

18UIT2A2- Mathematical foundations for Computer Science

K1 - Level

Unit-1 : Matrices

1. _____ is a rectangular array of numbers arranged in rows and columns.

- A) determinants. B) matrix
C) arrays D) relations

Answer: a) matrix

2. A matrix in which the number of rows and columns are equal is said to be _____

- A) null matrix B) symmetric matrix
C) square matrix. D) diagonal matrix

Answer : c) square matrix

3. The matrix obtained by interchanging the rows and columns of a matrix is called _____ of a matrix

- A) rank B) transpose
C) adjacent. D) inverse

Answer : B) transpose

4. Associative law of matrix is $(A+B)+C=$

- A) $A+ B+C$. B) $A+B$
C) $A(B+C)$. D) $A+(B+C)$

Answer : D) $A+(B+C)$

5. Matrix multiplication law is $(A+B)C=$

- A) $A+(B+C)$. B) $AC+BC$
C) ABC D) $AB(C)$

Answer : B) $AC+BC$

6. A square matrix A which satisfies the relation _____ is called idempotent.

- A) $A^2=A$ B) $2A=A$
C) $A^N=A$ D) $A=N$

Answer : A) $A^2 = A$

7. A square matrix which satisfies the relation _____ is called nilpotent.

- A) $A^A=N$. B) $A^2=A$
C) $A=2N$. D) $A^n=0$

Answer : D) $A^n=0$

8. The _____ is $\leq r$ if all the minors of order $(r+1)$ are 0.

- A) relation B) determinant
C) rank. D) matrix

Answer : C) rank

9. The rank is $\geq r$ if the minor of order r is _____

- A) zero. B) 2
C) 4. D) not zero

Answer : D) not zero

10. A square matrix all of whose elements except those in leading diagonal or zero is _____

- A) symmetric matrix. B) scalar matrix

C) diagonal matrix.

C) null matrix

Answer : C) diagonal matrix

Unit-2: Set Theory

1. A _____ is a well defined collection of objects or classes or dusting object's.

A) set.

B) union

C) intersection.

D) matrix

Answer : A) set

2. C is a set of _____

A) prime numbers.

B) real numbers

C) complex number.

D) integers

Answers : C) complex numbers

3. A set which contains only one element or unit is called _____

A) singular set.

B) singleton set

C) null set

D) equivalent set

Answer : B) singleton set

4. If the elements of one set can be put into one-to-one correspondence with the elements of another set then two sets are called _____

A) one to one set.

B) equivalent set

C) equal set

D) pairs

Answer : B) equivalent set

5. If s is any set, then the family of all the subsets of S is called the _____

- A) super set of s . B) subset of s
C) power set of s . C) universal set

Answer : c) power set of s

6. In properties of union of sets $A \cup (B \cup C) =$

- A) $(A \cup B) \cup C$. B) $A \cup B \cup C$
C) ABC . C) $AB(C)$

Answer : A) $(A \cup B) \cup C$

7. In properties of difference of two sets $A - A =$

- A) null set. B) A
C) 0 D) $-A$

Answer : A) null set

8. $A \Delta B =$

- A) $A - B$. B) $B - A$
C) $(A - B) \cup (B - A)$. D) $A \cup B$

Answer : C) $(A - B) \cup (B - A)$

9. $n(A) + n(B) - 2n(A \cap B) =$

- A) $n(A \cup B)$. B) $n(A \Delta B)$
C) $n(A + B)$. D) $n(A - B)$

Answer : B) $n(A \Delta B)$

10. Commutative property of symmetric difference _____

A) $A-B=B-A$.

B) $AB=BA$

C) $A+B=B+A$.

D) $A\Delta B=B\Delta A$

Answer : D) $A\Delta B=B\Delta A$

Unit-3 : Mathematical Logic

1. Two or more simple propositions can be denoted by means of _____

A) logical operator.

B) arithmetic operator

C) binary operator

D) assignment operator

Answer : A) logical operator

2. A proposition consists of only one propositional (constant) variable is called _____

A) constant proposition

B) single proposition

C) atomic proposition.

D) dynamic proposition

Answer : C) atomic proposition

3. The words and braces that are used to form a compound proposition are called _____

A) propositions.

B) connectives

C) logics.

