

Chapter 5

A Survey of Probability Concepts

True/False

1. Based on a classical approach, the probability of an event is defined as the number of favorable outcomes divided by the total number of possible outcomes.

Answer:

2. If only one of several events can occur at a time, we refer to these events as being mutually exclusive events.

Answer:

3. The classical approach to probability requires that the outcomes of an experiment are not equally likely.

Answer:

4. The probability of rolling a 3 or 2 on a single die is an example of conditional probability.

Answer:

5. The probability of rolling a 3 or 2 on a single die is an example of mutually exclusive events.

Answer:

6. The Cunard luxury liner, Queen Elizabeth 2, cannot be docked in Hong Kong and Bangkok at the same time. Events such as these that cannot occur simultaneously are said to be outcomes.

Answer:

7. The probability of rolling a 3 or 2 on a single die is an example of joint probability.

Answer:

8. The probability assigned to an event that is certain not to occur is 1.0.

Answer:

9. The probability assigned to an event that is certain not to occur is 0.0.

Answer:

10. If an experiment, such as a die-tossing experiment, has a set of events that includes every possible outcome, the set of events is called collectively exhaustive.

Answer:

11. An individual can assign a subjective probability to an event based on the individual's knowledge about the event.

Answer:

12. To apply the special rule of addition, the events must be mutually exclusive.

Answer:

13. To apply the special rule of addition, the events must be independent.

Answer:

14. The probability that you would assign to the likelihood that the Tampa Bay Buccaneers will be in the Super Bowl this season must be between 0 and 10.

Answer:

15. A joint probability is a probability that measures the likelihood that two or more events will happen concurrently.

Answer:

16. If there are two independent events A and B , the probability that A and B will occur is found by multiplying the two probabilities. Thus for two events A and B , the special rule of multiplication shown symbolically is:

$$P(A \text{ and } B) = P(A) P(B).$$

Answer:

17. The general rule of multiplication is used to find the joint probability that two events will occur. Symbolically, the general rule of multiplication is

$$P(A \text{ and } B) = P(A) P(B|A).$$

Answer:

18. A tree diagram is very useful for portraying conditional and joint probabilities.

Answer:

19. A coin is tossed four times. The probability is $\frac{1}{4}$ or 0.25 that all four tosses will result in a head face up.

Answer:

20. If there are 'm' ways of doing one thing and 'n' ways of doing another thing, the multiplication formula states that there are $(m) \bullet (n)$ ways of doing both.

Answer:

21. A permutation is an arrangement of a set of objects in which there is an order from the first through the last.

Answer:

22. A combination is an arrangement of a set of objects in which there is an order from the first through the last.

Answer:

23. Two coins are tossed. The tossing of the coins is called an experiment, and one possible event is two heads.

Answer:

24. The complement rule states that the probability of an event not occurring is equal to one minus the probability of its occurrence.

Answer:

25. If two events are mutually exclusive, then $P(A \text{ or } B) = P(A) + P(B)$.

Answer:

26. The combination formula is: $n! / (n - r)!$

Answer:

27. A probability is a number from -1 to $+1$ inclusive that measures one's belief that an event resulting from an experiment will occur.

Answer:

28. An experiment is an activity that is either observed or measured.

Answer:

29. An illustration of an experiment is turning the ignition key of an automobile as it comes off the assembly line to determine whether or not the engine will start

Answer:

30. A probability is usually expressed as a decimal, such as 0.70 or 0.27, but it can also be expressed as a fraction, such as $7/10$ or $27/100$.

Answer:

31. A tree diagram portrays outcomes that are mutually exclusive.

Answer:

32. The closer a probability is to 0, the more likely that an event will happen. The closer the probability is to 1.00, the more likely an event will not happen.

Answer:

33. It was announced that the probability of rain tomorrow is -1.0 . Such a low probability of -1.0 indicates that there is no chance of rain.

