A) 0.168
- B) 0.009
- C) 0.788
- D) 0.125

Answer:

44. An insurance agent has appointments with four prospective clients tomorrow. From past experience the agent knows that the probability of making a sale on any appointment is 1 out of 5. Using the rules of probability, what is the likelihood that the agent will sell a policy to 3 of the 4 prospective clients?

- A) 0.250
- B) 0.500
- C) 0.410
- D) 0.026

Answer:

45. Sweetwater & Associates write weekend trip insurance at a very nominal charge. Records show that the probability that a motorist will have an accident during the weekend and file a claim is 0.0005.

Suppose they wrote 400 policies for the coming weekend, what is the probability that exactly two claims will be filed?

- A) 0.8187
- B) 0.2500

- C) 0.0164
- D) 0.0001

Answer:

46. In which of the following discrete distribution does the probability of a success vary from one trial to the next?

- A) Binomial
- B) Poisson
- C) Hypergeometric
- D) All of the above

Answer:

47. Which of the following is a requirement for use of the hypergeometric distribution?

- A) Only 2 possible outcomes
- B) Trials are independent
- C) Probability of a success is greater than 1.0
- D) All of the above

Answer:

48. What is a listing of all possible outcomes of an experiment and their corresponding probability of occurrence called?

- A) Random variable
- B) Probability distribution
- C) Subjective probability
- D) Frequency distribution

Answer:

49. Which one of the following is NOT a condition of the binomial distribution?

- A) Independent trials
- B) Only two outcomes
- C) Probability of success remains constant from trial to trial
- D) At least 10 observations

Answer

50. Which is true for a binomial distribution?

- A) There are three or more possible outcomes
- B) Probability of success remains the same from trial to trial
- C) Value of p is equal to 1.50
- D) All of the above are correct

Answer

51. Which shape describes a Poisson distribution?

- A) Positively skewed
- B) Negatively skewed
- C) Symmetrical
- D) All of the above

Answer:

52. Sponsors of a local charity decided to attract wealthy patrons to its \$500-a-plate dinner by allowing each patron to buy a set of 20 tickets for the gaming tables. The chance of winning a prize for each of the 20 plays is 50-50. If you bought 20 tickets, what is the chance of winning 15 or more prizes?

- A) 0.250
- B) 0.021
- C) 0.006

D) 0.750

Answer:

53. What kind of distribution are the binomial and Poisson distributions?

- A) Discrete
- B) Continuous
- C) Both discrete and continuous
- D) Neither discrete or continuous

Answer:

54. Which of the following is correct about a probability distribution?

- A) Sum of all possible outcomes must equal 1
- B) Outcomes must be mutually exclusive
- C) Probability of each outcome must be between 0 and 1 inclusive
- D) All of the above

Answer:

55. The weight of an offensive lineman may be 205.15 pounds, 210.23 pounds, 225.05 pounds or 219.14 pounds. What is this an illustration of?

- A) Continuous random variable
- B) Discrete random variable
- C) Complement rule
- D) All of the above

Answer:

56. Carlson Jewelers permits the return of their diamond wedding rings, provided the return occurs within two weeks of the purchase date. Their records reveal that 10 percent of the diamond wedding rings are returned. Five different customers buy five rings. What is the probability that none will be returned?

- A) 0.250
- B) 0.073
- C) 0.590
- D) 0.500
- E) 0.372

Answer:

57. In a large metropolitan area, past records revealed that 30 percent of all the high school graduates go to college. From 20 graduates selected at random, what is the probability that exactly 8 will go to college?

- A) 0.114
- B) 0.887
- C) 0.400
- D) 0.231

Answer:

58. Chances are 50-50 that a newborn baby will be a girl. For families with five children, what is the probability that all the children are girls?

- A) 0.900
- B) 0.031
- C) 0.001
- D) 0.250

Answer:

59. A new car was put into production. It involved many assembly tasks. Each car was inspected at the end of the assembly line and the number of defects per unit was recorded. For the first 100 cars produced, there were 40 defective cars. Some of the cars had no defects; a few had one defect, and so on. The distribution of defects followed a Poisson distribution. Based on the first 100 produced, about how many out of every 1,000 cars assembled should have one or more defects?

- A) About 660
- B) About 165
- C) About 630
- D) About 330

Answer:

60. The production department has installed a new spray machine to paint automobile doors. As is common with most spray guns, unsightly blemishes often appear because of improper mixture or other problems. A worker counted the number of blemishes on each door. Most doors had no blemishes; a few had one; a very few had two, and so on. The average number was 0.5 per door. The distribution of blemishes followed the Poisson distribution. Out of 10,000 doors painted, about how many would have no blemishes?

