1. If A and B are subset of a set X, then what is $\{A \cap (X - B)\} \cup B$ equal to?
   (a) $A \cup B$
   (b) $A \cap B$
   (c) A
   (d) B
2. If A and B are disjoint sets, then $A \cap (A' \cup B)$ is equal to which one of the following?
   (a) ϕ
   (b) A
   (c) $A \cup B$
   (d) $A - B$
3. If $A = P\{1,2\}$ where P denotes the power set, then which one of the following is correct?
   (a) $\{1,2\} \subset A$
   (b) $1 \in A$
   (c) $\phi \notin A$
   (d) $\{1,2\} \in A$
4. If A and B are two sets satisfying $A - B = B - A$, then which one of the following is correct?
   (a) $A = \phi$
   (b) $A \cap B = \phi$
   (c) $A = B$
   (d) None of the above
5. If $(A - B) \cup (B - A) = A$ for subset A and B of the universal set $\cup$, then which one of the following is correct?
   (a) B is a proper non-empty subset of A
   (b) A and B are non-empty disjoint sets
   (c) $B = \phi$
   (d) none of the above
6. let $A = \{x \in R \mid -9 \le x < 4\}$
   $B = \{x \in R \mid -13 < x \le 5\}$ and
   $C = \{x \in R \mid -7 \le x \le 8\}$ then which one of the following is correct?
   (a) $-9 \in (A \cap B \cap C)$
   (b) $-7 \in (A \cap B \cap C)$
   (c) $4 \in (A \cap B \cap C)$
   (d) $5 \in (A \cap B \cap C)$
7. Which one of the following is correct?
   (a) $A \cup P(A) = P(A)$
   (b) $A \cap P(A) = A$
   (c) $A - P(A) = A$
   (d) $P(A) - \{A\} = P(A)$

   Here, $P(A)$ denotes the power set of set A.
8. The set of intelligent students in a class is.
   (a) A null set
   (b) A singleton set
   (c) A finite set
   (d) Not a well defined collection
9. If $N_a = \{ax \mid x \in N\}$ then what is $N_{12} \cap N_8$ equal to?
   (a) N_{12}
   (b) N_{20}
   (c) N_{24}
   (d) N_{48}
10. Which one of the following is the empty set?
    (a) $\{x : x \text{ is a real number and } x^2 - 1 = 0\}$
    (b) $\{x : x \text{ is a real number and } x^2 + 1 = 0\}$

(c) $\{x : x \text{ is a real number and } x^2 - 9 = 0\}$

(d) $\{x : x \text{ is a real number and } x^2 = x + 2\}$

11. If the sets A and B are defined as

$A = \left\{(x, y) : y = \frac{1}{x}, 0 \neq x \in R\right\}$

$B = \{(x, y) : y = -x, x \in R\}$, then

(a) $A \cap B = A$
(b) $A \cap B = B$
(c) $A \cap B = \phi$
(d) None of the above

12. Let $A = \{x : x \in R, |x| < 1\}$;

$B = \{x : x \in R, |x - 1| \geq 1\}$ and

$A \cup B = R - D$, then the set D is

(a) $\{x : 1 < x \leq 2\}$
(b) $\{x : 1 \leq x < 2\}$
(c) $\{x : 1 \leq x \leq 2\}$
(d) None of the above

13. Let $A = \{(x, y) : y = e^x, x \in R\}$,

$B = \{(x, y) : y = e^{-x}, x \in R\}$

(a) $A \cap B = \phi$
(b) $A \cap B \neq \phi$
(c) $A \cap B = R^2$
(d) None of the above

14. If A and B are two subset of a set X, then what is $A \cap (A \cap B)'$ equal to?

(a) A
(b) B
(c) ϕ
(d) A'

15. For a set A, consider the following statements

I. $A \cup P(A) = P(A)$

II. $\{A\} \cap P(A) = A$

III. $P(A) - \{A\} = P(A)$

Where P denotes point set.
Which of the statements given above is/are correct?

(a) I only
(b) II only
(c) III only
(d) I, II and III

16. If A, B and C are three finite sets, then what is $[(A \cup B) \cap C]'$ equal to

(a) $A' \cup B' \cap C'$
(b) $A' \cap B' \cap C'$
(c) $A' \cap B' \cup C'$
(d) $A \cap B \cap C$

17. Consider the following statement.

I. $\phi \in \{\phi\}$

II. $\{\phi\} \subseteq \phi$

Which of the statements given above is/are correct?