Answer:

34. Bayes' theorem is a method to revise the probability of an event given additional information.

Answer:

35. Bayes's theorem calculates a conditional probability called a posterior or revised probability.

Answer:

36. Bayes' theorem is used to calculate a subjective probability.

Answer:

Multiple Choice

37. The National Center for Health Statistics reported that of every 883 deaths in recent years, 24 resulted from an automobile accident, 182 from cancer and 333 from heart disease. Using the relative frequency approach, what is the probability that a particular death is due to an automobile accident?

A) $24/883$ or 0.027

B) $539/883$ or 0.610

C) $24/333$ or 0.072

D) $182/883$ or 0.206

Answer:

38. If two events A and B are mutually exclusive, what does the special rule of addition state?

A) $P(A \text{ or } B) = P(A) + P(B)$

B) $P(A \text{ and } B) = P(A) + P(B)$

C) $P(A \text{ and/or } B) = P(A) + P(B)$

D) $P(A \text{ or } B) = P(A) - P(B)$

Answer:

39. What does the complement rule state?

A) $P(A) = P(A) - P(B)$

B) $P(A) = 1 - P(\text{not } A)$

C) $P(A) = P(A) \bullet P(B)$

D) $P(A) = P(A)X + P(B)$

Answer

40. Which approach to probability is exemplified by the following formula?
Probability of an Event =

$$\frac{\text{Number of times event occurred in the past}}{\text{Total number of observations}}$$

- A) Classical approach
- B) Empirical approach
- C) Subjective approach
- D) None of the above

Answer:

41. A study of 200 computer service firms revealed these incomes after taxes:

<u>Income After Taxes</u>	<u>Number of Firms</u>
Under \$1 million	102
\$1 million up to \$20 million	61
\$20 million and more	37

What is the probability that a particular firm selected has \$1 million or more in income after taxes?

- A) 0.00
- B) 0.25
- C) 0.49
- D) 0.51

Answer:

42. Routine physical examinations are conducted annually as part of a health service program for the employees. It was discovered that 8% of the employees needed corrective shoes, 15% needed major dental work and 3% needed both corrective shoes and major dental work. What is the probability that an employee selected at random will need either corrective shoes or major dental work?

- A) 0.20
- B) 0.25
- C) 0.50
- D) 1.00
- E) None of the above

Answer:

43. A survey of top executives revealed that 35% of them regularly read Time magazine, 20% read Newsweek and 40% read U.S. News & World Report. Ten percent read both Time and U.S. News & World Report. What is the probability that a particular top executive reads either Time or U.S. News & World Report regularly?

- A) 0.85
- B) 0.06
- C) 1.00
- D) 0.65

Answer: 44. A study by the National Park Service revealed that 50% of the vacationers going to the Rocky Mountain region visit Yellowstone Park, 40% visit the Grand Tetons and 35% visit both. What is the probability that a vacationer will visit at least one of these magnificent attractions?

- A) 0.95
- B) 0.35

- C) 0.55
- D) 0.05

Answer:

45. A tire manufacturer advertises, "the median life of our new all-season radial tire is 50,000 miles. An immediate adjustment will be made on any tire that does not last 50,000 miles." You purchased four of these tires. What is the probability that all four tires will wear out before traveling 50,000 miles?

- A) $1/10$, or 0.10
- B) $1/4$, or 0.25
- C) $1/64$, or 0.0156
- D) $1/16$, or 0.0625

Answer:

46. A sales representative calls on four hospitals in Westchester County. It is immaterial what order he calls on them. How many ways can he organize his calls?

- A) 4
- B) 24
- C) 120
- D) 37

Answer:

47. There are 10 rolls of film in a box and 3 are defective. Two rolls are to be selected without replacement. What is the probability of selecting a defective roll followed by another defective roll?

- A) $1/2$, or 0.50
- B) $1/4$, or 0.25
- C) $1/120$, or about 0.0083
- D) $1/15$, or about 0.07

Answer:

48. Giorgio offers the person who purchases an 8 ounce bottle of Allure two free gifts, either an umbrella, a 1 ounce bottle of Midnight, a feminine shaving kit, a raincoat or a pair of rain boots. If you purchased Allure what is the probability you selected at random an umbrella and a shaving kit in that order?

