TRUE AND FALSE QUESTIONS.

Question – State whether the following statements are True or False —

(1) The system of linear equations $x - y = 1$ & $2x - 2y = 3$ has a unique soln.

(2) If A & B are matrices of same size, then $AB = BA$.

(3) If A is 3×4 and B is 4×2 matrix, then $(AB)^T$ is matrix of size 2×3.

(4) The matrix $\begin{bmatrix} 1 & 2 \\ 1 & 2 \end{bmatrix}$ is not Invertible.

(5) The matrix $\begin{bmatrix} -5 & 3 \\ 2 & -1 \end{bmatrix}$ is the inverted coefficient matrix of the system of equations —
$$x + 3y = 4$$
$$2x + 5y = 7$$

(6) A diagonal matrix is both upper and lower triangular matrix at same time.

---

(7) The determinant of the matrix $A = \begin{bmatrix} 1 & 1 & 0 \\ 2 & 4 & 1 \\ 3 & 3 & 0 \end{bmatrix}$ is 2.

(8) The absolute values of minors and cofactors of the elements of a square matrix are identical.

(9) If matrix A is invertible, then A^T is also invertible.

(10) If A is a square matrix with two proportional rows, then $\det(A) = 0$.

(11) If A is a square matrix, then $\det(A^{-1}) = \dfrac{1}{\det(A)}$.

(12) If A & B are square matrices of same size, then $\det(AB) \neq \det(A).\det(B)$

---

(13) If $(2,-1)$ and $(3,1)$ are the initial and terminal points of a vector, then $(1,-2)$ is the component of the vector.

(14) The vectors $(1,2,3)$ and $(-3,2,1)$ have same magnitude.

(15) The vectors $(4,10,0)$ and $(-5,2,9)$ are orthogonal to each other.

(16) If $u = (1,3,-2,7)$ and $V = (0,7,2,2)$, then distance between u & V is $\sqrt{58}$.

---

(17) The set R^3 is a subspace of R^4.

(18) Any plane passing through the Origin is a subspace of R^3.

(19) The set $\{(1,0,0),(0,1,0),(0,0,1)\}$ of vectors in R^3 is Linearly Independent.

(20) If a set has exactly one non-zero vector, then this set must be Linearly Dependent.

(21) All linearly independent set in a subspace W is a basis for W.

(22) The basis of a vector space is not unique.

(23) If 'A' is a 3x3 matrix such that $|A| \neq 0$, then row vectors of 'A' span R^3.

(24) If 'A' is mxn matrix, then row space of 'A' and column space of 'A' have different dimensions.

---

(25) The Sum of eigenvalues of a square matrix is same as its Trace.

(26) The eigenvalues of the matrix $A = \begin{bmatrix} 2 & 0 & 0 \\ 6 & -1 & 0 \\ 7 & 2 & 4 \end{bmatrix}$ are 2, 4 and 0.

(27) The Product of eigenvalues of a square matrix is same as its Determinant.

(28) $(1,0,2)$ is the real part of the complex vector $(i+1,\ 2i,\ 2i+2)$.

(29) The characteristic polynomial of 2x2 matrix 'A' is of degree 3.

(30) A square matrix 'A' is invertible iff $\lambda = 0$ is an eigenvalue of 'A'.

(31) If a matrix 'A' of size nxn has n linearly independent eigenvectors then matrix 'A' is not Diagonalizable.

(32) If an nxn matrix 'A' has n eigenvalues, then 'A' is Diagnolizable.

(33) If 'A' is real symmetric matrix, then 'A' has complex eigenvalues.

---

(34) The inner product of two vectors cannot be a negative real no.

(35) The inner product of a vector with itself can be negative real no.

(36) If u & v are orthogonal vectors in an inner product space, then $\langle u,v \rangle \neq 0$.

(37) If u & v are unit orthogonal vectors in an inner product space, then $\|u+v\| = 2$.

(38) If $u = (3,4)$ is a vector in R^2, then the length of u is 7.

---

(39) A square matrix 'A' is Orthogonal, if $A^{-1} = A$.

(40) A square matrix 'A' is Unitary, if $A^{*} = A$.

(41) The inverse of an Orthogonal matrix is not necessarily Orthogonal.

(42) If determinant of a matrix is 1 or −1, then the matrix is Orthogonal.

(43) If a matrix 'A' is Orthogonal, then $\det(A) = 1$ or -1.

