TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

1) Subjective probability implies that we can measure the relative frequency of the values of the random variable.

2) The use of "expert opinion" is one way to approximate subjective probability values.

3) Mutually exclusive events exist if only one of the events can occur on any one trial.

4) Stating that two events are statistically independent means that the probability of one event occurring is independent of the probability of the other event having occurred.

5) Saying that a set of events is collectively exhaustive implies that one of the events must occur.

6) Saying that a set of events is mutually exclusive and collectively exhaustive implies that one and only one of the events can occur on any trial.

7) A posterior probability is a revised probability.

8) Bayes' theorem enables us to calculate the probability that one event takes place knowing that a second event has or has not taken place.

9) A probability density function is a mathematical way of describing Bayes' theorem.

10) The probability, \( P \), of any event or state of nature occurring is greater than or equal to 0 and less than or equal to 1.

11) A probability is a numerical statement about the chance that an event will occur.

12) If two events are mutually exclusive, the probability of both events occurring is simply the sum of the individual probabilities.

13) Given two statistically dependent events \((A, B)\), the conditional probability of \( P(A | B) = \frac{P(B)}{P(AB)} \).

14) Given two statistically independent events \((A, B)\), the joint probability of \( P(AB) = P(A) + P(B) \).

15) Given three statistically independent events \((A, B, C)\), the joint probability of \( P(ABC) = P(A) \times P(B) \times P(C) \).

16) Given two statistically independent events \((A, B)\), the conditional probability \( P(A | B) = P(A) \).

17) Suppose that you enter a drawing by obtaining one of 20 tickets that have been distributed. By using the classical method, you can determine that the probability of your winning the drawing is 0.05.

18) Assume that you have a box containing five balls: two red and three white. You draw a ball two times, each time replacing the ball just drawn before drawing the next. The probability of drawing only one white ball is 0.20.

19) If we roll a single die twice, the probability that the sum of the dots showing on the two rolls equals four (4), is \( \frac{1}{6} \).
20) For two events $A$ and $B$ that are not mutually exclusive, the probability that either $A$ or $B$ will occur is $P(A) \times P(B) - P(A \text{ and } B)$.

21) If we flip a coin three times, the probability of getting three heads is 0.125.

22) Consider a standard 52-card deck of cards. The probability of drawing either a seven or a black card is $7/13$.

23) If a bucket has three black balls and seven green balls, and we draw balls without replacement, the probability of drawing a green ball is independent of the number of balls previously drawn.

24) Assume that you have an urn containing 10 balls of the following description:
   - 4 are white (W) and lettered (L)
   - 2 are white (W) and numbered (N)
   - 3 are yellow (Y) and lettered (L)
   - 1 is yellow (Y) and numbered (N)

   If you draw a numbered ball (N), the probability that this ball is white (W) is 0.667.

25) Assume that you have an urn containing 10 balls of the following description:
   - 4 are white (W) and lettered (L)
   - 2 are white (W) and numbered (N)
   - 3 are yellow (Y) and lettered (L)
   - 1 is yellow (Y) and numbered (N)

   If you draw a numbered ball (N), the probability that this ball is white (W) is 0.60.

26) Assume that you have an urn containing 10 balls of the following description:
   - 4 are white (W) and lettered (L)
   - 2 are white (W) and numbered (N)
   - 3 are yellow (Y) and lettered (L)
   - 1 is yellow (Y) and numbered (N)

   If you draw a lettered ball (L), the probability that this ball is white (W) is 0.571.

27) The joint probability of two or more independent events occurring is the sum of their marginal or simple probabilities.

28) The number of bad checks written at a local store is an example of a discrete random variable.

29) Given the following distribution:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Value of Random Variable</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>.4</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>.3</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>.2</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>.1</td>
</tr>
</tbody>
</table>

   The expected value is 3.

30) A new young executive is perplexed at the number of interruptions that occur due to employee relations.
She has decided to track the number of interruptions that occur during each hour of her day. Over the last month, she has determined that between 0 and 3 interruptions occur during any given hour of her day. The data is shown below.

<table>
<thead>
<tr>
<th>Number of Interruptions in 1 hour</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 interruption</td>
<td>.5</td>
</tr>
<tr>
<td>1 interruptions</td>
<td>.3</td>
</tr>
<tr>
<td>2 interruptions</td>
<td>.1</td>
</tr>
<tr>
<td>3 interruptions</td>
<td>.1</td>
</tr>
</tbody>
</table>

On average, she should expect 0.8 interruptions per hour.

A new young executive is perplexed at the number of interruptions that occur due to employee relations. She has decided to track the number of interruptions that occur during each hour of her day. Over the last month, she has determined that between 0 and 3 interruptions occur during any given hour of her day.
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<td>.3</td>
</tr>
<tr>
<td>2 interruptions</td>
<td>.2</td>
</tr>
<tr>
<td>3 interruptions</td>
<td>.1</td>
</tr>
</tbody>
</table>

On average, she should expect 1.0 interruptions per hour.

32) The *expected value* of a binomial distribution is expressed as \( np \), where \( n \) equals the number of trials and \( p \) equals the probability of success of any individual trial.

33) The standard deviation equals the square of the variance.