- A) 0.00
- B) 1.00
- C) 0.05
- D) 0.20

Answer:

49. A board of directors consists of eight men and four women. A four-member search committee is to be chosen at random to recommend a new company president. What is the probability that all four members of the search committee will be women?

- A) 1/120 or 0.00083
- B) 1/16 or 0.0625
- C) 1/8 or 0.125
- D) 1/495 or 0.002

Answer:

50. A lamp manufacturer has developed five lamp bases and four lampshades that could be used together. How many different arrangements of base and shade can be offered?

- A) 5
- B) 10
- C) 15
- D) 20

Answer:

51. A gumball machine has just been filled with 50 black, 150 white, 100 red and 100 yellow gum balls that have been thoroughly mixed. Sue and Jim approached the machine first. They both said they wanted red gum balls. What is the likelihood they will get their wish?

- A) 0.50
- B) 0.062
- C) 0.33
- D) 0.75

Answer:

52. What does $\frac{6! 2!}{4! 3!}$ equal?

- A) 640
- B) 36
- C) 10
- D) 120
- E) None of the above

Answer:

53. In a management trainee program, 80 percent of the trainees are female, 20 percent male. Ninety percent of the females attended college, 78 percent of the males attended college. A management trainee is selected at random. What is the probability that the person selected is a female who did NOT attend college?

- A) 0.20
- B) 0.08
- C) 0.25
- D) 0.80

Answer:

54. Three defective electric toothbrushes were accidentally shipped to a drugstore by the manufacturer along with 17 non-defective ones. What is the probability that the first two electric toothbrushes sold will be returned to the drugstore because they are defective?

- A) $3/20$ or 0.15
- B) $3/17$ or 0.176
- C) $1/4$ or 0.25
- D) $3/190$ or 0.01579

Answer:

55. An electronics firm sells four models of stereo receivers, three CD decks, and six speaker brands. When the four types of components are sold together, they form a "system." How many different systems can the electronics firm offer?

- A) 36
- B) 18
- C) 72
- D) 144

Answer:

56. The numbers 0 through 9 are to be used in code groups of four to identify an item of clothing. Code 1083 might identify a blue blouse, size medium. The code group 2031 might identify a pair of pants, size 18, and so on. Repetitions of numbers are not permitted, i.e., the same number cannot be used more than once in a total sequence. As examples, 2256, 2562 or 5559 would not be permitted. How many different code groups can be designed?

- A) 5,040
- B) 620
- C) 10,200
- D) 120

Answer:

57. There are two letters C and D. If repetitions such as CC are permitted, how many permutations are possible?

- A) 1
- B) 0
- C) 4
- D) 8

Answer:

58. You have the assignment of designing color codes for different parts. Three colors are to be used on each part, but a combination of three colors used for one part cannot be rearranged and used to identify a different part. This means that if green, yellow and violet were used to identify a camshaft, yellow, violet and green (or any other combination of these three colors) could not be used to identify a pinion gear. If there are 35 combinations, how many colors were available?

- A) 5
- B) 7
- C) 9
- D) 11

Answer:

59. A builder has agreed not to erect all "look alike" homes in a new subdivision. Five exterior designs are offered to potential homebuyers. The builder has standardized three interior plans that can be incorporated in any of the five exteriors. How many different ways can the exterior and interior plans be offered to potential homebuyers?

- A) 8
- B) 10
- C) 15
- D) 30

Answer:

60. Six basic colors are to be used in decorating a new condominium. They are to be applied to a unit in groups of four colors. One unit might have gold as the principal color, blue as a complementary color, red as the accent color and touches of white. Another unit might have blue as the principal color, white as the complimentary color, gold as the accent color and touches of red. If repetitions are permitted, how many different units can be decorated?