- A) About 6,065
- B) About 3,935
- C) About 5,000
- D) About 500

Answer:

61. A manufacturer of headache medicine claims it is 70 percent effective within a few minutes. That is, out of every 100 users 70 get relief within a few minutes. A group of 12 patients are given the medicine. If the claim is true, what is the probability that 8 have relief within a few minutes?

- A) 0.001
- B) 0.168
- C) 0.667
- D) 0.231

Answer:

62. A true-false test consists of six questions. If you guess the answer to each question, what is the probability of getting all six questions correct?

- A) 0
- B) 0.016
- C) 0.062
- D) 0.250

Answer:

63. A farmer who grows genetically engineered corn is experiencing trouble with corn borers. A random check of 5,000 ears revealed the following: many of the ears contained no borers. Some ears had one borer; a few had two borers; and so on. The distribution of the number of borers per ear approximated the Poisson distribution. The farmer counted 3,500 borers in the 5,000 ears. What is the probability that an ear of corn selected at random will contain no borers?

- A) 0.3476
- B) 0.4966
- C) 1.000
- D) 0.0631

Answer:

64. A tennis match requires that a player win three of five sets to win the match. If a player wins the first two sets, what is the probability that the player wins the match, assuming that each player is equally likely to win each match?

- A) 0.5
- B) $1/8$ or 0.125
- C) $7/8$ or 0.875
- D) Cannot be computed.

Answer:

65. A machine shop has 100 drill presses and other machines in constant use. The probability that a machine will become inoperative during a given day is 0.002. During some days no machines are inoperative, but during some days, one, two, three or more are broken down. What is the probability that fewer than two machines will be inoperative during a particular day?

- A) 0.0200
- B) 0.1637
- C) 0.8187
- D) 0.9824

Answer:

66. What is the following table called?

Number of Heads	Probability of Outcome
0	$1/8 = 0.125$
1	$3/8 = 0.375$
2	$3/8 = 0.375$
3	$1/8 = 0.125$

- A) Probability distribution
- B) Cumulative frequency distribution
- C) Standard deviation
- D) Frequency table

Answer:

67. What is the only variable in the Poisson probability formula?

- A) π
- B) x
- C) e
- D) P

Answer:

68. Which of the following is NOT a characteristic of a binomial probability distribution?

- A) Each outcome is mutually exclusive
- B) Each trial is independent
- C) Probability of success remains constant from trial to trial
- D) Each outcome results from two trials
- E) All of the above are characteristics of the binomial distribution

Answer: 69. What must you know to develop a binomial probability distribution?

- A) Probability of success
- B) Number of trials
- C) Number of successes
- D) "a" and "b" only
- E) "a" and "c" only

Answer:

70. In a Poisson distribution the mean is equal to

A) $n\pi$

$\frac{\sum x}{n}$

B) $\frac{\sum x}{n}$

C) e^{-x}

$\frac{\mu^x e^{-\mu}}{x!}$

D) $\frac{\mu^x e^{-\mu}}{x!}$

E) zero.

Answer

71. In a Poisson distribution the variance is equal to

A) $n\pi$

$\frac{\sum x}{n}$

B) $\frac{\sum x}{n}$

C) e^{-x}

$\frac{\mu^x e^{-\mu}}{x!}$

D) $\frac{\mu^x e^{-\mu}}{x!}$

E) zero.

Answer:

Fill-in-the-Blank

72. How many possible experimental outcomes do the binomial distribution and the Poisson distribution have? _____

Answer

73. What type of population consists of a fixed number of individuals, objects, or measurements?

Answer:

74. A probability distribution is a listing of the expected outcomes of an experiment and the probability of each outcome occurring. What is the sum of the probabilities? _____

Answer:

75. To construct a binomial distribution we need to know the total number of _____ and the probability of a success.

Answer

76. A probability distribution shows the outcomes of an experiment and the _____ of each one occurring.

Answer:

77. In a binomial experiment, the probability of a _____ remains constant.

Answer:

78. In a binomial experiment, what does the probability of a failure equal?

Answer:

79. A binomial probability distribution approaches a greater degree of symmetry as the probability of success remains constant and the number of trials becomes _____

Answer:

80. The Poisson distribution or, the law of improbable events, is _____ skewed.

Answer:

81. If $\pi = 1/3$ and $n = 900$, what is the mean of this binomial distribution? _____

Answer:

82. If $\pi = 1/5$ and $n = 100$, what is the standard deviation of this binomial distribution? _____

Answer:

83. If $n = 900$ and $\pi = 1/3$, what is the variance of this binomial distribution? _____

Answer:

84. A _____ random variable can assume only a certain number of separated values.

Answer:

85. A continuous random variable can assume one of an _____ number of values within a specific range.

Answer:

86. In the _____ distribution the probability of a success is not the same on each trial.

Answer:

87. For the hypergeometric distribution there are _____ possible outcomes.

Answer:

88. A random variable with a Poisson distribution has one of _____ mutually exclusive values.

Answer:

89. In a Poisson distribution each trial is _____.

Answer:

90. The arrival of customers at a service desk follows a Poisson distribution. If they arrive at a rate of two every five minutes, what is the probability that no customers arrive in a five-minute period? _____

Answer:

91. The arrival of customers at a service desk follows a Poisson distribution. If they arrive at a rate of four every five minutes, what is the probability that more than four customers arrive in a five minute period? _____

Answer

Use the following to answer questions 92-95:

Elly's hot dog emporium is famous for its chilidogs. Elly's latest sales indicate that 30% of the customers ordering her chilidogs order it with hot peppers. Suppose 18 customers are selected at random.