(44) Every symmetric matrix is Orthogonally Diagonalizable.

(45) In case of real matrices, Unitary and Orthogonal matrices are same.

(46) The eigenvalues of a Hermitian matrix are all real.

---

(47) If $T: V \to V$ is an operator such that $T(v) = 2$, $\forall\, v \in V$, then T is Linear.

(48) If $T: V \to W$ is an isomorphism, then kernel of T is the zero subspace.

(49) The function $T: R^2 \to R^3$ given by $T(x_1, x_2) = (2x_1 + 3x_2,\ 4x_2 - 1 - x_1,\ x_1)$ is Linear.

(50) If T is translation operator, then it is Linear.

---

(51) Every square matrix need not have LU-decomposition.

(52) The dominant eigenvalue is 5 for set of eigenvalues $\{3, 4, 5, -5\}$.

(53) If 'A' is an $m \times n$ matrix, then $A^T A$ is an $n \times n$ matrix.

(54) If 'A' is an $m \times n$ matrix, then $A^T A$ is Orthogonally diagonalizable.

(55) In Linear Programming Problems, all variables are restricted to positive values only.

(56) In LPP, a linear objective function is to be optimized.

(57) One of the quickest way to plot a constraint is to find the two points where the constraint crosses the axes and draw a straight line between these points.

(58) The graphical method is used only when LPP have exactly two unknown variables.

ANSWERS

(1) F	(11) T	(21) F	(31) F	(41) F	(51) T
(2) F	(12) F	(22) T	(32) F	(42) F	(52) F
(3) T	(13) F	(23) T	(33) F	(43) T	(53) T
(4) T	(14) T	(24) F	(34) F	(44) T	(54) T
(5) T	(15) T	(25) T	(35) T	(45) T	(55) F
(6) T	(16) T	(26) T	(36) F	(46) T	(56) T
(7) F	(17) F	(27) T	(37) F	(47) F	(57) T
(8) T	(18) T	(28) T	(38) F	(48) T	(58) T
(9) T	(19) T	(29) F	(39) T	(49) F	
(10) T	(20) F	(30) F	(40) F	(50) T	

OBJECTIVE TYPE QUESTIONS

Question – Select one of alternatives from the following questions as your answer —

① Which of the following is Reduced Row Echelon form —

(a) $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & 3 \end{bmatrix}$ (d) None

② The inverse of the matrix $\begin{bmatrix} -2 & 3 \\ -1 & 1 \end{bmatrix}$ is —

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

③ If $A = \begin{bmatrix} 2 & -1 & 5 \\ 3 & 4 & 2 \end{bmatrix}$, then $((A^T)^T)^T$ is —

(a) $\begin{bmatrix} 2 & -1 & 5 \\ 3 & 4 & 2 \end{bmatrix}$ (b) $\begin{bmatrix} 2 & 3 \\ -1 & 4 \\ 5 & 2 \end{bmatrix}$ (c) $(A^3)^T$ (d) does not exist.

④ The inverse of an invertible Upper triangular matrix is —

(a) Upper triangular (b) lower triangular (c) diagonal (d) does not exist.

⑤ If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then matrix A is —

(a) Upper triangular (b) lower triangular (c) diagonal (d) all of the above.

---

⑥ If $A = \begin{bmatrix} 3 & 2 & -1 \\ -1 & 8 & 7 \\ 4 & -3 & 1 \end{bmatrix}$, then the values of minor and cofactor corresponding to the entry a_{23} are — (a) $1, -1$ (b) $-1, 1$ (c) $-17, 17$ (d) $17, -17$

⑦ If the determinant of $A = \frac{1}{2}$, then $\det(A^{-1})$ is —

(a) $\frac{1}{2}$ (b) 2 (c) $-\frac{1}{2}$ (d) None

⑧ If $A = \begin{bmatrix} 2 & -1 \\ 5 & -2 \end{bmatrix}$, then adjoint of A is —

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

---

⑨ If $u = (2,1,3)$ and $v = (-1,3,2)$, then the distance between u & v is —

(a) $\sqrt{13}$ (b) $\sqrt{14}$ (c) $\sqrt{15}$ (d) $\sqrt{17}$.

⑩ If $\|u\| = 1$, $\|v\| = 2$, $u.v = 0$, then the angle between u & v is —

(a) 0 (b) π (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{3}$.