- A) 7,825
- B) 25
- C) 125
- D) 1,296

Answer:

61. The ABCD football association is considering a Super Ten Football Conference. The top 10 football teams in the country, based on past records, would be members of the Super Ten Conference. Each team would play every other team in the conference during the season and the team winning the most games would be declared the national champion. How many games would the conference commissioner have to schedule each year? (Remember, Oklahoma versus Michigan is the same as Michigan versus Oklahoma.)

- A) 45
- B) 50
- C) 125
- D) 14

Answer:

62. A rug manufacturer has decided to use 7 compatible colors in her rugs. However, in weaving a rug, only 5 spindles can be used. In advertising, the rug manufacturer wants to indicate the number of different color groupings for sale. How many color groupings using the seven colors taken five at a time are there? (This assumes that 5 different colors will go into each rug, i.e., there are no repetitions of color.)

- A) 120
- B) 2,520
- C) 6,740
- D) 36

Answer:

63. The first card selected from a standard 52-card deck was a king. If it is returned to the deck, what is the probability that a king will be drawn on the second selection?

- A) $1/4$ or 0.25
- B) $1/13$, or 0.077
- C) $12/13$, or 0.923
- D) $1/3$ or 0.33

Answer:

64. The first card selected from a standard 52-card deck was a king. If it is NOT returned to the deck, what is the probability that a king will be drawn on the second selection?

- A) $1/3$ or 0.33
- B) $1/51$, or 0.0196
- C) $3/51$, or 0.0588
- D) $1/13$ or 0.077

Answer:

65. Which approach to probability assumes that the events equally likely?

- A) Classical
- B) Empirical
- C) Subjective
- D) Mutually exclusive

Answer:

66. An experiment may have:

- A) Only one result
- B) Only two results
- C) Two or more results
- D) None of the above

Answer:

67. When are two events mutually exclusive?

- A) They overlap on a Venn diagram
- B) If one event occurs, then the other cannot
- C) Probability of one affects the probability of the other
- D) Both (a) and (b)

Answer:

68. Probabilities are important information when

- A) using inferential statistics.
- B) applying descriptive statistics.
- C) predicting a future outcome.
- D) A and B
- E) A and C

Answer:

69. The result of a particular experiment is called a(n)

- A) observation.
- B) conditional probability.
- C) event.
- D) outcome.

Answer:

70. The probability of two or more events occurring concurrently is called a

- A) conditional probability.
- B) empirical probability.
- C) joint probability.
- D) tree diagram.
- E) none of the above.

Answer:

71. The probability of an event that is affected by two or more different events is called a

- A) conditional probability.
- B) empirical probability.
- C) joint probability.
- D) tree diagram.
- E) none of the above.

Answer:

72. A graphical method useful in calculating joint and conditional probability is

- A) a tree diagram.
- B) a Venn diagram.
- C) a histogram.
- D) inferential statistics.

Answer:

73. When an experiment is conducted "without replacement",

- A) events are independent
- B) events are equally likely
- C) the experiment can be illustrated with a Venn Diagram
- D) the probability of two or more events is computed as a joint probability

Answer:

74. If two events are independent, then their joint probability is

- A) computed with the special rule of addition
- B) computed with the special rule of multiplication
- C) computed with the general rule of multiplication
- D) computed with Bayes theorem

Answer:

75. When applying the special rule of addition for mutually exclusive events, the joint probability is:

- A) 1
- B) .5
- C) 0
- D) unknown

Answer:

76. A student received an "A" on the first test of the semester. The student wants to calculate the probability of scoring an "A" on the second test. Historically, the instructor knows that the joint probability of scoring "A"s on the first two tests is 0.5. Also, historically, the probability that a student scores an "A" on the second test given that a student scored an "A" on the first test is 0.9. What is the probability that a student will score an "A" on the second test?

- A) 0.50
- B) 0.95
- C) 0.55
- D) 0.90

Answer:

77. When an event's probability depends on the likelihood of another event, the probability is a

- A) conditional probability.
- B) empirical probability.
- C) joint probability.
- D) Mutually exclusive probability.

