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|----|-----|-----|-----|-----|-----|
| 1 | (a) | (b) | (c) | (d) | (e) |
| 2 | (a) | (b) | (c) | (d) | (e) |
| 3 | (a) | (b) | (c) | (d) | (e) |
| 4 | (a) | (b) | (c) | (d) | (e) |
| 5 | (a) | (b) | (c) | (d) | (e) |
| 6 | (a) | (b) | (c) | (d) | (e) |
| 7 | (a) | (b) | (c) | (d) | (e) |
| 8 | (a) | (b) | (c) | (d) | (e) |
| 9 | (a) | (b) | (c) | (d) | (e) |
| 10 | (a) | (b) | (c) | (d) | (e) |
| 11 | (a) | (b) | (c) | (d) | (e) |
| 12 | (a) | (b) | (c) | (d) | (e) |
| 13 | (a) | (b) | (c) | (d) | (e) |
| 14 | (a) | (b) | (c) | (d) | (e) |
| 15 | (a) | (b) | (c) | (d) | (e) |
| 16 | (a) | (b) | (c) | (d) | (e) |
| 17 | (a) | (b) | (c) | (d) | (e) |
| 18 | (a) | (b) | (c) | (d) | (e) |
| 19 | (a) | (b) | (c) | (d) | (e) |
| 20 | (a) | (b) | (c) | (d) | (e) |
| 21 | (a) | (b) | (c) | (d) | (e) |
| 22 | (a) | (b) | (c) | (d) | (e) |
| 23 | (a) | (b) | (c) | (d) | (e) |
| 24 | (a) | (b) | (c) | (d) | (e) |
| 25 | (a) | (b) | (c) | (d) | (e) |

Q 1 What is the x-intercept of the straight line $y = 3x + 6$?
(a) -2 (b) 2 (c) $(0, -2)$ (d) $(-2, 0)$ (e) $(0, 6)$

Q 2 A straight line passes through two points $(1, 1)$ and $(2, 3)$. What is the slope of this line?
(a) 1 (b) 2 (c) -1 (d) -2 (e) 0

Q 3 Which one of the following straight lines is perpendicular to the straight line of $x + y = 1$?
(a) $x - y = 1$ (b) $y + 2x = 0$ (c) $2x + y = 1$ (d) $y = 0$ (e) $x = 0$

Q 4 For what value of k will the three points $(0, 1)$, $(1, 0)$ and $(3, k)$ be on the same line?
(a) 1 (b) 2 (c) -1 (d) -2 (e) 0

Q 5 Which of the following system of linear equation has no solutions at all?
(a) $\begin{cases} x = 0 \\ y = 0 \end{cases}$ (b) $\begin{cases} x + y = 0 \\ y - x = 0 \end{cases}$ (c) $\begin{cases} x + 2y = 1 \\ y + x = 2 \end{cases}$ (d) $\begin{cases} x - y = 0 \\ y = 3 \end{cases}$ (e) $\begin{cases} x - y = 0 \\ y - x = 2 \end{cases}$

Q 6 What is the result of the following matrix multiplication?

$$\begin{bmatrix} 1 & -1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

(a) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ (c) $\begin{bmatrix} 2 \end{bmatrix}$ (d) $\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$ (e) $\begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & -3 & 3 \end{bmatrix}$

Q 7 What is the result of the following matrix multiplication?

$$\begin{bmatrix} 3 & 2 & -1 \\ 1 & 0 & -1 \end{bmatrix} \cdot \begin{bmatrix} 0 & -3 \\ 2 & -1 \\ 3 & -5 \end{bmatrix}$$

(a) $\begin{bmatrix} 1 & -6 \\ -3 & 2 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ (c) $\begin{bmatrix} 9 \end{bmatrix}$ (d) $\begin{bmatrix} -1 \\ 4 \\ 3 \end{bmatrix}$ (e) $\begin{bmatrix} 0 & -1 & 1 \\ 2 & -2 & 5 \\ -3 & 4 & 3 \end{bmatrix}$

Q 8 If $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$, which of the following is the matrix A^{-1} ?