D) braces

Answer : B) connectives

4. The symbol for negation is _____

A) \wedge .

B) $\$$

C) \sim

D) $\&$

- A) void relation B) equivalence relation
 C) equal sets D) equivalent

Answer : B) equivalence relation

10. Let R_1 be a relation from A to B and R_2 be the relation from B to C , then the composition relation is denoted as _____

- A) $(R_2 \circ R_1)$ B) (R_1 / R_2)
 C) $(R_2 (R_1))$ D) $R_2 \subset R_1$

Answer : A) $(R_1 \circ R_2)$

Unit-5 : Graph Theory

1. In a graph, written as $G=G(V,E)$, then the finite set of vertices V , also called _____

- A) points B) edges
 C) vertices D) graphs

Answer : A) points

2. A graph written as $G=G(V,E)$, then the finite set of _____ is also called lines or arcs connecting pair of vertices .

- A) points B) nodes
 C) junction D) edges ,E

Answer : D) edges ,E

3. Each pair of vertices connecting with an edge is called _____

- A) end points B) originate
 C) terminal D) nonterminal

Answer : A) end points

9. In a walk , First and last vertices in the sequence are called

A) origin vertices

B) paths

C) cycles.

D) Terminal services

Answer : D) Terminal vertices

10. A walk is said to be the _____ if a walk begins and ends at the same vertices

A) open walk.

B) closed path

C) closed walk.

D) open vertices

Answer : C) closed walk

18UIT2A2 - MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

K2 LEVEL

Unit-1 : Matrices

1. Define set.

Matrix is a rectangular array of numbers arranged in rows and columns

2. Discuss the equality of sets .

The sets A and B are said to be equal if the A has the same number of rows and same of columns as B

3. Define row matrix .

Matrix which contains only one row is called row matrix

4. Define columns matrix.

Matrix which contains only one column is called columns matrix.

5. Define square matrix .

A matrix is said to be square matrix ,if the number of rows = the number of columns

6. Define null or zero matrix .

If a matrix , rectangular or square, has all its elements equal to zero, it is called a null matrix .

7. Define diagonal matrix.

A square matrix which all the elements are 0 except in the leading diagonal is called diagonal matrix

8. List the types of matrices.

Upper triangular matrix, lower triangular matrix

9. Define upper triangular matrix .

A square matrix in which all the elements below the leading diagonal are zero is called upper triangular matrix

10 .Define lower triangular matrix .A square matrix in which all the elements above the leading diagonal are zero is called lower triangular matrix

Unit-2 : Set Theory

1. Define set .

A set is a well defined collection or class of distinct objects

2. Which is called as members or elements ?

An object in the set is called members or elements.

3. List any two standard sets and symbols ?

(i) R = set of all real numbers

(ii) P = set of all prime numbers

4. What are the methods of set description ?

(i) roster method

(ii) set builder method

5. Describe cardinal number ?

The number of elements in a set is called cardinal number .

6. List any three types of sets .

(i) finite set

(ii) infinite set

(iii) singleton set

7. Recall null set.

A set which contains no element is called an empty or null set .

8. Show the equation in vennuler diagram .

(a) A and B are disjoint

9. Name any two properties of union of sets .

1. The union of sets is commutative

2. The union of sets is associative

10. show the union of sets is associative .

$$A \cup (B \cup C) = (A \cup B) \cup C$$

Unit-3 : Mathematical Logic

1. What is meant by contradiction

If a compound statement is false for all true values assigned for components, it is known as a contradiction

2. Demonstrate the importance of tautology

Tautology helps conclude some statement from some given statements

3. Define biconditional statement

The connective "if and only if" is called a biconditional connective and is denoted by \Leftrightarrow

4. List the notations of predicate calculus

Terms, predicates, quantifiers

5. What is propositional calculus

It is also called statement calculus; it is used to describe a logical system

6. Define conjunction

When two or more statements are joined by the connective "and", it is called conjunction

7. Define disjunction

When two or more statements are joined by the connective "or", it is denoted by \vee

8. Illustrate the two different meanings of disjunction

Inclusive and exclusive disjunction

9. List the basic logical operations

Conjunction, disjunction, and negation

10. How many basic logical operations are there?

There are three basic logical operations

Unit-4: Relations and Functions

1. Define binary relation

A binary relation is said to be defined in a set if for any order pair (x, y) of element of A , it is meaningful to say whether x has or not the relation R to y

2. How set operations on relations for difference of R and S $x(R-S)y$

$$xRy \wedge xSy$$

3. Show that the composition of functions obeys associative law

$$(h \circ g) \circ f = h \circ (g \circ f)$$

4. List the invertible function

One-one and onto function

5. How the inverse of relation R is represented

R^{-1}

6. How set operations on relations for union of R and S is representative R and S are two relations $x(R \cup S)y$

$$xRy \vee xSy$$

7. What is many one function

If two or more different element in A have same f - image in B

8. What is one to one

If different element in A have different f -image

9. Which possesses a inverse is said to be?

Invertible

10. How set operations on relations for intersection of R and S : $x(R \cap S)y$?

$$xRy \wedge xSy$$

Unit-5 : Graph Theory

1. What is indegree

The indegree of a vertex V in a directed graph is the number of edges ending at it is denoted by $\text{indeg}(V)$

2. Define outdegree

The outdegree of a vertex in a directed graph is the number of edges beginning from it and denoted by $\text{outdegree}(v)$

3. Illustrate degree of vertex

The degree of a vertex denoted by $d(v)$ or $\text{deg}(v)$ is the number of edges are connected.

4. Define finite graph

A graph with countable sets of vertices and Edges is called finite graph

5. What is undirected graph

An undirected graph is also defined in the same manners directed graph except that edges are unordered pairs of distinct vertices

6. Define multiple or parallel edge

In same directed or undirected graph there exists certain pair of nodes that are joined by more than one edges such edges are called multiple or parallel edge

7. What is pseudo graph

A graph in which loop and multiple edges are allowed is called pseudo graph

8. Define simple graph

A simple graph is one in which does not have multiple edges or loop.

9. Define walk

A walk is a sequence of vertices and Edges that begins at vertex and travel along edges

10. What is closed and open walk

A walk is said to be the closed walk if it is possible that a walk begins and end at the same vertices.

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K3 LEVEL

Unit-1: Matrices

- 1.Explain any five types of matrices.
2. Explain the multiplication of matrices with example .
- 3.Explain the reversal law for the Transpose of a product of two matrices .
4. Discuss the rank of a matrix with its definition and rules .
5. Find the inverse of a matrix .

$$A = \begin{pmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & -7 \end{pmatrix}$$

Unit-2: Set Theory

- 1.conclude the distributive laws using venn-diagrams?
2. Classify the types of sets?
- 3.List any properties of union of sets.
- 4.List any five properties of intersection of sets.
- 5.Illustrate any five properties of complement Of sets

Unit-3 : Mathematical Logic

1. List the five logical connectives using the table.
2. Prove that $\sim p \vee \sim q = \sim(p \wedge q)$.
3. Show that the statement $(p \wedge q) \wedge \sim(p \vee q)$ is contradiction or not.
4. Prove that $p \vee q = \sim(\sim p \wedge \sim q)$.
5. Explain the derived connectives with examples

Unit-4: Relations and Functions

1. List the types of relations
2. Classify any two properties of relations
3. Classify any five types of functions
4. Compare the difference between a function and its value
5. Show that the composition of functions obeys associative law

Unit-5: Graph Theory

1. Describe the hand shaking theorem
2. Illustrate diagram for each of the following graph $G(V,E)$
 - a) $V=\{a,b,c,d,e,f\}, E=\{(a,d),(a,f),(b,c),(b,f),(c,e)\}$
 - b) $V=\{a,b,c,d,e\}, E=\{(a,a),(b,c),(b,d),(c,d),(e,a),(e,d)\}$
 - c) $V=\{a,b,c,d,e\}, E=\{(a,d),(b,c),(b,d),(b,e),(d,e),(c,e)\}$
3. Classify the bipartite and weighted graph with examples
4. Discuss the definitions and properties of tree
5. Illustrate the for set Tree with examples

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K4 & K5 level

Unit-1 : Matrices

1 .Clasify the type of matrices .

2 . Find the adjoint of the matrix

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$$

And verify the property $A(\text{adj } A) = (\text{adj } A) \cdot A = |A| \cdot I$.