Answer:

78. Using the terminology of Bayes' Theorem, a posterior probability can also be defined as:

- A) a conditional probability
- B) a joint probability
- C) 1
- D) 0

Answer:

79. The process used to calculate the probability of an event given additional information has been obtained is

- A) Bayes's theorem.
- B) classical probability.
- C) permutation.
- D) subjective probability.

Answer:

Fill-in-the-Blank

80. Complete the following analogy: an experiment relates to the roll of a die, as an outcome relates to _____.

Answer:

81. If a set of events are collectively exhaustive and mutually exclusive, what does the sum of the probabilities equal? ____

Answer:

82. When the special rule of multiplication is used events A and B must be _____

Answer:

83. Suppose four heads appeared face up on four tosses of a coin. What is the probability that a head will appear face up in the next toss of the coin? _____

Answer:

84. What approach to probability is based on a person's degree of belief and hunches that a particular event will happen? _____

Answer:

85. If there are five vacant parking places and five automobiles arrive at the same time, in how many different ways they can park? _____

Answer:

86. A collection of one or more possible outcomes of an experiment is called an _____.

Answer:

87. A new computer game has been developed and 80 veteran game players will test its market potential. If sixty players liked the game, what is the probability that any veteran game player will like the new computer game? _____

Answer:

88. A company has warehouses in four regions: South, Midwest, Rocky Mountain and Far West. The company will randomly select one warehouse to store a seldom-used item. What is the probability that the warehouse selected will be in the Far West region? _____

Answer:

89. One card will be randomly selected from a standard 52-card deck of cards. What is the probability that it will be the jack of hearts? _____

Answer:

90. The number of times an event occurred in the past is divided by the total number of occurrences. What is this approach to probability called? _____

Answer:

91. If there is absolutely no chance a person will purchase a new car this year, what is the probability assigned to this event? _____

Answer:

92. What is the probability that a one-spot or a two-spot or a six-spot will appear face up on the throw of one die? _____

Answer: 1

93. What is a measured or observed activity called? _____

Answer:

94. What is a probability that is based on someone's opinion, guess or hunch called?

Answer:

95. What is a particular result of an experiment called? _____

Answer:

96. What is a collection of one or more basic outcomes called? _____

Answer:

97. To apply the special rule of addition, what must be true about the events? _____

Answer:

98. What are two events called when the occurrence of one event does not affect the occurrence of the other event? _____.

Answer:

99. What is it called when the order of a set of objects selected from a single group is important?

Answer:

100. The method for calculating the probability of an event given there is additional information is called

_____.

Answer:

101. The probability that a specific event will occur given that a specific other event has occurred is what type of probability? _____

Answer:

Multiple Choice

Use the following to answer questions 102-106:

A group of employees of Unique Services will be surveyed about a new pension plan. In-depth interviews with each employee selected in the sample will be conducted. The employees are classified as follows.

<u>Classification</u>	<u>Event</u>	<u>Number of Employees</u>
Supervisors	A	120
Maintenance	B	50
Production	C	1,460
Management	D	302
Secretarial	E	68

102. What is the probability that the first person selected is classified as a maintenance employee?

- A) 0.20
- B) 0.50
- C) 0.025
- D) 1.00
- E) None of the above

Answer:

103. What is the probability that the first person selected is either in maintenance or in secretarial?

- A) 0.200
- B) 0.015
- C) 0.059
- D) 0.001

Answer:

104. What is the probability that the first person selected is either in management or in supervision?

- A) 0.00
- B) 0.06
- C) 0.15
- D) 0.21

Answer:

105. What is the probability that the first person selected is a supervisor and in management?

- A) 0.00
- B) 0.06
- C) 0.15
- D) 0.21

Answer:

Use the following to answer questions 106-108:

Each salesperson in a large department store chain is rated on their sales ability and their potential for advancement. The data for the 500 sampled salespeople are summarized in the following table.

		Potential for Advancement		
		Fair	Good	Excellent
Sales Ability	Below Average	16	12	22
	Average	45	60	45
	Above Average	93	72	135

106. What is the probability that a salesperson selected at random has above average sales ability and is an excellent potential for advancement?