(a) I only
(b) II only
(c) Both I and II
(d) Neither I nor II

18. If $A = \{x : f(x) = 0\}$ and $B = \{x : g(x) = 0\}$ then $A \cap B$ will be

(a) $\{f(x)\}^2 + \{g(x)\}^2 = 0$

(b) $\dfrac{f(x)}{g(x)}$

(c) $\dfrac{g(x)}{f(x)}$

(d) None of the above

19. If $A = \{(x, y) : x^2 + y^2 = 25\}$ and

$B = \{(x, y) : x^2 + 9y^2 = 144\}$ then $A \cap B$ contains

(a) One point

(b) Three point
(c) Two point
(d) Four point

20. If $A=\{4n+2|n$ is a natural number $\}$ and $B=\{3n|n$ is a natural numbers $\}$,then what is $(A\cap B)$ equal to?
(a) $\{12n^2+6n|n$ is a natural numbers $\}$
(b) $\{24n-12|n$ is a natural numbers $\}$
(c) $\{60n+30|n$ is a natural numbers $\}$
(d) $\{12n-6|n$ is a natural numbers $\}$

21. If X and Y are any two non-empty sets, then what is $(X-Y)'$ equal to?
(a) $X'-Y'$
(b) $X'\cup Y$
(c) $X\cap Y'$
(d) $X-Y'$

22. If A, B and C are non-empty sets such that $A\cap C=\phi$ then what is $(A\times B)\cap(C\times B)$ equal to?
(a) $A\times C$
(b) $A\times B$
(c) $B\times C$
(d) ϕ

23. If P, Q and R are subset of a set A, then $R\times(P^c\cup Q^c)^c$ is equal to
(a) $(R\times P)\cap(R\times Q)$
(b) $(R\times Q)\cap(R\times P)$
(c) $(R\times P)\cup(R\times Q)$
(d) Non of these

24. If $A=\begin{bmatrix}-5 & -8 & 0\\ 3 & 5 & 0\\ 1 & 2 & -1\end{bmatrix}$ then A^2 is
(a) Idempotent
(b) Nilpotent
(c) Involutory
(d) Periodic

25. $X=[X_1X_2....X_n]'$ is an n-tuple non-zero vector the $n\times n$ metric $V=XX'$.
(a) Has rank zero
(b) Has rank 1
(c) Is orthogonal
(d) Has rank n

26. Consider a non-homogeneous system of linear equations representing mathematically on over determined system. Such a system will be
(a) Consistent having a unique solution
(b) Consistent having many solution
(c) Inconsistent having no solution
(d) All of the above

27. All the four entries of the 2×2 matrix $P=\begin{bmatrix}p_{11} & p_{12}\\ p_{21} & p_{22}\end{bmatrix}$ are non zero, and one of its Eigen value is zero. Which one of the following statements is true?
(a) $p_{11}p_{22}-p_{12}p_{21}=1$
(b) $p_{11}p_{22}-p_{12}p_{21}=-1$
(c) $p_{11}p_{22}-p_{12}p_{21}=0$
(d) $p_{11}p_{22}+p_{12}p_{21}=0$

28. The rank of the following $(n+1)\times(n+1)$ matrix where a is real number $\begin{bmatrix}1 & a & a^2 & \cdots & a^n\\ 1 & a & a^2 & \cdots & a^n\\ \vdots & \vdots & \vdots & \vdots & \vdots\\ 1 & a & a^2 & \cdots & a^n\end{bmatrix}$ is
(a) 1
(b) 2
(c) n
(d) depends on 'a'

29. dimV, where
$V=\{a_1,a_2,....,a_{100}:a_1+a_2=0,a_3+a_4=0\}$ is
(a) 97
(b) 98
(c) 99
(d) 100

30. Consider the real vector space $V=\mathbb{R}^3$ and following of its subset
I. $S=\{(x,y,z)\in V: x=y=0\}$
II. $T=\{(x,y,z)\in V: x=0\}$
III. $W=\{(x,y,z)\in V: z\neq 0\}$

Which one of the following statement is correct?
(a) *S*,*T* and *W* are subspace
(b) Only *S* and *W* are subspace
(c) Only *T* and *W* are subspace
(d) Only *S* and *T* are subspace

31. Let *V* be a vector space over the filed F of dimension n. consider the following
I. Every subset of *V* containing *n* elements is a basis of *V*.
II. No linearly independent subset of *V* contain more then *n* elements.

Which of the above statement is/are correct?
(a) I only
(b) II only
(c) Both I and II
(d) Nether I nor II

32. If *A* and *B* are two odd order skew-symmetric matrices such that $AB=BA$, then what is the matrix *AB* ?
(a) An orthogonal matrix
(b) A skew-symmetric matrix
(c) A symmetric matrix
(d) An identity matrix

33. Consider the vector space *V* over the field of real numbers spanned by the set
$$S=\begin{Bmatrix}(0,1,0,0),(1,1,0,0),(1,0,1,0),\\(0,0,1,0),(1,1,1,0),(1,0,0,0)\end{Bmatrix}$$
What is the dimension of *V*?
(a) 1
(b) 2
(c) 3
(d) 4

34. If *V* is the real vector space of all mapping from R to R
$V_1=\{f\in V/f(-x)=f(x)\}$ and
$V_2=\{f\in V/f(-x)=-f(x)\}$ then
which one of the following is correct?
(a) Neither V_1 nor V_2 is a subspace of *V*
(b) V_1 is a subspace of *V*, but V_2 is a subspace of *V*
(c) V_1 is not subspace of *V*, but V_2 is a subspace of *V*
(d) Both V_1 and V_2 are subspace of *V*

35. If *A* and *B* are symmetric matric of the same order, then which one of the following is not correct?
(a) A+B is a symmetric matrix.
(b) AB+BA is a symmetric matrix.
(c) AB-BA is a symmetric matrix.
(d) $A+A^T$ and $B+B^T$ are symmetric matrices.

36. Under which one of the following condition does the system of equations
$$\begin{bmatrix}1&2&4\\2&1&2\\1&2&a-4\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}6\\4\\a\end{bmatrix}$$ have a unique solution?
(a) For all $a\in R$
(b) $a=8$

(c) For all $a \in Z$
(d) $a \neq 8$

37. Consider the real vector space R^3. The subspace $\{(x,y,z) \in R^3 : Y = X\}$ of R^3 is generated by which one of the following?
(a) $\{(1,1,0),(0,01)\}$
(b) $\{(1,1,0),(1,0,0)\}$
(c) $\{(1,0,0),(0,1,0)\}$
(d) $\{(1,0,1),(0,0,1)\}$

38. Let V be a vector space over a field and $a \in F$ and $u \in V$. Which of the following statement is not correct?
(a) $\alpha u = \theta \Rightarrow$ either $\alpha = 0$ or $u = \theta$
(b) $|-1u| = |-1|u$ for all $u \in v$
(c) $a\theta = \theta$
(d) $\theta u = \theta$

39. What is the dimension of the vector space formed by the solution of the system of the following equations?
$$x_1 + x_2 + x_3 = 0$$
$$x_1 + 2x_2 = 0$$
$$x_2 - x_3 = 0$$
(a) 1
(b) 2
(c) 3
(d) 0

40. Given the vector
$\alpha = (1,2,3), \beta = (3,1,0), \gamma = (2,1,3)$ and $\delta = (-1,3,6)$
Consider the following statement
I. γ is a linear combination of α and β
II. δ is a linear combination of α and β

Which of the following statement given above is/are correct?
(a) I only
(b) II only
(c) Both I and II
(d) Neither I nor II

41. Let A and B be any two $n \times n$ matrices and $tr(A) = \sum_{i=1}^{n} a_{ii}$ and $tr(B) = \sum_{i=1}^{n} b_{ii}$
consider the following statement
I. $tr(AB) = tr(BA)$
II. $tr(A+B) = tr(A) + tr(B)$
Which of the following statement given above is/are correct?
(a) I only
(b) II only
(c) Both I and II
(d) Neither I nor II

42. Let $A = \begin{pmatrix} 2 & 0 \\ 3 & 5 \end{pmatrix}$ be expressed as $P + Q$, where P is symmetric matrix and Q is skew-symmetric matrix. which one of the following is correct?
(a) $Q = \begin{pmatrix} 1/2 & -3/2 \\ 3/2 & 0 \end{pmatrix}$
(b) $Q = \begin{pmatrix} 0 & 3/2 \\ 3/2 & 0 \end{pmatrix}$
(c) $Q = \frac{1}{2}\begin{pmatrix} 0 & -3 \\ 3 & 0 \end{pmatrix}$
(d) $Q = \frac{1}{2}\begin{pmatrix} 2 & 3 \\ 0 & 5 \end{pmatrix}$

43. Let R be the set of all real number and $\mathbb{R}^2 = \{(X_1, X_2) : X_1 \in R, X_2 \in R\}$ then one of the following is a subspace of $\mathbb{R}^2$ over $\mathbb{R}$?

(a) $\{(X_1, X_2): X_1 > 0, X_2 > 0\}$
(b) $\{(X_1, X_2): X_1 \in \mathrm{R}, X_2 > 0\}$
(c) $\{(X_1, X_2): X_1 < 0, X_2 < 0\}$
(d) $\{(X_1, 0): X_1 \in R\}$

44. If $W_1 = \{(0, x_2, x_3, x_4, x_5): x_2, x_3, x_4, x_5 \in \mathbb{R}\}$ and $W_2 = \{(x_1, 0, x_3, x_4, x_5): x_1, x_3, x_4, x_5 \in \mathbb{R}\}$ be subspace of R^5, then $\dim(W_1 \cap W_2)$ is equal to
(a) 5
(b) 4
(c) 3
(d) 2

45. If *A* be a non-zero square matrix of orders *n*, then
(a) The matrix $A + A'$ is anti- symmetric, but the matrix $A - A'$ is symmetric.
(b) The matrix $A + A'$ is symmetric, but the matrix $A - A'$ is anti -symmetric.
(c) Both $A + A'$ and $A - A'$ are symmetric.
(d) Both $A + A'$ and $A - A'$ are anti - symmetric

46. Square matrix A of order *n* over $\mathbb{R}$ has rank *n*. which one of the following statement is not correct?
(a) A^T has rank *n*
(b) *A* has *n* linearly independent columns
(c) A is non-singular
(d) *A* is singular

47. If *C* is a non-singular matrix and
$$B = C\begin{bmatrix} 0 & x & y \\ 0 & 0 & z \\ 0 & 0 & 0 \end{bmatrix}C^{-1}, \text{ then}$$
(a) $B^2 = 1$
(b) $B^2 = 0$
(c) $B^3 = 1$
(d) $B^3 = 0$

48. Suppose,
$$X = \left\{ \begin{vmatrix} a \\ b \\ c \\ d \end{vmatrix} : b - c = 4 \right\}; Y = \left\{ \begin{vmatrix} a \\ b \\ c \\ d \end{vmatrix} : a = b + c \right\}$$
and
$$Z = \left\{ \begin{vmatrix} a \\ b \\ c \\ d \end{vmatrix} : b = 0, c = d \right\}$$
Which of these subset of the vector space $\mathbb{R}^4$ is/are subspace(S)?
(a) *X* only
(b) *Y* and *Z*
(c) *X*, *Y* and *Z*
(d) *X* and *Z*

