1. An urn contains two white balls and two red balls. In a carnival game, balls are drawn from this urn, one at a time, without replacement, until a red ball is drawn. A player has to pay \$1 to play the game and receives \$0.50 for each ball drawn. What is the expected earnings of a player in dollars?

a. $-\frac{1}{4}$ b. $-\frac{1}{12}$ c. $-\frac{1}{6}$ d. $-\frac{1}{24}$ e. 0

2. The probability distribution of a random variable X is

k	Pr(X = k)
5	0.2
10	0.6
15	0.2

Find the variance of X.

a. 10 b. 115 c. $\sqrt{10}$ d. $\sqrt{115}$ e. $\sqrt{70}$

3. An urn contains 2 black balls and 4 green balls. Ten balls are drawn, one at a time, with replacement. What is the probability that exactly four of these 10 balls are green?

a. $\binom{10}{4}\left(\frac{2}{3}\right)^6\left(\frac{1}{3}\right)^4$ b. $\left(\frac{2}{3}\right)^4$ c. $\left(\frac{2}{3}\right)^4\left(\frac{1}{3}\right)^6$

d. $\binom{10}{4}\left(\frac{2}{3}\right)^4\left(\frac{1}{3}\right)^6$ e. $\left(\frac{2}{3}\right)^6\left(\frac{1}{3}\right)^4$

4. A printed circuit board (PCB) contains 20 transistors. The probability of a transistor failing in the first 100 hours of operation is 0.01. The PCB will function so long as at least 18 transistors are working. Assuming that the failure of the transistors is independent of one another, what is the probability that the P C B will **not** function after 100 hours?

a. $1 - \left[\binom{20}{18} (0.99)^{18} (0.01)^2 + \binom{20}{19} (0.99)^{19} (0.01) + (0.99)^{20}\right]$

b. $1 - \left[\binom{20}{18} (0.99)^2 (0.01)^{18} + \binom{20}{19} (0.99) (0.01)^{19} + (0.01)^{20}\right]$

c. $\binom{20}{18} (0.99)^{18} (0.01)^2 + \binom{20}{19} (0.99)^{19} (0.01) + (0.99)^{20}$

d. $(0.99)^{18} (0.01)^2 + (0.99)^{19} (0.01) + (0.99)^{20}$

e. $(0.99)^2 (0.01)^{18} + (0.99) (0.01)^{19} + (0.01)^{20}$

5. Thirty percent of the students in a campus are opposed to the death penalty (the remaining 70% favor it). Let X be the number of students opposed to the death penalty in a sample of 100 students. What is the standard deviation of X?

a. 21 b. $\sqrt{21}$ c. $\sqrt{30}$ d. 30 e. 70

6. What is the area under the standard normal curve between z = –0.5 and z = 1?

a. .8413 b. .4672 c. .1498 d. .6915 e. .5328

7. The shaded area under the standard normal curve is 0.4599. Find the value of z.

a. 2 b. .1

c. 1.75 d. 1.5 e. 1

8. The lifetime of a radiator hose is normally distributed with a mean of 1000 hours and a standard deviation of 100 hours. If the manufacturer wants to be 99.95% sure that the hose will not fail before replacement, after how many hours should they recommend that the hose be replaced?

a. 1000 b. 740 c. 830 d. 670 e. 690

9. The birth weights of newborn rhinoceros is normally distributed with mean 20 lbs and standard deviation 2 lbs. Find the probability that the weight of a newborn rhinoceros is between 19 and 23 lbs.

a. 0.6247 b. 0.7333 c. 0.84 d. 0.6174 e. .7257

10. Four-fifths of the population in a county opposes a county income tax proposal. A sample of 25 county residents is chosen. Use the normal approximation to estimate the probability that the number of residents in the sample who oppose the tax is between 18 and 21, inclusive.

a. .5328 b. .5678 c. .5468 d. .3721 e. .4931

11. What is the equation of the line that is perpendicular to the line $2x + 3y = 4$ and passes through the point (1,3)?

a. $y = \frac{2}{3}(x - 1) + 3$ b. $y = -\frac{3}{2}(x - 1) + 3$ c. $y = -\frac{1}{3}(x - 1) + 3$

d. $y = \frac{1}{3}(x - 1) + 3$ e. $y = \frac{3}{2}(x - 1) + 3$

12. In which of the following diagrams is the feasible set of $\begin{cases} x - y \le 0 \\ 2x + 3y \ge 6 \end{cases}$ left unshaded?

a. b. c.

d. e.