- A) 0.20
- B) 0.50
- C) 0.27
- D) 0.75

Answer:

107. What is the probability that a salesperson selected at random will have average sales ability and good potential for advancement?

- A) 0.09
- B) 0.12
- C) 0.30
- D) 0.525

Answer:

108. What is the probability that a salesperson selected at random will have below average sales ability and fair potential for advancement?

- A) 0.032
- B) 0.10
- C) 0.16
- D) 0.32

Answer:

109. What is the probability that a salesperson selected at random will have an excellent potential for advancement given they also have above average sales ability?

- A) 0.27
- B) 0.60
- C) 0.404
- D) 0.45

Answer:

110. What is the probability that a salesperson selected at random will have an excellent potential for advancement given they also have average sales ability?

- A) 0.27
- B) 0.30
- C) 0.404
- D) 0.45

Answer:

Use the following to answer questions 111-113:

A study of the opinion of designers with respect to the primary color most desirable for use in executive offices showed that:

<u>Primary Color</u>	<u>Number of Opinions</u>
Red	92
Orange	86
Yellow	46
Green	91
Blue	37
Indigo	46
Violet	2

111. What is the probability that a designer does not prefer red?

- A) 1.00
- B) 0.77
- C) 0.73
- D) 0.23

Answer:

112. What is the probability that a designer does not prefer yellow?

- A) 0.000
- B) 0.765
- C) 0.885
- D) 1.000

Answer:

113. What is the probability that a designer does not prefer blue?

- A) 1.0000
- B) 0.9075
- C) 0.8850
- D) 0.7725

Answer:

Use the following to answer questions 114-115:

An automatic machine inserts mixed vegetables into a plastic bag. Past experience revealed that some packages were underweight and some were overweight, but most of them had satisfactory weight.

<u>Weight</u>	<u>% of Total</u>
Underweight	2.5
Satisfactory	90.0
Overweight	7.5

114. What is the probability of selecting three packages that are overweight?

- A) 0.0000156
- B) 0.0004218
- C) 0.0000001
- D) 0.075

Answer:

115. What is the probability of selecting three packages that are satisfactory?

- A) 0.900
- B) 0.810
- C) 0.729
- D) 0.075

Answer:

Use the following to answer questions 116-118:

A mortgage holding company has found that 2% of its mortgage holders default on their mortgage and lose the property. Furthermore, 90% of those who default are late on at least two monthly payments over the life of their mortgage as compared to 45% of those who do not default.

116. What is the joint probability that a mortgagee has two or more late monthly payments and does not default on the mortgage?

- A) 0.432
- B) 0.441
- C) 0.018
- D) 0.039

Answer:

117. What is the joint probability that a mortgagee has one or less late monthly payments and does not default on the mortgage?

- A) 0.528
- B) 0.539
- C) 0.002
- D) 0.039

Answer:

118. Based on Bayes' Theorem, what is the posterior probability that a mortgagee will not default given one or less payments over the life of the mortgage?

- A) Nearly 1
- B) Nearly 0
- C) 0.538
- D) 0.98
- E) Cannot be computed

Answer:

Fill-in-the-Blank

Use the following to answer questions 119-121:

A cell phone salesperson has kept records on the customers who visited the store. 40% of the customers who visited the store were female. Furthermore, the data show that 35% of the females who visited his store purchased a cell phone, while 20% of the males who visited his store purchased a cell phone. Let A_1 represent the event that a customer is a female, A_2 represent the event that a customer is a male, and B represent the event that a customer will purchase a phone.

119. What is the probability that a female customer will purchase a cell phone?

Answer:

120. What is the probability that a male customer will purchase a cell phone?

Answer:

121. The salesperson has just informed us that a cell phone was purchased. What is the probability that customer was female?

Answer:

Essay

122. Draw a Venn diagram showing the probability for two mutually exclusive events and a Venn diagram showing the probability for two events that are not mutually exclusive. Explain the difference in the two diagrams.

Answer: