Question 9

1 / 1 pts

Consider the following matrix $A = \begin{bmatrix} 2 & 8 \\ 8 & 9 \end{bmatrix}$. Choose the correct statement.

- A^3 has exactly 2 negative eigenvalue
- A^2 has no negative eigenvalues
- A^2 has only non-positive eigenvalues
- A^3 has no negative eigenvalue

Question 10

1 / 1 pts

Consider the following matrix $A = \begin{bmatrix} 1 & 7 \\ 7 & 9 \end{bmatrix}$. Choose the correct statement.

- A^3 has exactly 2 negative eigenvalues
- A^3 has no negative eigenvalue
- A^2 has no negative eigenvalues
- A^2 has only non-positive eigenvalues

Question 7

1 / 1 pts

If $A = [\alpha]$ and $\alpha > 0$ then choose the incorrect statement

- A is positive definite
- rank(A)=1
- A is symmetric
- None of these

Question 8

1 / 1 pts

In the given matrix equation $Ax = b$, if the $rank(A) = m$, where m is the number of rows then

- rank(A)>rank([A|b])
- rank(A)<rank([A|b])
- Information insufficient to conclude about rank([A|b])
- rank(A)=rank([A|b])

Question 9

1 / 1 pts

If $A = \begin{bmatrix} -1 & b \\ c & 6 \end{bmatrix}$, then choose the correct statement

- ○ Product of eigenvalues is -6
- ◉ Sum of eigenvalues is 5
- ○ None of these
- ○ The degree of characteristic polynomial is 1

Question 10

1 / 1 pts

If $V = span\{v_1, \ ..v_6\}$, where $v_1 = \begin{bmatrix}1\\2\\3\\4\\5\\6\\0\end{bmatrix}, v_2 = \begin{bmatrix}1\\2\\0\\4\\5\\6\\0\end{bmatrix}, v_3 = \begin{bmatrix}1\\62\\3\\0\\56\\6\\1\end{bmatrix}, v_4 = \begin{bmatrix}0\\2\\3\\4\\5\\6\\0\end{bmatrix}, v_5 = \begin{bmatrix}0\\2\\0\\0\\0\\0\\1\end{bmatrix}, v_6 = \begin{bmatrix}2\\4\\3\\8\\10\\12\\a\end{bmatrix}$

then choose the most appropriate option

- A subset of $\{v_1,..,v_6\}$ is a basis of V ✓
- $\{v_1,..,v_6\}$ is a basis of V
- None of these
- rank($[v_1,..,v_6]$) =7

Question 8

1 / 1 pts

If $V = span\{v_1, \; ..v_6\}$, where $v_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ b \\ 0 \end{bmatrix}, v_2 = \begin{bmatrix} 0 \\ 2 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, v_3 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 3 \\ 0 \\ 0 \\ 0 \end{bmatrix}, v_4 = \begin{bmatrix} 0 \\ 2 \\ 3 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, v_5 = \begin{bmatrix} 0 \\ 2 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}, v_6 = \begin{bmatrix} 0 \\ a \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$

- ○ Dim V depends on a and b.
- ○ None of these
- ◉ Dim V=6 ✓
- ○ Dim V<6

Question 9

1 / 1 pts

What is the minimum value of $[x_1 \ \ x_2]\begin{bmatrix}5 & 0\\0 & 4\end{bmatrix}\begin{bmatrix}x_1\\x_2\end{bmatrix}$ with the additional constraint that $x_1^2 + x_2^2 = 1$?

- 0
- 5
- 3
- 4

Question 10

1 / 1 pts

The eigenvalues of the matrix $\begin{bmatrix}cos\theta & -sin\theta\\sin\theta & cos\theta\end{bmatrix}$ are

- Real for some values of θ only
- Real for no value of θ
- One of the eigenvalues is real and one is complex for all values of θ
- None of the other options

Question 2

1 / 1 pts

All the four entries of the 2 × 2 matrix $p = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix}$ are nonzero, and one of its eigenvalues is zero. Which of the following statements is true?

- $p_{11}p_{22} + p_{12}p_{21} = 0$
- $p_{11}p_{22} - p_{12}p_{21} \neq 0$
- $\mathbf{p_{11}p_{22} - p_{12}p_{21} = 0}$
- $p_{12}p_{22} - p_{11}p_{21} = 0$

Question 1

1 / 1 pts

If the sum and product of the eigenvalues of $\begin{bmatrix} a+1 & -1 \\ 1 & a-1 \end{bmatrix}$ are s_1 and s_2 respectively then s_1^2 =

- $4s_2$
- $2s_2$
- s_2
- 0

Question 10

1 pts

Let $\{e_1, e_2, e_3\}$ be a basis of a vector space over $\mathbb{R}$. Consider the following sets :

$$P = \{e_2, e_1 + e_2, e_1 + e_2 + e_3\}$$
$$Q = \{e_1, e_1 - e_2, e_1 - e_2 + e_3\}$$
$$R = \{2e_1, 3e_2 + e_3, 6e_1 + 3e_2 + e_3\}$$

Then pick the correct option:

- ○ Q and R are basis of V
- ○ Only Q is basis of V
- ○ P and Q are basis of V
- ○ P and R are basis of V

◂ Previous

Question 1

1 / 1 pts

The rank of a 3 X 3 matrix C(=AB), found by multiplying a non-zero column matrix A of a size 3 X 1 and a non-zero row Matrix B of a size 1 X 3 is

- 0
- 1 ✓
- 3
- 2

Question 3

1 / 1 pts

True/False: A Hermitian matrix can have complex numbers with a non-zero imaginary part on the diagonal

-
-
- False ✓
- True

Question 4

1 / 1 pts

Let V be finite dimension vector space over field , T be a linearly independent subset v, B be a basis of V and S be a set of generators of V, then which relation is correct

- |T| > |B| > |S|
- |T| <= |B| <= |S|
- |T| >= |B| > |S|
- |T| > |B| >= |S|

Question 7

1 / 1 pts

Let u be a $n \times 1$ non-zero vector and n>1. What is the determinant of uu^T?

- Depends on 'u'
- 0
- 1
- None of the other options

Question 5

1 / 1 pts

Let u be a $1 \times n$ non-zero vector. What is the determinant of uu^T?

- 1
- -1
- 0
- $u_1^2+u_2^2+\cdots+u_n^2$

Question 7

1 / 1 pts

Consider the matrix $A = \begin{bmatrix} 0 & -3 & 4 & 4 \\ 3 & 0 & 2 & 0 \\ -4 & -2 & 0 & 11 \\ -4 & 0 & -11 & 0 \end{bmatrix}$ $Which$ of the statement is true ?

- (selected) The matrix has only imaginary eigenvalues
- The matrix has an eigenvalue $\frac{-1}{\sqrt{2}}$
- The matrix has an eigenvalue $\frac{1}{\sqrt{2}}$
- The matrix has a nonzero real eigenvalue

Question 8

1 / 1 pts

It is known that A is a 3 by 3 matrix. . It is also given that one of the eigenvalues is a complex eigenvalue value with nonzero imaginary part. Choose the correct statement

- The magnitudes of 3 eigenvalues are different from each other
- The matrix has exactly 2 real eigenvalue
- The matrix has exactly no real eigenvalue
- (selected) The matrix has exactly one real eigenvalue

Question 3

1 / 1 pts

Consider the matrix $A = \begin{bmatrix} \beta & 7 & 7 & 7 \\ 7 & \alpha & 8 & 5 \\ 7 & 8 & 6 & 5 \\ 7 & 8 & 6 & 5 \end{bmatrix}$ where α and β are unknowns. Choose the correct statement

- The matrix do not have zero eigenvalues
- The matrix row reduced echelon form will be I_4
- The matrix has one imaginary eigenvalue
- The product of all eigenvalues is zero.

Question 1

1 / 1 pts

It is known that A is a 2×2 matrix. It is also given that one of the eigenvalues is a complex value with nonzero imaginary part. Choose the correct statement

- The second eigenvalue of A has same magnitude as the first eigenvalue
- The second eigenvalue of A is real
- The second eigenvalue of A is zero
- The second eigenvalue is a real number

Question 2

1 / 1 pts

True/False: Consider the matrix $A = \begin{bmatrix} \alpha_1 & \beta \\ \beta & \alpha_2 \end{bmatrix}$. For the matrix to be positive-definite it is sufficient to have $\alpha_1 > 0, \alpha_2 > 0$.

- True
-
- False
-

Question 5

1 / 1 pts

Let Gaussian elimination be performed on an $m \times n$ matrix A of rank 2 where $m < n$ to obtain a row-echelon form U. If the pivot in the first row of U is in the position (1,1) and the pivot in the 2nd row is in the position (2,4). What is the maximum number of non-zero elements in U?

- None of the other options
- 2n - 4
- 2
- 2n - 3

Question 10

1 / 1 pts

Consider the 2×2 matrix $\begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} \\ -1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix}$. Its eigenvalues must be

- Both the same and real
- Different and complex
- Same and complex
- Different and real

Question 2

1 / 1 pts

If $A = \begin{bmatrix} a & c \\ c & d \end{bmatrix}, ad - c^2 < 0$, then

- Eigenvalues are of opposite sign
- Eigenvalues are negative
- None of these
- Eigenvalues are positive

Question 1

1 / 1 pts

The set of all $A \in R$ for which the vectors $(2, A, 0)$, $(0, A^2, 2)$, $(2, 0, A)$ are linearly dependent

- $\{A \in R: A^2 = 0\}$
- $\{A \in R: A^2 \neq 1\}$
- $\{A \in R: A^2 \neq 0\}$
- $\{A \in R: A^2 = -2\}$

Question 2

1 / 1 pts

If A = $\begin{pmatrix} 1 & 0 & 0 \\ a & 1 & 0 \\ a & b & -1 \end{pmatrix}$, then A^2 is equal to

- None of these ✓
- -A
- A
- Unit Matrix

Question 1

1 / 1 pts

The value of a in order that $\begin{pmatrix} 2 & 3 & 5 \\ 1 & a & 2 \\ 0 & 1 & -1 \end{pmatrix}$ is singular, is

- -5/3
- -2
- 2
- 5/3

Question 5

1 / 1 pts

Let u, v, w be three mutually orthogonal $n \times 1$ vectors. Then the matrix $uv^T + uw^T$ has rank

- None of the other options
- 1
- 2
- 3

Question 8

1 / 1 pts

For what value of 'a' following system is inconsistent:

$x + y = 2; x + ay = 3$

- a=2
- a=0
- a=-1
- a=1

Question 7

1 / 1 pts

The smallest rank of any matrix is

- Zero
- Depends on 'n'
- Two
- One

Question 8

1 / 1 pts

If A is a 2x2 matrix with eigenvalue 1 and -1 then what can you say about A^2 ?

- Zero matrix
- Not defined
- -A
- Identity Matrix

Question 4

1 pts

Which of the following is a vector space

- $M = \{(x, y, z) \in R^3 / x + y + z - 3 = 0, z = 0\}$
- $M = \{(x, y, z) \in R^3 / x - 1 = 0, y = 0\}$
- $M = \{(x, y, z) \in R^3 / x \geq 0, y \geq 0\}$
- $M = \{(x, y, z) \in R^3 / x + 2y = 0, 2x + 3z = 0\}$

.

Question 1 1 / 1 pts

If $u, v, w \in \boldsymbol{R}^3$ and are orthogonal to each other then

Statement-I: $\{u, v, w\}$ is a linearly independent set.

Statement-II: $\{u, v, w\}$ is a linearly dependent set.

Choose the correct option.

- Statement II is always true.
- None of these
- Statement I is always true.
- One of the statements (I or II) is true

Question 1

1 / 1 pts

Consider 5 vectors v_1, v_2, v_3, v_4, v_5 such that the first i components in each v_i are non-zero and the remaining components are zero. Then the vectors can be said to be

- None of the other given options
- Linearly independent depending on the values of the non-zero components
- Linearly independent
- Linearly dependent

Question 9

1 / 1 pts

If A = $\begin{bmatrix} 5 & 5\alpha & \alpha \\ 0 & \alpha & 5\alpha \\ 0 & 0 & 5 \end{bmatrix}$, and $|A^2| = 25$ then $|\alpha| =$

- 1/2
- 1/5
- 1/10
- 5

Question 3

1 / 1 pts

It is known that A is a 2×2 matrix. It is also given that one of the eigenvalues is a complex value with nonzero imaginary part. Choose the correct statement

- The second eigenvalue is a real number
- The second eigenvalue of A has same magnitude as the first eigenvalue
- The second eigenvalue of A is real
- The second eigenvalue of A is zero

Question 5

1 / 1 pts

It is known that A is a 3 by 3 matrix. . It is also given that one of the eigenvalues is a complex eigenvalue value with nonzero imaginary part. Choose the correct statement

- The matrix has exactly no real eigenvalue
- The matrix has exactly 2 real eigenvalue
- The matrix has exactly one real eigenvalue
- The magnitudes of 3 eigenvalues are different from each other

Question 5

1 / 1 pts

Consider a 3×3 matrix M such that $M[x\ y\ z]^T = [x\ y\ 0]^T$. Then the dimension of the null space of M is

- (selected) 1
- any one of 1,2 or 3
- 3
- 2

Question 9

1 / 1 pts

Consider the equation where is Ax=b where A is a 5 x 7 matrix, Then the null space of A has dimension.