34) The probability of obtaining specific outcomes in a Bernoulli process is described by the binomial probability distribution.

35) The variance of a binomial distribution is expressed as \( np/(1-p) \), where \( n \) equals the number of trials and \( p \) equals the probability of success of any individual trial.

36) The *F* distribution is a continuous probability distribution that is helpful in testing hypotheses about variances.

37) The mean and standard deviation of the Poisson distribution are equal.

38) In a normal distribution the *Z* value represents the number of standard deviations from a value \( X \) to the mean.

39) Assume you have a normal distribution representing the likelihood of completion times. The mean of this distribution is 10, and the standard deviation is 3. The probability of completing the project in 8 or fewer days is the same as the probability of completing the project in 18 days or more.

40) Assume you have a normal distribution representing the likelihood of completion times. The mean of this distribution is 10, and the standard deviation is 3. The probability of completing the project in 7 or fewer days is the same as the probability of completing the project in 13 days or more.

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

41) The classical method of determining probability is
Subjective probability assessments depend on
A) experience and judgment.
B) the number of occurrences of the event.
C) the relative frequency of occurrence.
D) the total number of trials.
E) None of the above

If two events are mutually exclusive, then
A) their probabilities can be added.
B) if one occurs, the other cannot occur.
C) they may also be collectively exhaustive.
D) the joint probability is equal to 0.
E) All of the above

A ________ is a numerical statement about the likelihood that an event will occur.
A) standard deviation
B) collectively exhaustive construct
C) probability
D) mutually exclusive construct
E) variance

A conditional probability \( P(B|A) \) is equal to its marginal probability \( P(B) \) if
A) the events are mutually exclusive.
B) it is a joint probability.
C) \( P(A) = P(B) \).
D) statistical dependence exists.
E) statistical independence exists.

The equation \( P(A|B) = \frac{P(AB)}{P(B)} \) is
A) the formula for a joint probability.
B) the marginal probability.
C) the formula for a conditional probability.
D) only relevant when events \( A \) and \( B \) are collectively exhaustive.
E) None of the above

Suppose that we determine the probability of a warm winter based on the number of warm winters experienced over the past 10 years. In this case, we have used ________.
A) subjective probability
B) relative frequency
C) the classical method
D) the logical method
E) None of the above

Bayes' theorem is used to calculate
A) subjective probabilities.
B) joint probabilities.
C) marginal probabilities.
D) revised probabilities.
E) prior probabilities.

49) If the sale of ice cream and pizza are independent, then as ice cream sales decrease by 60 percent during the winter months, pizza sales will
   A) decrease by 60 percent.
   B) increase by 40 percent.
   C) increase by 60 percent.
   D) decrease by 40 percent.
   E) be unrelated.

50) If \( P(A) = 0.3, P(B) = 0.2, P(A \text{ and } B) = 0.0 \), what can be said about events \( A \) and \( B \)?
   A) They are mutually exclusive.
   B) They are independent.
   C) They are posterior probabilities.
   D) None of the above
   E) All of the above

51) Suppose that 10 golfers enter a tournament and that their respective skill levels are approximately the same. What is the probability that one of the first three golfers that registered for the tournament will win?
   A) 0.100
   B) 0.001
   C) 0.299
   D) 0.700
   E) 0.300

52) Suppose that 10 golfers enter a tournament and that their respective skill levels are approximately the same. Six of the entrants are female and two of those are older than 40 years old. Three of the men are older than 40 years old. What is the probability that the winner will be either female or older than 40 years old?
   A) 0.198
   B) 0.900
   C) 1.100
   D) 0.200
   E) 0.000

53) Suppose that 10 golfers enter a tournament and that their respective skill levels are approximately the same. Six of the entrants are female and two of those are older than 40 years old. Three of the men are older than 40 years old. What is the probability that the winner will be a female who is older than 40 years old?
   A) 1.100
   B) 0.000
   C) 0.198
   D) 0.200
   E) 0.900

54) "The probability of event \( B \), given that event \( A \) has occurred" is known as a _______ probability.
   A) marginal
   B) continuous
   C) conditional
   D) joint
   E) simple

55) When does \( P(A \mid B) = P(A) \)?
   A) when \( A \) and \( B \) are mutually exclusive
   B) when \( A \) and \( B \) are statistically dependent
   C) when \( A \) and \( B \) are statistically independent
   D) when \( P(B) = 0 \)
   E) when \( A \) and \( B \) are collectively exhaustive

56) A consulting firm has received 2 Super Bowl playoff tickets from one of its clients. To be fair, the firm is randomly selecting two different employee names to "win" the tickets. There are 6 secretaries and 5 consultants.
Which of the following statements is not true?

A) The probability of a secretary winning a ticket on the first draw is 6/15.
B) The probability of two secretaries winning both tickets is 1/7.
C) The probability of a secretary winning a ticket on the second draw given that a consultant won a ticket on the first draw is 6/15.
D) The probability of a partner winning a ticket on the second draw given that a secretary won a ticket on the first draw is 4/14.
E) The probability of a consultant winning a ticket on the first draw is 1/3.

A consulting firm has received 2 Super Bowl playoff tickets from one of its clients. To be fair, the firm is randomly selecting two different employee names to "win" the tickets. There are 6 secretaries, 5 consultants, and 4 partners in the firm. Which of the following statements is true?

