

D. M.  
10-10-19



Class: F.Y. BSc IT

Subject: Discrete Mathematics

[Time:  $2\frac{1}{2}$  Hours]

[Marks: 75]

NOTE:

- All questions are compulsory.
- Figures to the right indicate marks.
- Use of calculator is allowed.

Q.1. Attempt any three from the following:

[5X3=15]

1. Let  $U = \{1,2,3,4,5,6,7,8,9\}$ . If  $A = \{1,2,3,4\}$ ,  $B = \{3,4,5,6\}$ ,  $C = \{1,3,5,7,9\}$  then compute  $A \cup B$ ,  $A \cap B$ ,  $(A \cup B)'$  and show that  $(A \cap B)' = A' \cup B'$ .
2. Explain symmetric difference and Cartesian product of sets with an example.
3. Using Venn diagram show that
  - i.  $(A \cup B)' = A' \cap B'$
  - ii.  $(A \cap B)' = A' \cup B'$
4. If A, B, C and D are any four sets then show that  $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$ .
5. Explain implication and bi-implication logical operator and also give its truth table.
6. Let p: She is beautiful; q: She is clever. Write verbal form for each of the following:
  - i.  $p \wedge \sim q$
  - ii.  $\sim p \vee q$
  - iii.  $\sim p \vee \sim q$
  - iv.  $\sim p$  implies  $\sim q$
  - v.  $\sim p$  bi-implication  $\sim q$

Q.2. Attempt any three from the following:

[5X3=15]

1. Explain predicates and quantifiers with an example.
2. Restore the following statements using variables and quantifiers
  - i. All quadrilaterals have four sides.
  - ii. Sum of all angles of a triangle is 180.
  - iii. No snakes have hands.
  - iv. Some numbers are perfect numbers.

3. All tigers are violent.

Some tigers do not eat grass.

Therefore Some violent animals do not eat grass.

Convert this argument using quantifier.

4. State and prove party theorem.

5. Negate each of the following statements:

- i. All the voters are 18 and above.
- ii. For all real numbers  $x$ , if  $x > 5$  then  $x^2 > 25$ .
- iii. There is an honest shopkeeper.
- iv. Square of all non zero real numbers are positive.

6. Prove that square  $\sqrt{3}$  is irrational.

**Q.3. Attempt any three from the following:**

**i [5X3=15]**

1. What is sequence. And also write first 7 terms of  $a_n = a_{n-1} + 1.5$  where  $a_1 = 2.5$ .
2. Prove by mathematical induction

$$1+2+3+\dots+n = n(n+1)/2, \quad \text{for all } n \geq 1.$$

3. Prove by mathematical induction that  $2^n < n!$ , for  $n \in \mathbb{N}$  and  $n \geq 4$ .
4. Solve the recurrence relation  $a_n = -2a_{n-1}$ ,  $n \geq 2$ , and  $a_1 = 3$  by using backtracking method.
5. Solve the recurrence relation  $a_n = 4a_{n-1} + 5a_{n-2}$ ,  $a_1 = 2$ ,  $a_2 = 6$ .
6. If  $f: \mathbb{R} - \{-3/5\}$  to  $\mathbb{R} - \{9/5\}$  be a function defined as  $f(x) = (9x+5)/(5x+3)$  then show that  $f$  is bijective function.

**Q.4. Attempt any three from the following:**

**[5X3=15]**

1. Explain relation and inverse relation.
2. If  $A = \{1, 2, 3, 4, 5\}$  and following be the matrix representation of relation on  $A$  then find that relation and also write its inverse relation.

i. 
$$M = \begin{bmatrix} 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

ii. 
$$M = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

3. What is symmetric, asymmetric and antisymmetric relations.
4. Explain equivalence relation and also give an example.

5. Determine whether R is an equivalence relation on  $A=\{1,2,3,4\}$

$$R=\{(1,1),(1,2),(2,1),(2,2),(3,4),(4,3),(3,3),(4,4)\}$$

6. Explain the types of Graph.

**Q.5. Attempt any three from the following:**

**[5X3=15]**

1. What is sample space , event and favorable events.
2. Suppose two dice are tossed and the numbers on the top faces are recorded. What is the probability that, sum of the numbers is (I) 5 (ii) at least 7, (iii) prime.
3. Draw a possibility tree for the following situations:

A president, vice-president and a secretary are to be selected from four persons, Ajay, Vijay, Jayesh and Umesh. Ajay can not be president and either Jayesh or Umesh must be secretary.

4. From a set of 16 tickets numbered from 1 to 16, one ticket is drawn at random. Find the probability that,
  - i. The number on ticket is divisible by 3 or 7.
  - ii. Not divisible by 3 or 7.
  - iii. Divisible by 2 or 5.

5. A random variable has the following probability distribution.

|      |     |     |     |     |
|------|-----|-----|-----|-----|
| X    | 4   | 5   | 6   | 8   |
| P(X) | 0.1 | 0.3 | 0.4 | 0.2 |

Find the expected value.

6. A student is to answer eight out ten questions in an examination. How many choices does he have? How many choices has he if he must answer the first three questions?

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