- (selected) At least 2
- Exactly 2
- None of the above
- Exactly one

Question 5

1 / 1 pts

. Consider the matrix $A = \begin{bmatrix} \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{2}} & \frac{-\sqrt{3}}{\sqrt{10}} \\ \frac{-1}{\sqrt{3}} & \frac{1}{\sqrt{2}} & \frac{\sqrt{3}}{\sqrt{10}} \\ \frac{1}{\sqrt{3}} & 0 & \frac{2}{\sqrt{10}} \end{bmatrix}$. Which of the statement is true?

- ○ The matrix has an eigenvalue $\frac{1}{\sqrt{2}}$
- ◉ The sum of absolute values of eigenvalues is 3
- ○ The matrix has a zero eigenvalue
- ○ The matrix has an eigenvalue $\frac{\sqrt{3}}{\sqrt{10}}$

Question 9

1 / 1 pts

Consider the matrix $A = \begin{bmatrix} 1/3 & -2/3 & 2/3 \\ 2/3 & -1/3 & -2/3 \\ 2/3 & 2/3 & 1/3 \end{bmatrix}$. Which of the statement is true?

- The sum of absolute values of eigenvalues is 3
- The matrix has an eigenvalue 1/√2
- The sum of absolute values of eigenvalues is 0
- The matrix has an eigenvalue 1/3

Question 2

1 / 1 pts

Let the $n \times n$ matrix A consist of three mutually orthogonal vectors u, v, w, and other columns which are linear combinations of these three vectors. Then the rank of $A^T A$ is

- n-3
- 4
- n
- 3

Question 4

1 / 1 pts

If A is a square matrix of order n and $rank(A) = n - 1$ then

- Product of eigenvalues is 0
- Product of eigenvalues cannot be determined using the given information
- None of these
- Product of eigenvalues is n-1

Question 3

1 / 1 pts

Define $\langle x|y\rangle = x_1 y_1$, where $x = [x_1, x_2]^T, y = [y_1, y_2]^T \in V$.

Statement 1: $\langle x|y\rangle$ is an inner product if $V = R^2$.

Statement 2: $\langle x|y\rangle$ is an inner product if $V = \{[x_1, x_2]^T \in \underline{R^2 | x_2 = 0}\}$.

- Statement 2 is correct.
- Statements 1 and 2 are correct.
- Statement 1 is correct.
- Statements 1 and 2 are incorrect.

Question 9

1 / 1 pts

Define $\langle x|y\rangle = x_1y_1$, where $x = [x_1, x_2]^T, y = [y_1, y_2]^T \in V$.

Statement 1: $\langle x|y\rangle$ is an inner product if $V = R^2$.

Statement 2: $\langle x|y\rangle$ is an inner product if $V = \{[x_1, x_2]^T \in R^2 | x_1 = 0\}$.

- ○ Statement 1 is correct.
- ○ Statements 1 and 2 are incorrect.
- ◉ Statement 2 is correct.
- ○ Statements 1 and 2 are correct.

Question 7

1 / 1 pts

Consider the following two statements

1. The maximum number of linearly independent columns vectors of a matrix A is called the rank of A.
2. If A is a square matrix, A will be non-singular of rank A= n

with reference to the above statements which of the following are applicable

- ○ Only second is true
- ◉ both statements are true
- ○ Only first is true
- ○ both statements are false

Question 10

1 / 1 pts

Consider a square matrix B It is known that the matrix have a trace value which is a negative number. It is also known that the product of eigenvalues is 0. Choose the correct statement

- The matrix inverse exists.
- The matrix has to be a symmetric matrix
- The matrix REF have 0 non-pivot variable.
- The matrix REF have at least 1 non-pivot variable.

Question 5

1 / 1 pts

Consider the matrix $A = \begin{bmatrix} 3 & 4 & 1 \\ 2 & 2 & 4 \\ 4 & 2 & 3 \end{bmatrix}$. Choose the correct statement. (α is a real number)

- The determinant of $A + \alpha I$ is $\alpha \det(A)$.
- **The sum of eigenvalues of $A + \alpha I$ is bigger than sum of eigenvalues of A by 6.**
- The Trace of $A + \alpha I$ is same as trace of A
- The eigenvalues of A+2I is same as that of A