⑪ If θ is the angle between $u = (1,2,3)$ & $v = (3,2,1)$ then $\cos\theta$ is —

(a) $\frac{10}{\sqrt{14}\sqrt{14}}$ (b) $\frac{5}{7}$ (c) both (a) & (b) (d) Neither (a) nor (b)

⑫ The vector $(2,0,1,-1)$ is orthogonal to the vector —

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

⑬ If $u = (2,-3,1)$ and $v = (0,5,7)$ are two vectors in R^3, then $u \times v$ is —

(a) $(-26,14,10)$ (b) $(-26,-14,10)$ (c) $(-26,-14,-10)$ (d) $(26,14,10)$

---

(14) Which of the following set of vectors in R^3 is a basis —

(a) $\{(1,2,-4), (-8,14,6), (3,4,-9), (1,0,0)\}$ (b) $\{(1,2,5), (2,5,1), (1,5,2)\}$

(c) $\{(1,2,3), (0,0,0), (3,2,1)\}$ (d) $\{(3,2,-4), (24,16,-32)\}$

(15) The dimension of the vector space of 4x3 matrices of real numbers under the usual addition and scalar multiplication of matrices is —

(a) 7 (b) 12 (c) 6 (d) Infinite

(16) For which value of a and b the vector $W = (1,-3,4)$ is a linear combination of $u = (2,4,0)$ and $V = (1,4,-2)$

(a) $a=1$, $b=-2$ (b) $a=-3$, $b=-2$ (c) $a=-1$, $b=-2$ (d) None

(17) If 'A' is a 4x5 matrix with rank 3, then nullity of 'A' is —

(a) 1 (b) 2 (c) 3 (d) 0

(18) If the rank of a 4x4 matrix is equal to 3, then —

(a) the matrix is invertible (b) the dimension of null space is 4.

(c) the dimension of null space is 3 (d) the dimension of row space is 3.

(19) Let $S = \{V_1, V_2, V_3\}$ is a basis of V and $v = 2V_1 - 3V_2$. Then the coordinate vector of v relative to S is —

(a) $(2,3,0)$ (b) $(2,0,-3)$ (c) $(2,-3,0)$ (d) $(2,-3)$.

---

(20) The eigenvalues of a matrix, $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 2 & 0 \\ 0 & 3 & -1 \end{bmatrix}$ are —

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

(21) If $\{1,2,3\}$ are the eigenvalues of a matrix, then its Trace & Determinant are—

(a) 3, 3 (b) 4, 4 (c) 6, 6 (d) 5, 5

(22) If '0' is an eigenvalue of a square matrix 'A', then A is —

(a) invertible (b) not invertible (c) an identity matrix (d) None

(23) The eigenvalues of a real symmetric matrix are —

(a) complex only (b) complex and real both (c) always real (d) always zero.

(24) If 'λ' is an eigenvalue of nxn matrix A, then system of eqn. $(\lambda I - A)x = 0$ has —

(a) trivial soln. only (b) non-trivial solutions (c) both trivial & non-trivial (d) No Soln.

---

(25) If $u = (1,-2,3)$, $V = (2,0,1)$ and $k=1$, then the value of $\langle ku, v\rangle$ is —

(a) 10 (b) -10 (c) 5 (d) -5

(26) If $p = 4+3x-2x^2$ is a vector in the vector space P_2, then $\|p\|$ is —

(a) $\sqrt{7}$ (b) $\sqrt{21}$ (c) 5 (d) $\sqrt{29}$.

(27) If $\|u\| = \sqrt{18}$, $\|V\| = \sqrt{12}$ and $\langle u, v \rangle = -6$, then $\cos\theta$ is —

(a) $\frac{6}{\sqrt{18}\,\sqrt{12}}$ (b) $\frac{1}{\sqrt{6}}$ (c) $-\frac{1}{\sqrt{6}}$ (d) None.

(28) The values of k for which $u = (k, -4, 8)$ and $V = (k, k, -4)$ are orthogonal in Euclidean Inner Product Space R^3 are —

(a) 4, −8 (b) −4, −8 (c) 8, −4 (d) 4, 8.

---

(29) The matrix $A = \begin{bmatrix} \frac{3}{7} & \frac{2}{7} & \frac{6}{7} \\ -\frac{6}{7} & \frac{3}{7} & \frac{2}{7} \\ \frac{2}{7} & \frac{6}{7} & -\frac{3}{7} \end{bmatrix}$ is —

(a) Hermitian (b) Orthogonal (c) Unitary (d) Skew-symmetric.