49. If $X = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ then the rank of $X^T X$, where X^T denotes the transpose of *X*, is
(a) 0
(b) 2
(c) 3
(d) 4

50. Let ξ_1, ξ_2 and ξ_3 be vector space *V* over the field *F*. if *r* and *S* are arbitrary element of *F* and the set $(\xi_1, \xi_2, r\xi_1 + S\xi_2 + \xi_3)$ is linearly dependent, then (ξ_1, ξ_2, ξ_3) is
(a) Linearly dependent set
(b) A null set
(c) Linearly independent set
(d) None of the above

51. The dimension of the subspace of $\mathbb{R}^3$ spanned by $(-3,0,1),(1,2,1)$ and $(3,0,-1)$
   (a) 0
   (b) 1
   (c) 2
   (d) 3
52. If V is a vector space over an infinite field F such that $\dim V = 2$, then the number of distinct subspace V has is
   (a) 2
   (b) 3
   (c) 4
   (d) Infinite
53. The set
   $S_1 = \left\{ \alpha = \begin{bmatrix} 1 & -2 & 4 \\ 3 & 0 & -1 \end{bmatrix}, \beta = \begin{bmatrix} 2 & -4 & 8 \\ 6 & 0 & -2 \end{bmatrix} \right\}$ and
   $S_2 = \left(d = u^3 + 3u + 4, g = u^3 + 4u + 3 \right)$ are
   (a) Both Linearly dependent
   (b) Both Linearly independent
   (c) S_1 is Linearly dependent S_2 is not
   (d) S_2 is Linearly dependent S_1 is not
54. Let $M_{2\times2}(R)$ be the vector space of 2×2 matrices over R and
   $W_1 \left\{ \begin{bmatrix} x & y \\ 0 & x \end{bmatrix} : x, y \in R \right\}$ and
   $W_2 \left\{ \begin{bmatrix} x & y \\ z & 0 \end{bmatrix} : x, y, z \in R \right\}$ then
   $\dim(W_1 \cap W_2)$ is equal to
   (a) 0
   (b) 1
   (c) 2
   (d) 3
55. If $S = \{(1,1,0),(2,1,3)\} \subseteq \mathbb{R}^3$ the which following vectors of R^3 is not in the span [S]?
   (a) $(0,0,0)$
   (b) $(3,2,3)$
   (c) $(1,2,3)$
   (d) $(4/3,1,1)$
56. The system of equation
   $kx + y + z = 1, x + ky + z = k$ and
   $x + y + kz = k^3$ does not have a solution, if k is equal
   (a) 0
   (b) 1
   (c) -1
   (d) -2
57. If the set of all triples (x_1, x_2, x_3) of real number R from vector space V_3, then a subspace denoted by a vertical plane $y = x$ can be obtained by a linear combination of the sets.
   (a) $(1,1,0)$ and $(0,0,1)$
   (b) $(1,1,0)$ and $(1,0,0)$
   (c) $(1,0,0)$ and $(0,1,0)$
   (d) $(1,0,1)$ and $(0,0,1)$
58. The system of equation
   $x - y + 3z = 4$
   $x + z = 2$ has
   $x + y - z = 0$
   (a) A unique solution
   (b) Finitely many solution
   (c) infinitely many solution
   (d) No solution
59. Which one of the following statement is correct?

(a) There is no vector space of diension1.
(b) Any three vector of voter space of dimension 3 are Linearly dependent.
(c) There is one and only one basis of a vector space of finite dimension.
(d) If a non-zero vector space *V* is generated by a finite set *S*, then *V* can be generated by a linearly independent subset of *S*.

60. Let *A* be an $n \times n$ matrix from the set of numbers and $A^3 - 3A^2 + 4A - 6l = 0$, where *l* is $n \times n$ unit matrix. If A^{-1} exist then
(a) $A^{-1} = A - l$
(b) $A^{-1} = A + 6l$
(c) $A^{-1} = 3A - 6l$
(d) $A^{-1} = \frac{1}{6}\left(A^2 - 3A + 4l\right)$

61. Let *M* be a $m \times n(m < n)$ matrix with rank *m*. then
(a) For every *b* in $\mathbb{R}^m, M_x = b$ has unique solution
(b) For every *b* in $\mathbb{R}^m, M_x = b$ has a solution but it is not unique
(c) There exists $b \in \mathbb{R}^m$ $M_x = b$ has no solution
(d) None of the above

62. Let *A* be a $m \times n$ $m \times n(m < n)$ matrix with row rank. The dimension of the space of solution of the system of linear equation $AX = 0$ is
(a) r
(b) $n - r$
(c) $m - r$
(d) $\min(m, n) - r$

63. A matrix *M* has Eigen value 1 and 4 with corresponding Eigen vector $(1, -1)^T$ and $(2, -1)^T$ respectively. Then, M is
(a) $\begin{pmatrix} -4 & -8 \\ 5 & 9 \end{pmatrix}$
(b) $\begin{pmatrix} 9 & -8 \\ 5 & -4 \end{pmatrix}$
(c) $\begin{pmatrix} 2 & 2 \\ 1 & 3 \end{pmatrix}$
(d) $\begin{pmatrix} 3 & 2 \\ 1 & 2 \end{pmatrix}$