13. The long distance rates to Malaysia on AT & T is $2 for the first minute and $1.50 for each minute thereafter. The rates on MCI are $3 for the first minute and $1.25 for each minute thereafter. Find the length of the call for which both companies charge the same amount.

a. 4 minutes b. 4.5 minutes c. 5 minutes

d. 2 minutes e. MCI always costs more than AT & T.

14. Pivot the following matrix about the circled entry $\begin{bmatrix} 1 & 2 & 3 \\ 3 & 3 & 6 \\ 1 & 3 & 4 \end{bmatrix}$

a. $\begin{bmatrix} 1 & 0 & 1 \\ 3 & 3 & 6 \\ 1 & 0 & -2 \end{bmatrix}$ b. $\begin{bmatrix} -1 & 0 & -1 \\ 3 & 3 & 6 \\ -2 & 0 & -2 \end{bmatrix}$ c. $\begin{bmatrix} 1 & 0 & -1 \\ 3 & 1 & 2 \\ 1 & 0 & -2 \end{bmatrix}$

d. $\begin{bmatrix} -1 & 0 & -1 \\ 1 & 1 & 2 \\ -2 & 0 & -2 \end{bmatrix}$ e. $\begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

15. Which of the following statements about the solution of the system

$$\begin{cases} x + 2y - z = 1 \\ 2x + 5y - z = 3 \\ x + 3y + 2z = 6 \end{cases}$$ is correct?

a. The system has infinitely many solutions

b. The system does not have any solutions

c. $x = 5$ d. $x = 1$ e. $x = -1$

16. Find the general solution to the system whose augmented matrix is

$$\begin{array}{c} \begin{matrix} x & y & z & w \end{matrix} \\ \left[\begin{array}{cccc|c} 1 & 2 & 0 & 3 & 1 \\ 0 & 0 & 2 & 1 & 5 \\ 0 & 0 & 0 & 1 & 1 \end{array}\right] \end{array} .$$

a. $x = -2 - 2y$
y = any value
z = any value
$w = 1$

b. $x = 1 - 2y$
y = any value
$z = 5$
$w = 0$

c. $x = -2 - 2y$
y = any value
$z = 2$
$w = 1$

d. $x = 2$
$y = 0$
$z = 2$
$w = 1$

e. $x = 0$
$y = 1$
$z = 2$
$w = 1$

17. Let $A = \begin{bmatrix} 1 & 3 & 4 \\ 2 & -1 & 0 \\ 1 & 3 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 3 & -1 & 1 \\ 1 & 4 & 1 & 3 \\ 2 & 1 & 3 & 3 \end{bmatrix}$. Find the entry in the second row and the third column of AB.

a. 19 b. −3 c. AB is not defined d. 4 e. 5

18. Let A be a 3x4 matrix, B a 3x3 matrix, C a 2x3 matrix and D a 4x4 matrix. Which of the following matrices is **not** defined?

a. AD + BA b. C + CB c. C(AD) d. AD + CA e. CBA

19. Given that $\begin{bmatrix} 1 & -1 & 2 \\ 2 & -3 & 3 \\ 1 & -1 & 1 \end{bmatrix}^{-1} = \begin{bmatrix} 0 & -1 & 3 \\ 1 & -1 & 1 \\ 1 & 0 & -1 \end{bmatrix}$ solve for x in the following system of equations. $\begin{cases} x - y + 2z = p \\ 2x - 3y + 3z = q \\ x - y + z = r \end{cases}$

a. x = q + r b. x = p − q + 2r c. x = p − q + r

d. x = 2p − 3q + 3r e. x = 3r − q

20. If $A = \begin{bmatrix} 2 & 1 \\ 7 & 3 \end{bmatrix}$, find A^{-1}.

a. $\begin{bmatrix} \frac{-3}{13} & \frac{1}{13} \\ \frac{7}{13} & \frac{-2}{13} \end{bmatrix}$ b. $\begin{bmatrix} -3 & 1 \\ 7 & -2 \end{bmatrix}$ c. $\begin{bmatrix} \frac{2}{13} & \frac{7}{13} \\ \frac{1}{13} & \frac{3}{13} \end{bmatrix}$ d. $\begin{bmatrix} \frac{3}{13} & \frac{1}{13} \\ \frac{7}{13} & \frac{2}{13} \end{bmatrix}$ e. $\begin{bmatrix} 2 & -7 \\ -1 & 3 \end{bmatrix}$