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322452(14)

B. E. (Fourth Semester) Examination,

April-May 2020

(New Scheme)

(CSE Branch)

DISCRETE STRUCTURES

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each question is compulsory and carries 2 marks. Attempt any* ***two*** *the remaining questions and carries 7 marks each.*

Unit-I

1. (a) Define Universal and Existential quantifiers. 2

(b) Prove that $(P \leftrightarrow q) \wedge (q \leftrightarrow r) \rightarrow (P \leftrightarrow r)$ is a tautology. 7

(c) Obtain the conjunctive normal form of the following function : 7

$$f(x, y, z) = xy' + xz + zy.$$

(d) Prove that for every elements a and b of a Boolean algebra 7

(i) $(a+b)' = a' \cdot b'$

(ii) $(a \cdot b)' = a' + b'$

Unit-II

2. (a) Define Equivalence Relation. 2

(b) If A, B, C are any three non empty sets then prove that

$$A \times (B \cap C) = (A \times B) \cap (A \times C)$$ 7

(c) Show that the function $f : R \rightarrow R$ defined by $f(x) = 5x^3 - 1$ is one-one onto. Where R is the set of real numbers. 7

(d) Explain : 7

(i) Partial Order Relation

(ii) Hasse Diagram

(iii) Lattice

Unit-III

3. (a) Define algebric structure. 2

(b) Show that the set of all integers I forms a group with respect to binary operation '*' defined by the rule $a * b = a + b + 1, \ \forall a, b, \in I$. 7

(c) Define the following with example : 7

(i) Rings

(ii) Integral Domain

(d) Prove that the order of each subgroup of a finite group is a divisor of the order of the group. 7

Unit-IV

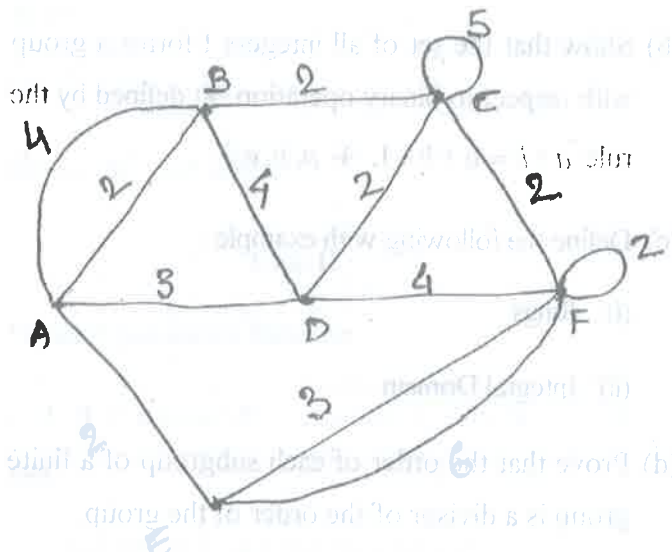
2. (a) Define the following terms : 2

(i) Directed Graph

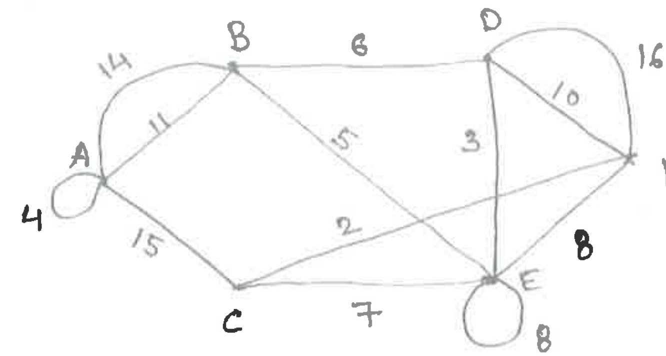
(ii) Undirected Graph

(b) Prove that if G is a tree with n vertices then it has exactly $(n-1)$ edges. 7

(c) Using Dijkstra's algorithm, find the shortest path between A and F for the following graph. 7



(d) Find the minimal spanning tree of the weighted Graph using Prim's algorithm. 7



Unit-V

5. (a) If ${}^{n}P_4 = 12 \times {}^{n}P_2$ then find the value of n. 2

(b) Use method of induction to prove that

$$1^3 + 2^3 + 3^3 + \ldots\ldots + n^3 = \frac{n^2(n+1)^2}{4}$$ 7

(c) Find the generating function for

$$a_r = 3^r, \quad r \geq 0.$$ 7

(d) Solve the recurrence relation

$$9\,a_r - 6\,a_{r-1} + a_{r-2} = 0$$

given that $a_0 = 0$ and $a_1 = 1$. 7