64. Let $A \in C^{m \times n}$ and $A'\ A^*$ denote, respectively the transpose and conjugate transpose of *A*. then
(a) $\text{Rank}\left(AA^*A\right) = \text{rank}(A)$
(b) $\text{rank}(A) = \text{rank}\left(A^2\right)$
(c) $\text{rank}(A) = \text{rank}\left(A'A\right)$
(d) $\text{rank}\left(A^2\right)$ - $\text{rank}(A) = \text{rank}\left(A^3\right)$- $\text{rank}\left(A^2\right)$

65. Let *A* be $n \times n$ matrix which both Hermit Ian and unitary. Then
(a) $A^2 = l$
(b) A is real
(c) The Eigen value of *A* are 0,1,-1
(d) The characteristic and minimal polynomials of *A* are the same

66. Let *P* be a matrix of order of order $m \times n$ and Q be a matrix of order $n \times P, n \neq P.$ if rank $(P) = n$ and $(Q) = P$, then rank (PQ) is
(a) n
(b) P

(c) nP
(d) $n+P$

67. let A be a 3×3 matrix with real entries such that $\det(A)=6$ and the trace of A is 0. If $\det(A+I)=0$, where I denotes the 3×3 identity matrix, then the Eigen values of A are
   (a) $-1,2,3$
   (b) $-1,2,-3$
   (c) $1,2,-3$
   (d) $-1,-2,3$

68. let A be a 4×4 matrix with real entries such that $-1,1,2,-2$ are its Eigen values. If $B=A^4-5A^2+5I$ where I denotes the 4×4 identity matrix, then which of the following statements are correct?
   (a) $\det(A+B)=0$
   (b) $\det(B)=1$
   (c) trace of $A-B$ is 0
   (d) trace of $A+B$ is 0

69. Let V be the vector space of $m\times n$ matrices over a field k, then the dimension of V is
   (a) n
   (b) m
   (c) mn
   (d) $m-n$

70. the dimension of $C(R)$ is
   (a) 1
   (b) 2
   (c) 3
   (d) 4

71. Let V be the vector space of ordered pairs of complex numbers over the real filed $\mathbb{R}$ then, the dimension of V is
   (a) 1
   (b) 2
   (c) 3
   (d) 4

72. Let A be an $m\times n$ matrix where $m<n$. Consider the system of linear equation $A\underline{X}=\underline{b}$, where b is an $n\times1$ column vector and $b\neq0$. Which of the following is always true?
   (a) The system of equation has no solution
   (b) The system of equation has no solution. If and only if it has infinity many solutions
   (c) The system of equation has a unique solution
   (d) The system of equation has at least one solution

73. Let A be $n\times n$ matrix over R. consider the following statements
   I. Rank $A=n$
   II. Det $(A)\neq0$
   Then
   (a) $I\Rightarrow II$ but II does not imply I
   (b) $II\Rightarrow I$ but I does not imply I
   (c) $I\Leftrightarrow II$
   (d) There is no relation between the statements

74. If the characteristic root of $\begin{bmatrix}3&7\\2&5\end{bmatrix}$ are λ_1 and λ_2 the characteristic root of $\begin{bmatrix}5&-7\\-2&3\end{bmatrix}$ are
   (a) $\lambda_1+\lambda_2, \lambda_1-\lambda_2,$
   (b) $\frac{1}{\lambda_1}$ and $\frac{1}{\lambda_2}$
   (c) λ_1 and λ_2
   (d) $\lambda_1+\lambda_2$ and $|\lambda_1-\lambda_2|$

75. If A and B are two $n \times n$ matrices over $\mathbb{R}$ and $\alpha \in \mathbb{R}$ then
   (a) $\det(\alpha A + B) = \alpha \det(A) + \det(B)$
   (b) $\det(\alpha A - B) = \alpha \det(A) + \det(B)$
   (c) $\det(\alpha A \cdot B) = \alpha \det(A) + \det(B)$
   (d) $\det(\alpha A \cdot B) = \alpha \det(A) \cdot \det(B)$

76. If $A = \begin{bmatrix} 2 & 1 \\ 3 & -1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. Which of the following is the zero matrix?
   (a) $A^2 - A - 5I$
   (b) $A^2 + A - 5I$
   (c) $A^2 + A - I$
   (d) $A^2 - 3A - 5I$

77. Let W_1 and W_2 be finite dimensional subspace of a vector space V. if $\dim W_1 = 2$, $W_2 = 2$, $\dim(W_1 + W_2) = 3$ then $\dim(W_1 \cap W_2)$ is
   (a) 1
   (b) 2
   (c) 3
   (d) 4

78. The dimension of the vector space spanned by $(1,-2,3,-1)$ and $(1,1,-2,3)$ is
   (a) 1
   (b) 2
   (c) 4
   (d) None of above