(30) If $2x^2 + 6xy - 5y^2$ is the quadratic form, then associated symmetric matrix is —

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

(31) If $\begin{bmatrix} 6 & -6 \\ -6 & 3 \end{bmatrix}$ is the associated symmetric matrix, then quadratic form is —

(a) $6x^2 + 3y^2 + 12xy$ (b) $6x^2 + 3y^2 - 12xy$ (c) $6x^2 - 6y^2 + 3xy$ (d) None.

(32) The eigenvalues of Hermitian matrix are —

(a) Complex only (b) Complex and real both (c) always real (d) always zero.

(33) For which values of a & b, the matrix $\begin{bmatrix} 1 & 1+i & 2+6i \\ a & 2 & 2-4i \\ 2-6i & b & 3 \end{bmatrix}$ is Hermitian?

(a) $a = 1+i, b = 2-4i$ (b) $a = 1+i, b = 2+4i$ (c) $a = 1-i, b = 2+4i$ (d) $a = 1-i, b = 2-4i$.

(34) If a square matrix 'A' is such that $A^{-1} = A^*$, then 'A' is —

(a) Hermitian (b) Skew-Hermitian (c) Unitary (d) None.

---

(35) If $T: V \to V$ is an operator such that $T(u) = 1$, $\forall u \in V$, then

(a) T is linear (b) T is not linear (c) T is isomorphism (d) None

(36) Let $T: R^5 \to R^4$ is a linear transformation with rank 3, then no. of basis elements in the kernel of T is — (a) 1 (b) 2 (c) 3 (d) 4

(37) If $T: M_{33} \to R^8$ is a linear transformation with rank 6, then nullity of T is —

(a) 2 (b) 3 (c) 4 (d) 15.

(38) Let $T: R^2 \to R^2$ be a linear operator given by $T(x_1, x_2) = (x_2 - x_1, -2x_1 + 2x_2)$. Which of the following vector is in ker(T) —

(a) (−1, 1) (b) (1, −1) (c) (1, 1) (d) (−1, 2).

---

(39) Which of the following sets of eigenvalues have a dominant eigenvalue —

(a) $\{-10, 0, 1, 10\}$ (b) $\{5, -5, 3, 2\}$ (c) $\{-4, -3, 0, 1\}$ (d) None.

(40) The singular values of the matrix, $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ 1 & 0 \end{bmatrix}$ are —

(a) 1, 3 (b) 3, 2 (c) $1, \sqrt{3}$ (d) $3, \sqrt{3}$.

(41) If $B = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ be a matrix where $B = A^T A$, then singular values of A are —

(a) 1, 3 (b) 3, 2 (c) $1, \sqrt{3}$ (d) $3, \sqrt{3}$.

---

(42) In minimization problem, optimal solution occurring at corner point yields —

(a) mean value of objective function (b) mid-value of objective function

(c) lowest value of objective function (d) highest value of objective function.

(43) The valid objective function for a LPP is —

(a) $\max(x_1 x_2)$ (b) $\min(x_1^2 + x_2^2)$ (c) $\min\left(x_1 + x_2 - \frac{1}{3}x_3\right)$ (d) $\min\left\{\frac{x_1}{x_3} + \frac{x_2}{x_3}\right\}$.

(44) Which of the following constraints is not linear?

(a) $7X - 6Y \le 45$ (b) $X + Y + 3Z \ge 35$ (c) $2XY + X = 15$ (d) $X + \frac{1}{2}Y = 10$.

(45) The point (3,2) satisfy one of the following systems —

(a) $2x + 3y \ge 11$, $2x - 3y \ge 0$ (b) $2x + 3y = 12$, $2x - 3y \ge 0$ (c) both (a) & (b) (d) Neither (a) nor (b).

ANSWERS

(1) c	(11) c	(21) c	(31) b	(41) c
(2) a	(12) c	(22) b	(32) c	(42) c
(3) b	(13) b	(23) c	(33) c	(43) c
(4) a	(14) b	(24) b	(34) c	(44) c
(5) d	(15) b	(25) c	(35) b	(45) b
(6) c	(16) d	(26) d	(36) b	
(7) b	(17) b	(27) c	(37) b	
(8) a	(18) d	(28)	(38) c	
(9) b	(19) c	(29) b	(39) c	
(10) c	(20) d	(30) b	(40) c	