- (a) $\begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$ (b) $\begin{bmatrix} 2 & -5 \\ 1 & 2 \end{bmatrix}$ (c) $\begin{bmatrix} 2 & -5 \\ -1 & 3 \end{bmatrix}$ (d) $\begin{bmatrix} 3 & -5 \\ -1 & 2 \end{bmatrix}$ (e) $\begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$

Q 9 Subject to the constraints

$$\begin{cases} x + 2y - 2 \leq 0 \\ x \geq 0 \\ y \geq 0 \end{cases},$$

at which of the following point the objective function $x + y$ attains the maximum?

- (a) (0, 0) (b) (0, 1) (c) (2, 0) (d) (2, 2) (e) (1, 1)

Q 10 Let $U = \{a, b, c, d, e, f, g\}$, $S = \{a, b\}$, and $T = \{b, d, e, f, g\}$. Which one is the set of $S' \cap T'$?

- (a) $\{a, b, d, e, f, g\}$ (b) $\{c\}$ (c) $\{a, b\}$ (d) $\{b, d, e, f, g\}$ (e) $\{e\}$

Q 11 Let $A = \{a, b, c\}$. How many subsets does A have?

- (a) 3 (b) 8 (c) 9 (d) 10 (e) 27

Q 12 Given that $n(S) = 9$, $n(T) = 8$, and $n(S \cup T) = 15$, what is $n(S \cap T)$?

- (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

Q 13 If there are three routes from College Park to Baltimore and five routes from Baltimore to New York. How many routes are there from College Park to New York via Baltimore?

- (a) 8 (b) 3^5 (c) 5^3 (d) 15 (e) 25

Q 14 How many ways can you choose 2 of your 10 books to put in your backpack?

- (a) 20 (b) 12 (c) 45 (d) 90 (e) 100

Q 15 Which of the follow is equal to $P(6, 3)$?

- (a) 18 (b) 120 (c) 45 (d) 90 (e) 100

Q 16 Suppose that we toss a die and observe the side that faces upward. What is the probability that an odd number will occur?

- (a) 0 (b) $\frac{1}{6}$ (c) $\frac{1}{2}$ (d) 1 (e) $\frac{3}{2}$

Q 17 In tossing a fair die, we observe the upper most face. What is the probability that the result is odd or greater than 4?

- (a) 0 (b) $\frac{1}{6}$ (c) $\frac{1}{2}$ (d) $\frac{2}{3}$ (e) 1

Q 18 Let S be a sample space and E and F events associated with S . Suppose that $\Pr(E) = 0.5$, $\Pr(F) = 0.3$, and $\Pr(E \cap F) = 0.1$. What is the value of $\Pr(E'|F')$?

- (a) 0 (b) $\frac{3}{7}$ (c) $\frac{1}{3}$ (d) $\frac{4}{7}$ (e) 1

Q 19 Suppose that E and F are two independent events and $\Pr(E) = 0.4$. What is the value of $\Pr(E|F)$?

- (a) 0 (b) 0.2 (c) 0.4 (d) 0.6 (e) 1

Q 20 Suppose that E and F are two complementary events, namely $E = F'$. What is $\Pr(E|F)$?

- (a) 0 (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) 1 (e) can not be determined

Q 21 Of the students at a certain college, 50% regularly attend the football games, 30% are first-year students, and 40% are upper-class students who do not regularly attend football games. Suppose that a student is selected at random. What is the conditional probability that the person regularly attends football games given that he is a first-year student?

- (a) 0 (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{2}{3}$ (e) 1

Q 22 If a graph has 18 edges, 4 vertices of degree 4, and the other vertices of degree 5. How many vertices will this graph have **in total**?

- (a) 4 (b) 6 (c) 8 (d) 10 (e) 12

Q 23 An American roulette has 38 number on the roulette wheel. A dollar may be bet on pair of numbers. The expected earnings for this type of bet is $-\$ \frac{2}{19}$. How much money does the bettor receive if the ball lands on one of the two numbers?

- (a) \$15 (b) \$16 (c) \$17 (d) \$18 (e) \$19

Q 24 Consider a binary symmetric channel with transition probability p . If a three digit sequence 000 is sent through the channel, what is the probability that 101 is received?

- (a) 0 (b) $p(1-p)^2$ (c) $p^2(1-p)$ (d) p^3 (e) 1

Q 25 Consider a binary linear block code of length 4 determined by a matrix

$$\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}.$$

Which of the following binary vectors is a codeword?

- (a) [1, 1, 1, 1] (b) [1, 0, 0, 0] (c) [0, 0, 0, 1] (d) [0, 1, 1, 0] (e) [1, 1, 0, 0]