79. Consider the matrix $M = \begin{bmatrix} a^2 & ab & ac \\ ab & b^2 & bc \\ ac & bc & c^2 \end{bmatrix}$ where a,b and c are non- zero real numbers. Then the matrix has
   (a) Three non-zero real Eigen value
   (b) Complex Eigen value
   (c) Two non-zero Eigen values
   (d) Only one non-zero Eigen value

80. Let $M = \begin{bmatrix} 1 & 1+i & 2i & 9 \\ 1-i & 3 & 4 & 7-i \\ -2i & 4 & 5 & i \\ 9 & 7+i & -i & 7 \end{bmatrix}$, then
   (a) M has purely imaginary Eigen values
   (b) M has only real Eigen values
   (c) M is not diagonalizable
   (d) M has Eigen values which are neither real nor purely imaginary

81. If $(m,3,1)$ is a linear combination of vectors $(3,2,1)$ and $(2,1,0)$ in $\mathbb{R}^3$ then the value of m is
   (a) 1
   (b) 3
   (c) 5
   (d) None of the above

82. The set $V = \{(x,y) \in \mathbb{R}^2 : xy \geq 0\}$ is
   (a) A vector subspace of $\mathbb{R}^2$
   (b) A vector subspace of $\mathbb{R}^2$, since every element does not have an inverse in V
   (c) A vector subspace of $\mathbb{R}^2$, since it is not closed under scalar multiplication
   (d) A vector subspace of $\mathbb{R}^2$, since it is not closed under vector addition

83. If M is a 7×5 matrix of rank 3 and N is a 5×7 matrix of rank 5, then rank (MN) is
   (a) 5
   (b) 3
   (c) 2
   (d) 1

84. Let S and T be two subspace of R^{24} such that $\dim(S)=19$ and $\dim(T)=17$ then the
   (a) Smallest possible value of $\dim(S \cap T)$ is 2
   (b) Largest possible value of $\dim(S \cap T)$ is 18
   (c) Smallest possible value of $\dim(S+T)$ is 19
   (d) Largest possible value of $\dim(S+T)$ is 22

85. The set of all $x \in \mathbb{R}$ for which the vector $(1,x,0),(0,x,^2 1)$ and $(0,1,x)$ are linearly independent in $\mathbb{R}^3$ is
   (a) $\{x \in R : x = 0\}$
   (b) $\{x \in R : x \neq 0\}$
   (c) $\{x \in R : x \neq 1\}$
   (d) $\{x \in R : x \neq -1\}$

86. If the rank of (5×6) matrix A is 4, then which one of the following statements is correct?
   (a) A will have four linearly independent rows and four linearly independent columns
   (b) A will have four linearly independent rows and five linearly independent columns
   (c) AA^T will be invertible
   (d) $A^T A$ will be invertible

87. Consider the set of vectors (columns) defined by
   $X = \{x \in R^3 : x_1 + x_2 + x_3 = 0,\ \text{where } x^T = [x_1, x_2, x_3]\}$
   which of the following is true?
   (a) $\{[1,-1,0]^T [1,0,-1]^T\}$ is a basis for the subspace X.
   (b) $\{[1,-1,0]^T [1,0,-1]^T\}$ is a linearly independent set, but it does not span X and therefore is not a basis of X.
   (c) X is not a subspace for R^3
   (d) none of the above

88. let $M_{n\times n}(R)$ be the set of all $n \times n$ matrices. Then , the subset $S =$ diagonal $(d_1, d_2, ..., d_n)$ where $di \in R$ of $M_{n\times n}(R)$ where trace (Diagonal) =0 where of $A \in S$.
   (a) the set S does not forms a subspace of $V = M_{n\times n}$
   (b) the set S is not closed wrt multiplication.
   (c) Set S from a subspace of dimension $(n-1)$
   (d) Set S from a subspace of dimension $(n^2 - 1)$

89. $S = \{(x_1, x_2, ..., x_{100}) \in \mathbb{R}\}$ s.t.
   $x_1 = x_2 = ... = x_{50}, x_{51} + x_{52} + ... + x_{100} = 0\}$
   then, dim$S$ is
   (a) 49
   (b) 50
   (c) 47
   (d) 51

90. A is any matrix which satisfy $A^3 - A^2 + A - I = 0$ and $A_{3\times 3}$ then A^4 is
   (a) 0
   (b) I
   (c) $\Im$ no such matrix
   (d) $A^3 + A^2 - A + I$

91. Consider
$S = \{a_0 + a_1x + a_2x^2 + a_3x^3 : a_i \in \mathbb{R}, i = 0,1,2,3\}$
with usual addition and multiplication
(a) S does not from a vector space
(b) For vector space with dim4
(c) S does not from vector space because does not have identity
(d) From a vector space with dim3

92. Let A be a 4×3 matrix whose columns from a linearly independent set which conclusion is justified i.e., which are true?
(a) The set of row in A is linearly dependent
(b) The equation $Ax = b$ is consistent for every b in R^4
(c) The equation $Ax = 0$ has a non-trivial solution.
(d) There is a matrix B s.t. $AB = I_4$

93. The Eigen vectors of the matrix $\begin{bmatrix} 1 & 2 \\ 0 & 2 \end{bmatrix}$ are written in the from $\begin{bmatrix} 1 \\ a \end{bmatrix}$ and $\begin{bmatrix} 1 \\ b \end{bmatrix}$ what is $a+b$?
(a) 0
(b) $1/2$
(c) 1
(d) 2

94. An Eigen vector of $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 2 \\ 0 & 0 & 3 \end{bmatrix}$ is
(a) $[-1\ 1\ 1]^T$
(b) $[-1\ 2\ 1]^T$
(c) $[1\ \text{-}1\ 1]^T$
(d) $[2\ 1\ \text{-}1]^T$

95. For the matrix $A = \begin{bmatrix} 2 & -2 & 3 \\ -2 & -1 & 6 \\ 1 & 2 & 0 \end{bmatrix}$ one of the Eigen values is 3.
(a) 2,-5
(b) 3,-5
(c) 2,5
(d) 3,5

96. Consider the following matrix $A = \begin{bmatrix} 2 & 3 \\ x & y \end{bmatrix}$ if the Eigen values of A are 4 and 8, then
(a) $x = 4, y = 10$
(b) $x = 5, y = 8$
(c) $x = -3, y = 9$
(d) $x = -4, y = 10$

97. The Eigen values of skew-symmetric matrix are
(a) Always zero
(b) Always pure imaginary
(c) Either zero or pure imaginary
(d) Always real

98. If $A = \begin{bmatrix} -3 & 2 \\ -1 & 0 \end{bmatrix}$, then calculate A^9
(a) $511A + 510I$
(b) $309A + 104I$
(c) $154A + 155I$
(d) Exp(9)

99. Let V_1, V_2, V_3 be three non-zero vectors in $\mathbb{R}^n$ are linearly dependent, then
(a) V_3 must be linear combination of V_1 and V_2
(b) V_2 must be linear combination of V_1 and V_3

(c) V_1 must be linear combination of V_2 and V_3
(d) none of the above

100. let V And W be subspace of $\mathbb{R}^n$, then
(a) $\dim(V+W)$ must be $\dim V+\dim W$
(b) $\dim(V+W)>\dim V+\dim W$
(c) $\dim(V+W)<\min(\dim V+\dim W)$
(d) $\dim(V+W)\geq\max(\dim V+\dim W)$

101. If A is a 3×3 matrix over $\mathbb{R}$ and $\alpha,\beta,\alpha\neq\beta$ are the only characteristic roots (Eigen values) of A in $\mathbb{R}$, then the characteristic polynomial of A is
(a) $(x-\alpha)(x-\beta)$
(b) $(x-\alpha)^3+(x-\beta)^3$
(c) $(x-\alpha)(x-\beta)(x-\gamma)$ for some $\gamma\neq\alpha,\beta$
(d) $(x-\alpha)^2(x-\beta)$ and $(x-\alpha)(x-\beta)^2$

102. Let $S=\{(0,1,\alpha),(\alpha,1,0),(1,\alpha,1)\}$. then, S is a basis for R^3 if and only if
(a) $\alpha\neq0$
(b) $\alpha\neq1$
(c) $\alpha\neq0$ and $\alpha^2\neq2$
(d) $-1\leq\alpha\leq1$

103. Let A be a 3×3 matrix and consider the system of equation $Ax=\begin{bmatrix}1\\0\\-1\end{bmatrix}$ then
(a) If the system is consistent, then it has a unique solution
(b) If A is singular, then the system has infinity many solution
(c) If the system is consistent, then the $|A|\neq0$
(d) If the system has a unique solution, then A is non-singular

104. The characteristic polynomial of 3×3 matrix A is $|\lambda I-A|=\lambda^3+3\lambda^2+4\lambda+3$ let $x=\text{trace }(A)$ and $y=|A|$ the determinant of A. then
(a) $\frac{x}{y}=\frac{3}{4}$
(b) $\frac{x}{y}=\frac{4}{3}$
(c) $x=y=-3$
(d) $x=3$ and $y=-3$

105. Let $S=\{(-1,0,1),(2,1,4)\}$ the value of k for which the vector $(3k+2,3,10)$ belongs of the linear span of S is
(a) -2
(b) 2
(c) 8
(d) 3

106. Let $S=\{x_1,x_2,....x_m\}$ and $T=\{y_1,y_2,....y_m\}$ be subsets of the vector space V. then
(a) If S and T are both linearly independent, then $m=n$
(b) If S is a basis for V and if T spans V. then $m\geq n$
(c) If S is a basis for V and if T in linearly independent, then $m\leq n$
(d) If S linearly independent and if T spans V, then $m\leq n$

107. Which of the following sets of function is linearly dependent in the vector space $C[0,1]$ of real continuous function over[0,1]?
(a) $\{1,x,x^2+1\}$

(b) $\{\sqrt{2}, x^2, x^3, 3x^2+\sqrt{2}\}$

(c) $\{x+1, x^2+1\}$

(d) $\{x^2+1, x^2+5\}$

108. Let $\{e_1, e_2, e_3\}$ be a basis of vector space V over R. consider the following sets

$A=\{e_2, e_1+e_2, e_1+e_2+e_3\}$

$B=\{e_2, e_1-e_2, e_1-e_2+e_3\}$

$C=\{2e_1, 3e_2+e_3, 6e_1+3e_2+e_3\}$ then

(a) A and B are basis of V
(b) A and C are basis of V
(c) B and C are basis of V
(d) Only B is basis of V

109. Let A be an $m\times n$ matrix and $b=(b_1, b_2, ...b_n)^t$ be a fined vector. Consider a system of n linear equations $Ax=b$, where $x=(x_1, x_2, x_3)$. Consider the following statements

I. If rank $A=n$, the system has a unique solution.
II. If rank $A<n$, the system has infinity many solution
III. If $b=0$, the system has at least one solution

Which of the following is correct?

(a) I and II are sure
(b) I and III are sure
(c) Only I is true
(d) Only II is true

110. Let V is vector space of all 5×5 real skew-symmetric matrices. Then, the dimension of V is

(a) 20
(b) 15
(c) 10
(d) 5

111. A homogeneous system of 5 linear equation in 6-variables admits

(a) No solution in $\mathbb{R}^6$
(b) A unique solution in $\mathbb{R}^6$
(c) Infinity many solution in $\mathbb{R}^6$
(d) Finite, but more than 2 solution in $\mathbb{R}^6$

112. A square matrix A is said to be idempotent, if $A^2=A$. An independent matrix is non-singular if and only if

(a) All Eigen values are real
(b) All Eigen values are non-negative
(c) All Eigen values are either 1 or 0
(d) All Eigen values are 1

113. If A is a system matrix $\lambda_1, \lambda_2, ...\lambda_n$ be the Eigen values of A and $a_{11}, a_{22}, a_{33}, ..., a_{nn}$ is the diagonal entries of A then, which of the following is correct?

(a) $\sum a_{ii} < \sum \lambda_i$
(b) $\sum a_{ii} = \sum \lambda_i$
(c) $\sum a_{ii} > \sum \lambda_i$
(d) $\sum a_{ii} \le \sum \lambda_i$

114. If the characteristic polynomial of $A_{3\times3}$ is given by $\Delta(\lambda)=\lambda^3-\lambda^2+2\lambda+28.$ then, trace of A and determinant of A are, respectively

(a) 1 and 28
(b) -1 and 28
(c) 1 and -28
(d) -1 and -28

115. If $\begin{bmatrix} 1 \\ -1 \end{bmatrix}$ is an Eigen vector $\begin{bmatrix} 1 & -n \\ -3 & 2n \end{bmatrix}$, then n is

(a) 1

(b) -2
(c) 3
(d) 4

116. Let A be matrix with complex entries. If A is herniation as well as unitary and α is an Eigen value of then
(a) α can be any real number
(b) $\alpha = 1$ or -1
(c) α can be any complex number of absolution value 1
(d) None of the above

117. Consider 2×2 matrix $A=\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ if $a+d=1=ad-bc,$ then A^3 equals
(a) 0
(b) $-I$
(c) $3I$
(d) None of the above

118. Let A be 3×3 matrix whose characteristic roots are 3,2,-1. If $B=A^2-A$ then $|B|$ is
(a) 24
(b) -2
(c) 12
(d) -12

119. If b a non-singular matrix and A is a square matrix. Then , $\det\left(B^{-1}AB\right)$ is equal to
(a) $\det(BAB)$
(b) $\det(A)$
(c) $\det\left(B^{-1}\right)$
(d) $\det\left(A^{-1}\right)$

120. Choose the correct statement
(a) Every subset of a LI set is LI
(b) Every superset of a LI set is LI
(c) Every subset of a LD set is LD
(d) Every subset of a LD set is LI

121. Let U and W be the following subspace of $\mathbb{R}^4$
$U=\left\{[a,b,c,d]: b+c+d=0\right\}$
$W=\left\{[a,b,c,d]: a+b=0, c=2d\right\}$
Then, dim of U,W and $U\cap W$ are, respectively
(a) 2,3,1
(b) 3,2,1
(c) 2,2,2
(d) 1,2,3

122. If α is characteristic root of a non-singular matrix, then characteristic root of adj (A) is
(a) $\alpha|A|$
(b) α
(c) $\dfrac{|A|}{\alpha}$
(d) $\dfrac{|adj(A)|}{\alpha}$

123. Let A be the matrix of equation from $(x_1-x_2+2x_3)^2$ then, trace of A is
(a) 2
(b) 4
(c) 6
(d) 0

124. $A,B,(A+B)$ are non-singular matrices. Then $\left[B(A+B)^{-1}A\right]^{-1}$ is equals to
(a) $A+B$
(b) $A^{-1}+B^{-1}$
(c) $A^{-1}+B^{-1}+I$
(d) AB

125. If $\lambda_1,\lambda_2,....\lambda_n$ are Eigen values of matrix A, then trace of A is

(a) $\lambda_1, \lambda_2, \ldots. \lambda_n$

(b) $\lambda_1 + \lambda_2 + \ldots. + \lambda_n$

(c) $\frac{1}{\lambda_1, \lambda_2, \ldots. \lambda_n}$

(d) $\lambda_1^2 + \lambda_2^2 + \ldots.. + \lambda_n^2$

126. If A and B Herimitian, then select the incorrect one

(a) $AB + BA$ is Hermitian

(b) $AB - BA$ is skew-Hermitian

(c) $B^\theta B$ is Hermitian

(d) $A + A^\theta$ Hermitian

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