

Total No. of Questions : 12]

SEAT No. :

P2926

[Total No. of Pages : 4

[5463] - 104

First Year M.C.A. (Under Engineering Faculty) (Semester - I)
DISCRETE MATHEMATICS
(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of probability table, electronic pocket calculator is allowed.*
- 4) *Assume Suitable data if necessary.*

Q1) a) Using mathematical induction, prove that **[4]**

$$1^2 - 2^2 + 3^2 - 4^2 + \dots + (-1)^{n-1} n^2 = (-1)^{n-1} n(n+1)/2$$

- b) It was found that in the first year Computer Science of 90 students know COBOL, 55 know C, 46 know JAVA. It was also found that 37 know C and COBOL, 28 know C and JAVA, 25 JAVA and COBOL and 7 students do not know any language. **[4]**

Find: i) How many know all the three languages?

ii) How many know exactly two languages?

OR

Q2) a) How many integers between 1 - 500 are divisible by 2, 3, 5, or 7? **[4]**

b) Verify that If A & B are finite sets, then $|A \cup B| = |A| + |B| - |A \cap B|$ **[4]**

Q3) a) Write the following statements in symbolic forms: **[4]**

- i) If I am in a good mood or I am not busy, then I will go for movie.
- ii) If I finish my homework before dinner and it does not rain, then I will go to the ball game.
- iii) I will go to a movie only if I will not study discrete structures.
- iv) Either the food is good or service is good, but not both.

b) Prove that $(p \rightarrow (q \rightarrow r)) \Rightarrow (p \rightarrow q) \rightarrow (p \rightarrow r)$ **[4]**

OR

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Q4) a) Prove the Demorgan's law for OR and AND by using Venn Diagram. **[4]**

b) For the universe of all integers, let $P(x)$, $Q(x)$, $R(x)$, $S(x)$ and $T(x)$ be the following statements: **[4]**

$P(x)$: $x > 0$

$Q(x)$: x is even

$R(x)$: x is a perfect square

$S(x)$: x is divisible by 4

$T(x)$: x is divisible by 5

Write the following statement in symbolic form.

i) At least one integer is even.

ii) If x is even and x is perfect square, then x is divisible by 4.

iii) If x is even, then x is not divisible by 5.

iv) There exists an even integer divisible by 5.

Q5) a) Suppose repetitions are not possible. **[4]**

i) How many three digit numbers can be formed from six digits 2, 3, 4, 5, 7, 9?

ii) How many of these numbers are less than 400?

iii) How many numbers are even?

iv) How many are multiple of 5?

b) Two dice are rolled together. Event A denotes that sum of the numbers on top faces is even and event B denotes that there is 4 on at least one top faces. Find $P(A \cup B)$ and $P(A \cap B)$. **[5]**

OR

Q6) a) How many different seven persons committee can be formed each containing 3 women from an available set of 20 women and 4 men from an available set of 30 men? **[5]**

b) A die is rolled 6 times and the sequence of faces is noted. In how many sequences does the face "5" appear an even number of times? Also find the number of sequences in which "5" appears exactly twice or the face "3" appears exactly 4 times. **[4]**

Q7) a) Let $A = \{1, 2, 3, 4\}$ and $R = \{(1, 2), (2, 4), (1, 3), (3, 2)\}$ Find the transitive closure of R by Warshall's algorithm [4]

b) Let $A = \{a, b, c, d\}$ where $R_1 = \{(a, a), (a, b), (b, d)\}$ and $R_2 = \{(a, d), (b, c), (b, d), (c, b)\}$ Find $R_1 R_2, R_2 R_1, R_2^2, R_2^3$ [4]

OR

Q8) a) Function f, g, h are defined on a set $X = \{1, 2, 3\}$ as $f = \{(1, 2), (2, 3), (3, 1)\}$, $g = \{(1, 2), (2, 1), (3, 3)\}$, $h = \{(1, 1), (2, 2), (3, 1)\}$ find $f \circ g, g \circ f, f \circ g \circ h, f \circ h \circ g$. [4]

b) Let $f(x) = x + 2, g(x) = x - 2, h(x) = 3x$ for x belongs to R , where R = set of all real numbers. Find $g \circ f, f \circ g, h \circ f, f \circ h$. [4]

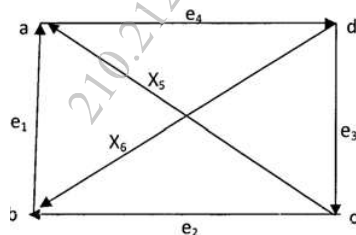
Q9) a) Define the following terms: [4]

- Edge connectivity
- Isomorphic Graph
- Hamiltonian circuit
- Eulerian path

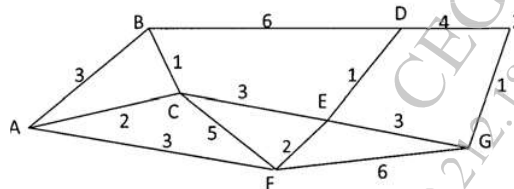
b) Determine the number of regions defined by a connected graph with 6 nodes and 10 edges. Draw the graph. [4]

OR

Q10) a) Consider the following graph and find out incidence matrix and Adjacency matrix of a graph. [4]



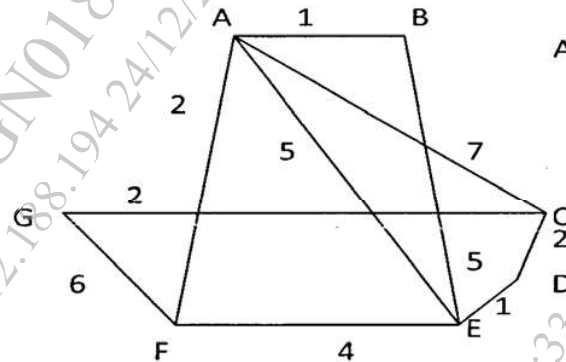
b) Find shortest path between A-Z for the given graph; using Dijkstra's algorithm: [4]



- Q11)a)** A tree has $2n$ vertices of degree 1, $3n$ vertices of degree 2 and n vertices of degree 3. Determine the number of vertices and edges in the tree. [4]
- b) Explain Prim's Algorithm with example. [5]

OR

- Q12)a)** Give the stepwise construction of minimum spanning tree for the following graph using Kruskal's algorithm. [5]



- b) Define i) Full Binary Tree ii) Rooted Tree iii) center of Tree iv) Fundamental Cut set. [4]