92. What is the probability that exactly ten customers will ask for hot peppers? _____

Answer

93. What is the probability that between two and six people inclusive want hot peppers? _____

Answer:

94. What is the probability that fifteen or more customers will want hot peppers? _____

Answer:

95. This situation is an example of what type of discrete probability distribution?

Answer:

Multiple Choice Questions

Use the following to answer questions 96-99:

David's gasoline station offers 4 cents off per gallon if the customer pays in cash and does not use a credit card. Past evidence indicates that 40% of all customers pay in cash. During a one-hour period twenty-five customers buy gasoline at this station.

96. What is the probability that at least ten pay in cash?

- A) 0.416
- B) 0.575
- C) 0.586
- D) 0.425

Answer:

97. What is the probability that no more than twenty pay in cash?

- A) 0.0
- B) 0.1
- C) 0.9
- D) 1.0

Answer:

98. What is the probability that more than ten and less than fifteen customers pay in cash?

- A) 0.541
- B) 0.401
- C) 0.380
- D) 0.562

Answer:

99. This situation is an example of what type of discrete probability distribution?

- A) Continuous probability distribution
- B) Poisson probability distribution
- C) Binomial probability distribution
- D) Hypergeometric probability distribution

Answer:

Use the following to answer questions 100-103:

Affirmative action commitments by industrial organizations have led to an increase in the number of women in executive positions. Satellite Office Systems has vacancies for two executives that it will fill from among four women and six men.

100. What is the probability that no woman is selected?

- A) $1/5$
- B) $1/3$
- C) $2/15$
- D) $8/15$

Answer

101. What is the probability that at least one woman is selected?

- A) $8/15$
- B) $3/5$
- C) $2/3$
- D) $3/4$

Answer:

Fill-in-the-Blank

102. What is the probability that exactly one woman is selected? _____

Answer:

103. This is an example of what type of probability distribution? _____

Answer

Multiple Choice

Use the following to answer questions 104-106:

A statistics professor receives an average of five e-mail messages per day from students. Assume the number of messages approximates a Poisson distribution.

104. What is the probability that on a randomly selected day she will have no messages?

- A) 0.0067
- B) zero
- C) 0.0335
- D) Impossible to have no messages

Answer:

105. What is the probability that on a randomly selected day she will have five messages?

- A) 0.0067
- B) 0.875
- C) 0.175
- D) 1.0

Answer:

106. What is the probability that on a randomly selected day she will have two messages?

- A) 0.0067
- B) 0.0014
- C) 0.420
- D) 0.084

Answer:

Use the following to answer questions 107-109:

A company is studying the number of monthly absences among its 125 employees. The following probability distribution shows the likelihood that people were absent 0, 1, 2, 3, 4, or 5 days last month.

<u>Number of days absent</u>	<u>Probability</u>
0	0.60
1	0.20
2	0.12
3	0.04
4	0.04
5	0

107. What is the mean number of days absent?

- A) 1.00
- B) 0.40
- C) 0.72
- D) 2.5

Answer:

108. What is the variance of the number of days absent?

- A) 1.99
- B) 1.41
- C) 5.00
- D) 55.52

Answer:

109. Given the probability distribution, which of the following predictions is correct?

- A) 60% of the employees will have more than one day absent for a month
- B) There is a 0.04 probability that an employee will be absent 1 day during a month
- C) There is a 0.12 probability that an employee will be absent 2 days during a month
- D) There is a 0.50 probability that an employee will be absent 0.72 days during a month.

Answer:

Fill-in-the-Blank

Reference: 06_05

Use the following to answer questions 110-113:

A company is studying the number of daily debit card purchases. If there were 20 purchases and the probability of a debit card purchase is 0.5, answer the following questions.

110. Of the 20 purchases, what is the expected value of the number of debit card purchases?

Answer:

111. What is the standard deviation of the number of debit card purchases? ____

Answer:

112. What is the shape of this distribution? Explain your answer.

Answer:

113. Based on the shape of the distribution, approximately 99.7 % of the purchases should be between _____ and _____.

Answer:

Essay

114. What is the difference between a binomial and a hypergeometric distribution?

Answer:

115. For a binomial distribution, explain why $n\pi = \sum xP(x)$.

Answer: