MCQ

1. The eigenvalues of the following Matrix are:

$$\begin{bmatrix} 4 & 0 & 1 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$$

a) 2,3 b) -1,-2,-3, c) 3 **d) 1, 2, 3**

2. The characteristic equations of the following matrix:

$$\begin{bmatrix} 10 & -9 \\ 4 & -2 \end{bmatrix}$$

a) $\lambda^2 - 8\lambda + 8 = 0$ **b)** $\lambda^2 - 8\lambda + 16 = 0$

c) $\lambda^2 - 2\lambda + 8 = 0$ d) $\lambda^2 + 8\lambda - 16 = 0$

3. The matrix P that diagonalizes to A is ,

$$A= \begin{bmatrix} -14 & 12 \\ -20 & 17 \end{bmatrix}$$

a) $P = \begin{bmatrix} \frac{1}{3} & 1 \\ 1 & 0 \end{bmatrix}$ **b)** $P = \begin{bmatrix} \frac{1}{3} & 0 \\ 1 & 1 \end{bmatrix}$ c) $P = \begin{bmatrix} \frac{1}{3} & 1 \\ 1 & 1 \end{bmatrix}$ d) $P = \begin{bmatrix} \frac{1}{3} & 1 \\ 0 & 1 \end{bmatrix}$

4. If u= (I, 2i, 3) and V= (4, -2i, 1+i) then u.v is
   a) 1+i b) -1-i **c) -1+i** d) 1-i

5. Solve the system

$$Y1/ = Y1 + 4\,Y2$$
$$Y2/ = 2Y1 + 3\,Y2$$

a) Y1= c1 e^{5X} -2c2e^{-X}, Y2= c1 e^{5X} + 2c2e^{-X}

b) Y1= c1 e^{-5X} -2c2e^{-X}, Y2= c1 e^{-5X} + 2c2e^{-X}

c) Y1= c1 e^{5X} -2c2e^{-X}, Y2= c1 e^{5X} - 2c2e^{-X}

d) Y1= c1 e^{-5X} - 2c2e^{-X}, Y2= c1 e^{-5X} - 2c2e^{-X}

6. Which of the following sets of vectors are orthogonal with respect to the Euclidean inner product on R2

a- (0,6), (7,0) b- (3,4),(2,6) c- (6,9),(5,2) **d- (0,0), (0,6)**

7. if $\|u\| = \sqrt{30}$, $\|v\| = \sqrt{18}$, and $\langle u, v\rangle = -9$ so $\cos\theta$ equal

a-9 b-5 **c-** $-\frac{3}{2\sqrt{15}}$ d-7

8. Find the cosine of the angle, θ, between p= x - x2, and q = 2 + 2x + 2x2

a-0 b-3 c-6 d-9

9. Let <u, v> be the Euclidean inner product on R2, and let $\vec{u} = (4, 3)$, $\vec{v} = (3, 5)$ then $\langle \vec{u}, \vec{v}\rangle$ is

a-8 **b-27** c-6 d-9

10. A straight line is

a- y=ax+b b-a+bx+cx2 d- a+bx+c2+dx3 d-none of the above

11. One of the following matrices is positive definite:

a- $\begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix}$ b- $\begin{bmatrix} -1 & 0 \\ 0 & 2 \end{bmatrix}$ c- $\begin{bmatrix} 0 & 0 \\ 0 & -2 \end{bmatrix}$ **d-** $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$

12. If A is a square orthogonal symmetric matrix , then:

a- $\det(A) = 2$ **b- $A^{-1}.A = A^2$**   c- $tr(A) > 0$ d- A is not invertible

13. One of the following matrices is orthogonally diagonalizable:

a- $\begin{bmatrix} 3 & -2 \\ 4 & -1 \end{bmatrix}$

b- $\begin{bmatrix} 3 & 2 & -4 \\ 2 & 4 & 6 \\ -4 & 6 & -1 \end{bmatrix}$

c- $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$

d- $\begin{bmatrix} 3 & 5 & 6 \\ 7 & -1 & 4 \\ 3 & 5 & 0 \end{bmatrix}$

14. One of the following quadratic forms is classified as Indefinite:

a- ${x_1}^2 - {x_2}^2$ b- ${x_1}^2 + {x_2}^2$ c- $(x_1 - x_2)^2$ d- $-{x_1}^2 - 3{x_2}^2$

15. Let T be a linear transformation from R^n to R^m and let $\vec{u} = T(\vec{0})$ where $\vec{0}$ is the zero vector in R^n. Choose the correct statement

A) $\vec{u}$ is a zero vector in R^n
B) $\vec{u}$ is a zero vector in R^m if and only if n ≤ m
C) $\vec{u}$ is a zero vector in R^m if and only if n = m