3 .Find the rank of the following matrix

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

4.Find the rank of the matrix

$$\begin{bmatrix} 1 & 2 & 1 & 2 \\ 1 & 3 & 2 & 2 \\ 2 & 4 & 3 & 4 \\ 3 & 7 & 4 & 6 \end{bmatrix}$$

5. Solve with the help of matrices ,the equations

$$5x+3y+3z=48$$

$$2x+6y-3z=18$$

$$8x-3y+2z=21 .$$

Unit-2 : Set Theory

1. Draw a venn diagram, if a and b are any two sets,

$$A \cup (B - A) = B, A \cup B = (A - B) \cup B, A \cap B = (A - B) \cap B$$

2. In a group two hundred people, each of whom are at least Accountant, Management consultant and Sales manager. It was found that 80 were Accountants, 110 are management consultants and 130 are Sales managers, 10 are all of the three. Find the no. of people who are Accountant as well as Management consultant but not sales manager.

3. Of 20 persons, 10 are interested in music, 7 are interested in photography and 4 like swimming. Further more 4 are interested in both music and photography, 3 are interested in both music and swimming and one is interested in all the three of them. Find how many people are interested in photography but not interested in music and swimming.

4. In a pollution study of 1500 Indian rivers, the following data were reported : 520 are polluted by sulphur compound, 335 were affected by the phosphate, 425 by crude oil. 100 were affected by crude oil and sulphur, 150 were affected by sulphur and phosphate, 150 were affected by crude oil and phosphate. 28 were affected by all the three of them. How many of the rivers were affected by at least one of the three impurities. How many rivers were not polluted by exactly one of the three impurities? How many were not polluted?

5. In a class of 25 students, 12 have taken economics, 8 have taken economics but not political science. Find the no. of students who were taken economics and political science and those who taken political and not economics.

Unit-3 : Mathematical Logic .

1. List the basic logic operations and explain .

2. Analyze the converse, inverse and contra positive statements with example or truth table

3. Show that $(P \Rightarrow (Q \wedge R)) \Rightarrow \sim (P \Rightarrow Q) \vee R$ using truth table .

4. Explain the NAND, NOR, XOR and support with truth table

5. Show the following equation with truth table

$$P \Delta q \Leftrightarrow (p \wedge \sim q) \vee (\sim p \wedge q)$$

Unit-4: Relations and Functions

1. Classify the types of relations .

2. Analyze the type of relations

3. Analyze the composition of function and show that the composition of functions obeys associative law .

4. If R and S are equivalence relations on a set A , prove that (R intersection S) is an equivalence reactions.

5 Let $f: R \rightarrow R$ and $g: R \rightarrow R$, where R is the set of all real numbers . Find $f \circ g$ and $g \circ f$, where $f(x) = x \times x$ and $g(x) = x + 4$. State whether these functions are injective , surjective and bijective .

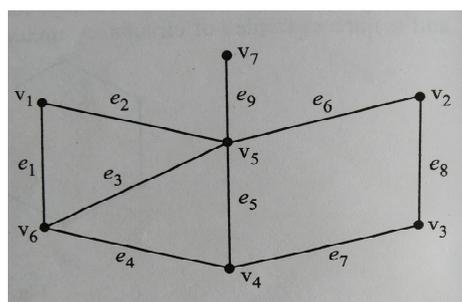
Unit-5: Graph Theory .

1. Analyze the type of graphs .

2. Classify the operations on graph .

3. Examine the definition and properties of trees .

4. Consider the graph and determine



A) pentent vertices

b) pentent edges

C) odd vertices

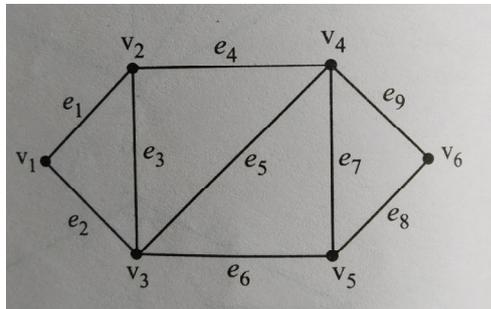
d) even vertices

E) incident edges

f) adjacent vertices

5. Consider the following graph $G(V,E)$ and determine the sub graphs

A) $G-v_1$ B) $G-$



v_5 c) $G-v_3$