A) The probability of a consultant winning on the second draw given that a consultant won on the first draw is 5/14.
B) The probability of a partner winning on the second draw given that a secretary won on the first draw is 8/30.
C) The probability of a partner winning on the second draw given that a partner won on the first draw is 3/14.
D) The probability of a secretary winning on the second draw given that a secretary won on the first draw is 2/15.
E) None of the above are true.

A consulting firm has received 2 Super Bowl playoff tickets from one of its clients. To be fair, the firm is randomly selecting two different employee names to "win" the tickets. There are 6 secretaries, 5 consultants, and 4 partners in the firm. Which of the following statements is true?

A) The probability of two secretaries winning is the same as the probability of a secretary winning on the second draw given that a consultant won on the first draw.
B) The probability of a secretary winning on the second draw given that a consultant won on the first draw is the same as the probability of a consultant winning on the second draw given that a secretary won on the first draw.
C) The probability that both tickets will be won by partners is the same as the probability that a consultant and secretary will win.
D) The probability of a secretary and a consultant winning is the same as the probability of a secretary and secretary winning.
E) None of the above are true.

At a university with 1,000 business majors, there are 200 business students enrolled in an introductory statistics course. Of these 200 students, 50 are also enrolled in an introductory accounting course. There are an additional 250 business students enrolled in accounting but not enrolled in statistics. If a business student is selected at random, what is the probability that the student is either enrolled in accounting or statistics, but not both?
60) At a university with 1,000 business majors, there are 200 business students enrolled in an introductory statistics course. Of these 200 students, 50 are also enrolled in an introductory accounting course. There are an additional 250 business students enrolled in accounting but not enrolled in statistics. If a business student is selected at random, what is the probability that the student is enrolled in accounting?

A) 0.50
B) 0.45
C) 0.40
D) 0.05
E) None of the above

61) At a university with 1,000 business majors, there are 200 business students enrolled in an introductory statistics course. Of these 200 students, 50 are also enrolled in an introductory accounting course. There are an additional 250 business students enrolled in accounting but not enrolled in statistics. If a business student is selected at random, what is the probability that the student is enrolled in statistics?

A) 0.30
B) 0.20
C) 0.05
D) 0.25
E) None of the above

62) At a university with 1,000 business majors, there are 200 business students enrolled in an introductory statistics course. Of these 200 students, 50 are also enrolled in an introductory accounting course. There are an additional 250 business students enrolled in accounting but not enrolled in statistics. If a business student is selected at random, what is the probability that the student is enrolled in both statistics and accounting?

A) 0.25
B) 0.05
C) 0.06
D) 0.20
E) None of the above

63) At a university with 1,000 business majors, there are 200 business students enrolled in an introductory statistics course. Of these 200 students, 50 are also enrolled in an introductory accounting course. There are an additional 250 business students enrolled in accounting but not enrolled in statistics. If a business student is selected at random and found to be enrolled in statistics, what is the probability that the student is also enrolled in accounting?

A) 0.30
B) 0.25
C) 0.05
D) 0.20
E) None of the above

64) Suppose that when the temperature is between 35 and 50 degrees, it has historically rained 40% of the time. Also, historically, the month of April has had a temperature between 35 and 50 degrees on 25 days.
You have scheduled a golf tournament for April 12. What is the probability that players will experience rain and a temperature between 35 and 50 degrees?

A) 0.333  B) 0.400  C) 0.480  D) 1.000  E) 0.833

65) Suppose that, historically, April has experienced rain and a temperature between 35 and 50 degrees on 20 days. Also, historically, the month of April has had a temperature between 35 and 50 degrees on 25 days. You have scheduled a golf tournament for April 12. If the temperature is between 35 and 50 degrees on that day, what will be the probability that the players will get wet?

A) 0.556  B) 0.333  C) 0.800  D) 0.667  E) 1.000

66) At a university with 1,000 business majors, there are 200 business students enrolled in an introductory statistics course. Of these 200, 50 are also enrolled in an introductory accounting course. There are an additional 250 business students enrolled in accounting but not enrolled in statistics. If a business student is selected at random, what is the probability that the student is enrolled in neither accounting nor statistics?

A) 0.55  B) 0.45  C) 0.05  D) 0.50  E) None of the above

67) At a university with 1,000 business majors, there are 200 business students enrolled in an introductory statistics course. Of these 200, 50 are also enrolled in an introductory accounting course. There are an additional 250 business students enrolled in accounting but not enrolled in statistics. If a business student is selected at random, what is the probability that the student is not enrolled in accounting?

A) 0.50  B) 0.25  C) 0.30  D) 0.20  E) None of the above

68) At a university with 1,000 business majors, there are 200 business students enrolled in an introductory statistics course.
Of these 200, 50 are also enrolled in an introductory accounting course. There are an additional 250 business students enrolled in accounting but not enrolled in statistics. If a business student is selected at random, what is the probability that the student is not enrolled in statistics?

A) 0.80  B) 0.05  C) 0.20  D) 0.25  E) None of the above

69) A production process is known to produce a particular item in such a way that 5 percent of these are defective.
ve. If two items are randomly selected as they come off the production line, what is the probability that the second item will be defective?

A) 0.20
B) 0.18
C) 0.005
D) 0.05
E) None of the above

70) A production process is known to produce a particular item in such a way that 5 percent of these are defective. If two items are randomly selected as they come off the production line, what is the probability that both are defective (assuming that they are independent)?

A) 0.0025
B) 0.0100
C) 0.0250
D) 0.1000
E) 0.2000

71) A company is considering producing some new Gameboy electronic games. Based on past records, management believes that there is a 70 percent chance that each of these will be successful and a 30 percent chance of failure. Market research may be used to revise these probabilities. In the past, the successful products were predicted to be successful based on market research 90 percent of the time. However, for products that failed, the market research predicted these would be successes 20 percent of the time. If market research is performed for a new product, what is the probability that the results indicate a successful market for the product and the product is actually not successful?

A) 0.06
B) 0.27
C) 0.07
D) 0.24
E) 0.63

72) A company is considering producing some new Gameboy electronic games. Based on past records, management believes that there is a 70 percent chance that each of these will be successful and a 30 percent chance of failure. Market research may be used to revise these probabilities. In the past, the successful products were predicted to be successful based on market research 90 percent of the time. However, for products that failed, the market research predicted these would be successes 20 percent of the time. If market research is performed for a new product, what is the probability that the results indicate an unsuccessful market for the product and the product is actually successful?

A) 0.63
B) 0.06
C) 0.21
D) 0.07
E) 0.24

73) A company is considering producing some new Gameboy electronic games. Based on past records,
management believes that there is a 70 percent chance that each of these will be successful and a 30 percent chance of failure. Market research may be used to revise these probabilities. In the past, the successful products were predicted to be successful based on market research 90 percent of the time. However, for products that failed, the market research predicted these would be successes 20 percent of the time. If market research is performed for a new product, what is the probability that the results indicate an unsuccessful market for the product and the product is actually unsuccessful?
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A) 0.10  B) 0.09  C) 0.91  D) 0.63  E) 0.90

A dry cleaning business offers a pick-up and delivery service for a 10 percent surcharge. Management believes 60 percent of customers will take advantage of this service. They are also considering offering customers the option of opening an account and receiving monthly bills. They believe 60 percent of their customers (regardless of whether or not they use the pick-up service) will use the account service. If the two services are introduced to the market, what is the probability a customer uses both services?

A) 0.36  B) 0.24  C) 0.60  D) 0.12  E) None of the above

A dry cleaning business offers a pick-up and delivery service for a 10 percent surcharge. Management believes 60 percent of the existing customers will take advantage of this service. They are also considering offering customers the option of opening an account and receiving monthly bills. They believe 60 percent of customers (regardless of whether or not they use the pick-up service) will use the account service. If the two services are introduced to the market, what is the probability a customer uses only one of these services?

A) 0.24  B) 0.60  C) 0.40  D) 0.48  E) None of the above

A dry cleaning business offers a pick-up and delivery service for a 10 percent surcharge. Management believes 60 percent of the existing customers will take advantage of this service. They are also considering offering customers the option of opening an account and receiving monthly bills. They believe 60 percent of customers (regardless of whether or not they use the pick-up service) will use the account service. If the two services are introduced to the market, what is the probability a customer uses neither of these services?

A) 0.24  B) 0.36  C) 0.80  D) 0.16  E) None of the above
However, for products that failed, the market research predicted these would be successes 20 percent of the time. If market research is performed for a new product, what is the probability that the product will be successful if the market research indicates a failure?

A) 0.20  B) 0.91  C) 0.90  D) 0.23  E) 0.63

79) Which distribution is helpful in testing hypotheses about variances?  
A) normal distribution  
B) $F$ distribution  
C) exponential distribution  
D) Poisson distribution  
E) binomial distribution

80) A company is considering producing two new electronic games designed for the popular Gameboy toy. Based on market data, management believes there is a 60 percent chance that a "cops and robbers" game will be successful and a 40 percent chance that a "let's play house" game will be successful. As these products are completely different, it may be assumed that the success of one is totally independent of the success of the other. If two products are introduced to the market, what is the probability that both are successful?

A) 0.24
B) 0.12
C) 0.36
D) 0.60
E) None of the above

81) A company is considering producing two new electronic games designed for the popular Gameboy toy. Based on market data, management believes that there is a 60 percent chance that a "cops and robbers" game will be successful and a 40 percent chance that "let's play house" game will be successful. As these products are completely different, it may be assumed that the success of one is totally independent of the success of the other. If two products are introduced to the market, what is the probability that both are failures?

A) 0.36
B) 0.80
C) 0.24
D) 0.16
E) None of the above

82) A company is considering producing some new Gameboy electronic games. Based on past records, management believes that there is a 70 percent chance that each of these will be successful and a 30 percent chance of failure. Market research may be used to revise these probabilities. In the past, the successful products were predicted to be successful based on market research 90 percent of the time. However, for products that failed, the market research predicted these would be successes 20 percent of the time. If market research is performed for a new product, what is the probability that the results indicate a successful market for the product and the product actually is successful?

A) 0.54
B) 0.63
C) 0.60
D) 0.90
E) None of the above

83) The expected value of a probability distribution is

A) the variance of the distribution.
B) the probability density function.
C) the range of continuous values from point A to point B, inclusive.
D) the measure of the spread of the distribution.
E) the average value of the distribution.

84) Which of the following is not true for discrete random variables?

A) A binomial random variable is considered discrete.
B) The expected value is the weighted average of the values.
C) They can assume only a countable number of values.
D) The probability values always sum up to 1.
E) The probability of each value of the random variable must be 0.

85) The number of phone calls coming into a switchboard in the next five minutes will either be 0, 1, or 2. The probabilities are the same for each of these (1/3). If X is the number of calls arriving in a five-minute time period, what is the mean of X?

A) 4/3
B) 2/3
C) 1/3
D) 1
86) The number of phone calls coming into a switchboard in the next five minutes will either be 0, 1, 2, 3, 4, 5, or 6. The probabilities are the same for each of these (1/7). If X is the number of calls arriving in a five-minute time period, what is the mean of X?
   A) 3
   B) 4
   C) 5
   D) 2
   E) None of the above

87) A discrete random variable has a mean of 400 and a variance of 64. What is the standard deviation?
   A) 8
   B) 20
   C) 64
   D) 400
   E) None of the above

88) Which of the following is not true about continuous random variables?
   A) The area under each of the curves represents probabilities.
   B) They can only be integer values.
   C) The entire area under each of the curves equals 1.
   D) They have an infinite set of values.
   E) Some may be described by uniform distributions or exponential distributions.

89) Historical data indicates that only 20% of cable customers are willing to switch companies. If a binomial process is assumed, then in a sample of 20 cable customers, what is the probability that exactly 2 customers would be willing to switch their cable?
   A) 0.1
   B) 0.04
   C) 0.794
   D) 0.206
   E) 0.137

90) Historical data indicates that only 20% of cable customers are willing to switch companies. If a binomial process is assumed, then in a sample of 20 cable customers, what is the probability that no more than 3 customers would be willing to switch their cable?
   A) 0.20
   B) 0.411
   C) 0.15
   D) 0.589
   E) 0.85

91) Properties of the normal distribution include
   A) use in queuing.
   B) a discrete probability distribution.
   C) a continuous bell-shaped distribution.
   D) the number of trials is known and is either 1, 2, 3, 4, 5, etc.
   E) the random variable can assume only a finite or limited set of values.

92) Which of the following characteristics is true for a normal probability distribution?
   A) It is symmetrical.
   B) The area under the curve is 1.
   C) The midpoint is also the mean.
   D) Sixty-eight percent of the area under the curve lies within one standard deviation of the mean.
   E) All of the above are true.

93) The number of cell phone minutes used by high school seniors follows a normal distribution with...
mean of 500 and a standard deviation of 50. What is the probability that a student uses fewer than 600 minutes?

A) 0.023
B) 0
C) 0.841
D) 0.977
E) None of the above

94) The number of cell phone minutes used by high school seniors follows a normal distribution with a mean of 500 and a standard deviation of 50. What is the probability that a student uses fewer than 400 minutes?

A) 0.159
B) 0
C) 0.023
D) 0.977
E) None of the above

95) The number of cell phone minutes used by high school seniors follows a normal distribution with a mean of 500 and a standard deviation of 50. What is the probability that a student uses more than 350 minutes?

A) 0.999
B) 0.618
C) 0.001
D) 0.382
E) None of the above

96) The number of cell phone minutes used by high school seniors follows a normal distribution with a mean of 500 and a standard deviation of 50. What is the probability that a student uses more than 580 minutes?

A) 0.0548
B) 0.848
C) 0.903
D) 0.152
E) None of the above

97) Data for a particular subdivision near downtown Houston indicate that the average price per square foot for a home is $100 with a standard deviation of $5 (normally distributed). What is the probability that the average price per square foot for a home is greater than $110?

A) 0.977
B) 0
98) Data for a particular subdivision near downtown Houston indicate that the average price per square foot for a home is $100 with a standard deviation of $5 (normally distributed). What is the probability that the average price per square foot for a home is greater than $90?
A) 0.159
B) 0.977
C) 0.023
D) 0
E) None of the above

99) Data for a particular subdivision near downtown Houston indicate that the average price per square foot for a home is $100 with a standard deviation of $5 (normally distributed). What is the probability that the average price per square foot for a home is less than $85?
A) 0.999
B) 0.618
C) 0.382
D) 0.001
E) None of the above

100) Data for a particular subdivision near downtown Houston indicate that the average price per square foot for a home is $100 with a standard deviation of $5 (normally distributed). What is the probability that the average price per square foot for a home is less than $108?
A) 0.152
B) 0.848
C) 0.945
D) 0.097
E) None of the above

101) The time required to complete a project is normally distributed with a mean of 80 weeks and a standard deviation of 10 weeks. The construction company must pay a penalty if the project is not finished by the due date in the contract. If a construction company bidding on this contract puts in a due date of 80 weeks, what is the probability that they will have to pay a penalty?
A) 0.500
B) 1/8
C) 1.000
D) 0
E) None of the above

102) The time required to complete a project is normally distributed with a mean of 80 weeks and a standard deviation of 10 weeks. The construction company must pay a penalty if the project is not finished by the due date in the contract. If a construction company bidding on this contract wishes to be 90 percent sure of finishing by the due date, what due date (project week #) should be negotiated?
A) 81.28
B) .81954
C) 92.8
D) 81.82
E) None of the above
103) The time required to travel downtown at 10 a.m. on Monday morning is known to be normally distributed with a mean of 40 minutes and a standard deviation of 5 minutes. What is the probability that it will take less than 40 minutes?
   A) 1.00
   B) 0.80
   C) 0.20
   D) 0.50
   E) None of the above

104) The time required to travel downtown at 10 a.m. on Monday morning is known to be normally distributed with a mean of 40 minutes and a standard deviation of 5 minutes. What is the probability that it will take less than 35 minutes?
   A) 0.53983
   B) 0.15866
   C) 0.46017
   D) 0.84134
   E) None of the above

105) The time required to travel downtown at 10 a.m. on Monday morning is known to be normally distributed with a mean of 40 minutes and a standard deviation of 5 minutes. What is the probability that it will take more than 40 minutes?
   A) 0.0625
   B) 0.5000
   C) 0.2500
   D) 1.000
   E) None of the above

106) Queuing Theory makes use of the
   A) uniform probability distribution.
   B) binomial probability distribution.
   C) Poisson probability distribution.
   D) normal probability distribution.
   E) None of the above

107) The number of cars passing through an intersection in the next five minutes can usually be described by the
   A) exponential distribution.
   B) Poisson distribution.
   C) normal distribution.
   D) uniform distribution.
   E) None of the above

108) Arrivals at a fast-food restaurant follow a Poisson distribution with a mean arrival rate of 16 customers per hour. What is the probability that in the next hour there will be exactly 12 arrivals?
   A) 0.7500
   B) 0.0661
   C) 0.1322
   D) 0.0000
   E) None of the above

109) Arrivals at a fast-food restaurant follow a Poisson distribution with a mean arrival rate of 16 customers
per hour. 109)
What is the probability that in the next hour there will be exactly 8 arrivals?
A) 1.000
B) 0.175
C) 0.825
D) 0.200
E) None of the above

110) Which of the following statements concerning the $F$ distribution is true?

A) The $F$ distribution is discrete.
B) The $F$ distribution is symmetrical.
C) The $F$ distribution is useful in modeling customer arrivals.
D) The $F$ distribution is interchangeable with the normal distribution for large sample sizes.
E) The $F$ distribution is useful in testing hypotheses about variance.

111) What is the $F$ value associated with $\alpha = 0.05$, numerator degrees of freedom (df$_1$) equal to 4, and denominator degrees of freedom (df$_2$) equal to 9?

A) 1.80
B) 6.0
C) 0.11
D) 0.18
E) 3.63

112) Which of the following characteristics is not true for the exponential distribution?

A) It is used to describe the times between customer arrivals.
B) The variance is the square of the expected value.
C) It is also called the negative exponential distribution.
D) It is used in dealing with queuing problems.
E) It is discrete probability distribution.

113) The length of time that it takes the tollbooth attendant to service each driver can typically be described by the
A) uniform distribution.
B) Poisson distribution.
C) exponential distribution.
D) normal distribution.
E) None of the above

114) The Department of Motor Vehicles (DMV) can service customers at a rate of 20 per hour (or 1/3 per minute) when it comes to license renewals. The service time follows an exponential distribution. What is the probability that it will take less than 2 minutes for a particular customer to get a license renewal?
A) 0.487
B) 0.1
C) 1
D) 0
E) 0.513

115) The Department of Motor Vehicles (DMV) can service customers at a rate of 20 per hour (or 1/3 per minute) when it comes to license renewals. The service time follows an exponential distribution. What is the probability that it will take less than 3 minutes for a particular customer to get a renewal?
116) Drivers arrive at a toll booth at a rate of 3 per minute during peak traffic periods. The time between consecutive driver arrivals follows an exponential distribution. What is the probability that takes less than 1/2 of a minute between consecutive drivers?
A) 0.223  B) 0.777  C) 0.167  D) 1  E) 0.5

117) Drivers arrive at a toll booth at a rate of 3 per minute during peak traffic periods. The time between consecutive driver arrivals follows an exponential distribution. What is the probability that takes more than 1/3 of a minute between consecutive drivers?
A) 0.632  B) 0.632  C) 0.111  D) 0.368  E) Not enough information given

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

118) An urn contains 7 blue and 3 yellow chips. If the drawing of chips is done with replacement, determine the probability of:
(a) drawing three yellow chips.
(b) drawing a blue chip on the first draw and a yellow chip on the second draw.
(c) drawing a blue chip on the second draw given that a yellow chip was drawn on the first draw.
(d) drawing a yellow chip on the second draw given that a blue chip was drawn on the first draw.
(e) drawing a yellow chip on the second draw given that a yellow chip was drawn on the first draw.

119) A market research study is being conducted to determine if a product modification will be well received by the public. A total of 1,000 consumers are questioned regarding this product. The table below provides information regarding this sample.

<table>
<thead>
<tr>
<th></th>
<th>Positive Reaction</th>
<th>Neutral Reaction</th>
<th>Negative Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>240</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>Female</td>
<td>260</td>
<td>220</td>
<td>120</td>
</tr>
</tbody>
</table>

(a) What is the probability that a randomly selected male would find this change unfavorable (negative)?
(b) What is the probability that a randomly selected person would be a female who had a positive reaction?
(c) If it is known that a person had a negative reaction to the study, what is the probability that the person is male?

120) In a production run of 300 units, there are exactly 20 defective items and 280 good items.
(a) What is the probability that a randomly selected item is defective?
(b) If two items are sampled without replacement, what is the probability that both are good?
(c) If two items are randomly sampled without replacement, what is the probability that the first is good but the second is defective?

121) A new television program was viewed by 200 people (120 females and 80 males). Of the females, 60 liked the program and 60 did not. Of the males, 60 of the 80 liked the program.
(a) What is the probability that a randomly selected individual liked the program?
(b) If a male in this group is selected, what is the probability that he liked the program?
What is the probability that a randomly selected individual is a female and liked the program?

122) Colonel Motors (an automobile company) has prepared a marketing campaign for its best selling car. The focus of the campaign is quality, and it is claimed that 97 percent of the purchasers of this car have no complaints in the first year. You and your sister Kim have each purchased one of these cars.
(a) What is the probability that neither of you has a complaint about the car in the first year if the advertising claim is true?
(b) What is the probability that exactly one of you has a complaint about the car in the first year if the advertising claim is true?

123) A local "home TV repair service" company has two repairmen who make all of the home repairs. The company sends Repairman D on 70 percent of all jobs, because the likelihood of a "second follow-up call" within a week is only 0.08 compared to 0.20 for Repairman K. If you had a recent repair job that is going to require a second follow-up call, what is the probability that Repairman K did your initial repair work?

124) Our department store is having a sale on personal computers, of which three are in stock (no rain checks). There is a certain probability of selling none. The probability of selling one is twice as great as the probability of selling none. The probability of selling two is three times the probability of selling none. Finally, the probability of selling all the personal computers is four times as great as the probability of selling none. In a table, list the outcomes and their probabilities. Hint: Let the probability of selling none equal x.

125) ABC Manufacturing has 6 machines that perform a particular task. Breakdowns occur frequently for this machine. Past records indicate that the number of breakdowns that occur each day is described by the following probability distribution:

<table>
<thead>
<tr>
<th>Number of Breakdowns</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.4</td>
</tr>
<tr>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>0.1</td>
</tr>
<tr>
<td>More than 3</td>
<td>0.0</td>
</tr>
</tbody>
</table>

(a) What is the expected number of breakdowns in any given day?
(b) What is the variance for this distribution?
(c) What is the probability that there will be at least 2 breakdowns in a day?

126) Fast Service Store has maintained daily sales records on the various size "Cool Drink" sales.

<table>
<thead>
<tr>
<th>&quot;Cool Drink&quot; Price</th>
<th>Number Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0.50</td>
<td>75</td>
</tr>
<tr>
<td>$0.75</td>
<td>120</td>
</tr>
<tr>
<td>$1.00</td>
<td>125</td>
</tr>
<tr>
<td>$1.25</td>
<td>80</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
</tr>
</tbody>
</table>

Assuming that past performance is a good indicator of future sales,
(a) what is the probability of a customer purchasing a $1.00 "Cool Drink?"
(b) what is the probability of a customer purchasing a $1.25 "Cool Drink?"
(c) what is the probability of a customer purchasing a "Cool Drink" that costs greater than or equal to $1.00?
(d) what is the expected value of a "Cool Drink"?
what is the variance of a "Cool Drink"?

127) In a given office, the color printer breaks down with a probability of 20% in any month. A binomial process is assumed for a period of 10 months.
   (a) What is the probability that the printer breaks down exactly 2 times?
   (b) What is the probability that the printer breaks down at most 1 time?
   (c) What is the probability that the printer breaks down more than once?

128) A southwestern tourist city has records indicating that the average daily temperature in the summer is 82 degrees F, which is normally distributed with a standard deviation of 3 degrees F. Based on these records, determine:
   (a) the probability of a daily temperature between 79 degrees F and 85 degrees F.
   (b) the probability that the daily temperature exceeds 90 degrees F.
   (c) the probability that the daily temperature is below 76 degrees F.

129) Using the table for finding the areas under normal curves, find the area under a normal curve with a mean of 200 and a standard deviation of 10 between the values of:
   (a) 200 to 205.
   (b) 195 to 205.
   (c) 200 to 215.
   (d) 195 to 215.
   (e) 186.5 to 217.

130) The time required to complete a project is known to be normally distributed with a mean of 44 weeks and a standard deviation of 8 weeks.
   (a) What is the probability that the project is finished in 40 weeks or fewer?
   (b) What is the probability that the project is finished in 52 weeks or fewer?
   (c) There is an 95 percent chance that the project will be finished in fewer than how many weeks?

131) Compute the $F$ value based on the following:
   (a) $df_1 = 2$, $df_2 = 4$, $\alpha = 0.01$
   (b) $df_1 = 3$, $df_2 = 6$, $\alpha = 0.05$

132) A call center receives calls from customers at a rate of 2 per min. The time between customer calls follows an exponential distribution.
   (a) What is the probability that it takes 1/3 of a minute or less between consecutive customer calls?
   (b) What is the probability that it take 1/2 of a minute or more between consecutive customer calls?

133) Arrivals in a university advising office during the week of registration are known to follow a Poisson distribution with an average of 4 people arriving each hour.
   (a) What is the probability that exactly 4 people will arrive in the next hour?
   (b) What is the probability that exactly 5 people will arrive in the next hour?

134) Explain why event probabilities range from 0 to 1.

135) Using a standard deck of 52 cards, explain why the situation of drawing a 7 and a club is not collectively exhaustive.

136) Name five common probability distributions.

137) If two events $(A,B)$ are mutually exclusive, what is the probability of event $A$ or event $B$ occurring?
138) If two events \((A, B)\) are not mutually exclusive, what is the probability of event \(A\) or event \(B\) occurring?

139) If two events \((A, B)\) are independent, what is their joint probability?

140) If two events \((A, B)\) are dependent, what is the conditional probability of \(P(A|B)\)?

141) If two events \((A, B)\) are independent, then the conditional probability of \(P(A|B) = \) _______.

142) Explain what a discrete random variable is.

143) The exponential distribution often describes ________.

144) List the two parameters of the normal distribution.

145) In what way is the \(F\) distribution often used?

146) List the parameter(s) of the Poisson distribution.
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<tr>
<td>41</td>
<td>B</td>
<td>42</td>
<td>A</td>
<td>43</td>
<td>E</td>
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<td>C</td>
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<td>E</td>
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<tr>
<td>46</td>
<td>C</td>
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<td>B</td>
<td>48</td>
<td>D</td>
<td>49</td>
<td>E</td>
<td>50</td>
<td>A</td>
</tr>
</tbody>
</table>
52) B
53) D
54) C
55) C
56) C
57) C
58) E
59) C
60) D
61) B
62) B
63) B
64) A
65) C
66) A
67) E
68) A
69) D
70) A
71) A
72) D
73) D
74) C
75) A
76) D
77) D
78) D
79) B
80) A
81) C
82) B
83) E
84) E
85) D
86) A
87) A
88) B
89) E
90) B
91) C
92) E
93) D
94) C
95) A
96) A
97) D
98) B
99) D
100) C
101) A
102) C
103) D
104) B
105) B
106) C
107) B
108) B
109) E
110) E
111) E
112) E
113) C
114) A
115) A
116) B
117) D

118) (a) 0.027 (b) 0.210 (c) 0.700 (d) 0.300 (e) 0.300
119) (a) 100/400 = 0.25 (b) 260/1000 = 0.260 (c) 100/220 = 0.4545
120) (a) 20/300 = 0.067 (b) (280/300)(279/299) = 0.871 (c) (280/300)(20/299) = 0.062
121) (a) 120/200 = 0.60 (b) 60/80 = 0.75 (c) 60/200 = 0.30
122) (a) 0.97(0.97) = 0.9409 (b) 0.03(0.97) + 0.97(0.03) = 0.0582
123) (a) 120/200 = 0.60 (b) 60/80 = 0.75 (c) 60/200 = 0.30
124) Outcome | Probability
--- | ---
Sell 0 | 0.1
Sell 1 | 0.2
Sell 2 | 0.3
Sell 3 | 0.4

125) (a) expected value = 1.0 (b) variance = 1(.4) + 0(.3) + 1(.2) + 4(.1) = 1.0 (c) P(2 or more) = 0.2 + 0.1 = 0.3
126) (a) 125/400 = 0.3125 (b) 80/400 = 0.20 (c) 205/400 = 0.5125
(d) .5(1.875) + .75(.3) + 1(.3125) + 1.25(.2) = .88125 (e) 0.064
127) (a) P(r=2) = 0.3020 (b) P(r≤1) = 0.3758 (c) P(r>1) = 0.6242
128) (a) P(79<X<85) = 0.68268 (b) P(X>90) = 0.00383 (c) P(X<76) = 0.02775
129) (a) 0.19146 (b) 0.38293 (c) 0.43319 (d) 0.62466 (e) 0.86693
130) (a) 0.30854 (b) 0.84135 (c) 44 + 1.645(8) = 57.16
131) (a) 18 (b) 4.76
132) (a) 0.487 (b) 0.368
133) (a) P(X=4) = 0.1954 (b) P(X=5) = 0.1563
134) The number 0 represents no chance of occurrence, while 1 represents a 100 percent chance of occurrence. Any number between 0 and 1 represents that particular event's chance of occurrence. Any negative number or number exceeding 1 has no meaning for an event probability.
135) It is possible to draw other cards that are non-clubs and also not a 7.
136) Answers could vary, but may include: binomial, normal, $F$, exponential, and Poisson.
137) $P(A \text{ or } B) = P(A) + P(B)$
138) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
139) $P(AB) = P(A) \times P(B)$
140) $P(A \mid B) = P(AB) \mid P(B)$
141) $P(A)$
142) A discrete random variable has a probability value assigned to each event. These values must be between 0 and 1, and they must sum to 1.
143) the time required to service a customer
144) mean ($\mu$) and standard deviation ($\sigma$)
145) It is helpful in testing hypotheses about variances.
146) the mean and the variance $\lambda$