D) $\vec{u}$ is a zero vector in R^m

16. Let A be an n ×n matrix of rank m. Any matrix similar to A:

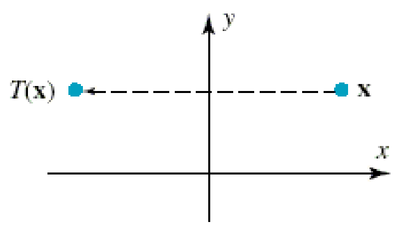
A) may have rank ≤ n
B) may have rank ≥ m
C) may have any rank ≥ m and ≤ n
D) must have rank m

17. Determine whether the linear transformation T is one-to-one.

$$T:R^m \rightarrow R^n,\ n < m.$$

A) The answer depends upon the value of m − n
B) T is one-to-one
C) **T is not one-to-one**
D) it is impossible to determine whether T is one-to-one

18. As indicated in the accompanying figure, let $T:R^2 \rightarrow R^2$ be the linear operator that reflects each point about the y -axis.



19. Find the kernel of T. Is T one-to-one?

A) ker(T) = {(0, y) | where y is any real number} ; T is one-to-one
B) ker(T) = {(x, 0) | where x is any real number} ; T is not one-to-one
C) **ker(T) = {0} ; T is one-to-one**
D) ker(T) = {0} ; T is not one-to-one

20. Find the domain and codomain of $T_2 \circ T_1$, and find $(T_2 \circ T_1)(x_1, x_2)$

$$T_1(x, y) = (2x, 4y),\ T_2(x, y) = (x - y, x + y)$$

A) The domain and codomain of $T_2 \circ T_1$ are R^3, and $(T_2 \circ T_1)(x_1, x_2) = (2x_1 - 4x_2, 2x_1 + 4x_2)$
B) **The domain and codomain of $T_2 \circ T_1$ are R^2, and $(T_2 \circ T_1)(x_1, x_2) = (2x_1 - 4x_2, 2x_1 + 4x_2)$**
C) The domain and codomain of $T_2 \circ T_1$ are R^3, and $(T_2 \circ T_1)(x_1, x_2) = (2x_1 - 2x_2, 4x_1 + 4x_2)$
D) The domain and codomain of $T_2 \circ T_1$ are R^2, and $(T_2 \circ T_1)(x_1, x_2) = (2x_1 - 2x_2, 4x_1 + 4x_2)$

21.Which of the following sets of eigenvalues have a dominant eigenvalue.

(a) {-4, -3,4, 1} **(b) {-3, -1, 0, 2}**

(c) { 0, 3, -3, -2} (d) {-5, 3, -2, 5}

22. The approximation of the time required to the forward phases of Gauss-Jordan elimination equal:

(a) $2/3n^3$ (b) n^2 (c) $2n^3$

23. If A is an m x n matrix, then A and A^TA have the same:

(a) Null space (b) row space

(d) rank (d) All of them

24. The singular values of A= $\begin{matrix} 5 & 0 \\ 0 & 2 \end{matrix}$

(a) {0, 1} (b) { 2, 5} (c) {2,0} {0,5}

25. The point (3,0) satisfy one of the following systems:

a) $x + y \geq 5$ b) $3x-y \geq 9$

$x + 2y \geq 3$ $4x+5y \leq 11$

c) $12x - y \geq 35$

$3x + 4y \leq 10$

d) $2x + y \geq 6$

$3x - 5y \geq 15$

26. one of the following system is bounded:

a) $y \geq x$ b) $y \leq x+3$

$y \geq -x$ $y \leq 4-x$

c) $x \geq 1$ **d) $y \leq 2x+3$**

$y \geq 3$ **$y \leq 6 - x$**

$y \geq 2$

27. the point at which $f = 3x + 5y$ has the highest value is:

a) (0,2) b) (4,0) c) (3,1) **d) (2,5)**

4) one of the following triples is the solution to the linear programming

$$\max\ 2x_1 + 3x_2 + 2x_3 \quad \text{subject to} \quad \begin{cases} x_1 + 4x_2 \leq 4 \\ x_1 - x_2 + 3x_3 \leq 5 \end{cases}, \quad x_1, x_2, x_3 \geq 0$$

a) (0,1,2) b) (4,0,0.5) **c) $(4,0,\frac{1}{3})$** d) (1,0,1)

28. One of the following is a valid objective function for a linear programming problem:

a) Max (5xy)

b) Min(4x + 3y + (2/3)z)

c) Max ($5x^2$ + 6y)

d) Min((x + y)/z)

29. The Slack is :

a. the difference between the left and right sides of a constraint.

b. the amount by which the left side of a < constraint is smaller than the right side.

c. the amount by which the left side of a $\geq$ constraint is larger than the right side.

d. exist for each variable in a linear programming problem.

30. To find the optimal solution to a linear programming problem using the graphical method

a. find the feasible point that is the farthest away from the origin.

b. find the feasible point that is at the highest location.

c. find the feasible point that is closest to the origin.

d. None.

31. Infeasibility means that the number of solutions to the linear programming models that satisfies all constraints is:

a. at least 1.

b. 0.

c. an infinite number.

d. at least 2.