

fuesl)

16

31

(Time: 2 1/2 Hours)

[Total Marks: 75]

- N.B.
- 1) All questions are compulsory.
 - 2) Figures to the right indicate marks.
 - 3) Illustrations, in-depth answers and diagrams will be appreciated.
 - 4) Mixing of sub-questions is not allowed.

Q. 1 Attempt All (Each of 5 Marks)

(15M)

(a) Select correct answer from the following:

1. A relation R on a set A is said to be _____ if aRb , bRc and aRc for all $a, b, c \in A$.
a) Reflexive b) Symmetric c) Transitive d) Antisymmetric
2. The value of $P(3, 2) =$ _____
a) 6 b) 9 c) 8 d) 5
3. Two vertices V_1 and V_2 in a graph G are said to be _____ to each other iff they are the end vertices of the same edge e .
a) Adjacent b) Parallel c) loops d) None
4. In _____ ways 8 different beads can be arranged to form a necklace
a) $8!$ b) $7!$ c) $9!$ d) None
5. Diagrammatic representation of a relation R defined on a set is called _____.
a) Diagraph b) Multigraph c) Hasse diagram d) None

(b) Fill in the blanks:

(Indegree, 45, 21, 35, increase, Lattice, POSET, Injective, Surjective)

1. A Set together with a partial order relation is called _____
2. An onto function is called as _____ function
3. The number of incoming edges on a vertex v is called _____ of a vertex.
4. The value of $C(10, 8) =$ _____.
5. In _____ ways 4 questions can be selected from 7 questions.

(c) Define the following.

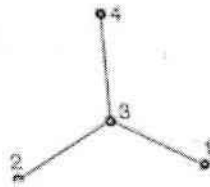
1. Equivalence Relation
2. Recurrence relation
3. Simple graph
4. Pigeonhole principle
5. Pascal identity

Q. 2 Attempt the following (Any THREE)

(15M)

- (a) If $f: R \rightarrow R$ is defined by $f(x) = \frac{(2x-3)}{7}$, for all $x \in R$, then show that f is a bijective function.
- (b) Define composition function. If f and g are two functions from the set of integers to the set of integers defined by $f(x) = x + 3$ and $g(x) = x^2$ then find $f \circ g(x)$ and $g \circ f(x)$.

- (c) Define equivalence relation and let $R = \{(1,1), (1,3), (2, 2), (2, 4), (3, 3), (3, 1), (4, 4), (4, 2)\}$ be the relation defined on $A = \{1, 2, 3, 4\}$. Show that R is an equivalence relation.
- (d) Describe the order pairs in the relation determined by the Hasse diagram of a poset (A, \leq) on the set $A = \{1, 2, 3, 4\}$



- (e) Solve the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$, $n \geq 2$ with initial conditions $a_0 = 0, a_1 = 1$ Using characteristic root method.
- (f) Explain Tower of Hanoi and solve the puzzle.

Q. 3 Attempt the following (Any THREE) (15M)

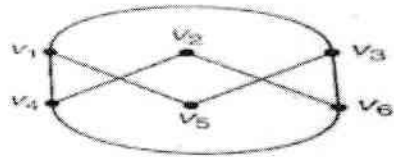
- (a) Prove that
 (i) $C(n,0) = 1$ (ii) $C(n,1) = n$ (iii) $C(n, n) = 1$ (iv) $C(n, r) = C(n, n-r)$
- (b) How many distinguishable permutations of the letters in the word SCIENCE are there?
- (c) Draw a tree diagram to find how many bit strings of length four do not have two consecutive 1's.
- (d) A class is composed of 2 brothers and 6 other boys. In how many ways can all the boys be seated at a round table so that the two brothers are not seated together?
- (e) Let $L = \{a, ab, a^2\}$ and $M = \{b^2, aba\}$ be languages over $A = \{a, b\}$. Find (i) LM (ii) MM
- (f) Find the language $L(G)$ over $\{a,b,c\}$ generated by the grammar G with productions $S \rightarrow aSb, aS \rightarrow Aa, Aab \rightarrow c$.

Q. 4 Attempt the following (Any THREE) (15)

- (a) Define adjacency matrix and Draw the undirected graph G corresponding to given adjacency matrix.

$$A = \begin{bmatrix} 1 & 2 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$

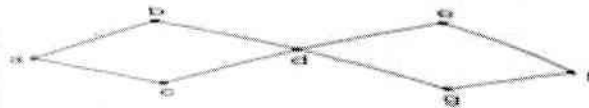
- (b) What is a planar graph? Draw a planar graph representation of the given graph.



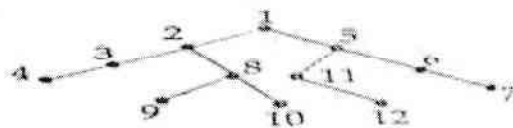
- (c) Explain the operations on graphs also find union and intersection of the given graphs.



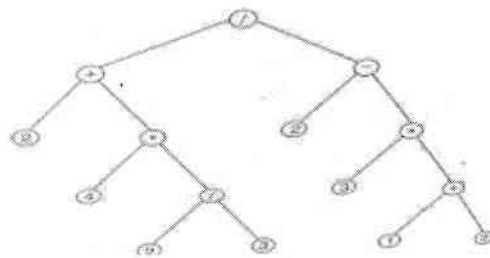
- (d) Use Depth first search algorithm to find a spanning tree for the given graph.



- (e) What is tree traversal and Find preorder, postorder and inorder search for the given tree.



- (f) Determine the value of the expression represented in a binary tree.



Q. 5 Attempt the following (Any THREE)

(15)

- (a) If $A = \{1, 2, 3\}$ and R be relation on A defined by xRy such that $x \leq y$. Find R and draw its diagraph.
- (b) Using generating function solve the recurrence relation $a_n = 3a_{n-1} + 2$ with initial condition $a_0 = 1$.
- (c) What is the probability that a randomly selected number that is between 100 and 999 (both inclusive) will not contain the digit 7?
- (d) What is a Complete graph .Draw a regular graph with 5 vertices
- (e) Consider the language $L = \{ab, c\}$ over $A = \{a, b, c\}$, Find : a) L^3 ; b) L^{-2}