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322412(14)

B. E. (Fourth Semester) Examination, 2020

(Old Scheme)

(CSE, IT Engineering Branch)

DISCRETE STRUCTURES

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt part (a) from each unit is compulsory and carries 2 marks. Attempt any* ***two*** *parts from (b), (c) and (d) are carries 7 marks each.*

Unit-I

1. (a) Define Tautology and Contradiction. 2

(b) Define logical equivalence. Show that : 7

$$p \Rightarrow (q \Rightarrow r) \equiv (p \wedge q) \Rightarrow r$$

(c) Find complete disjunctive normal form in three variables, and show that its value is 1. 7

(d) Replace the following switching circuit by a simpler one : 7

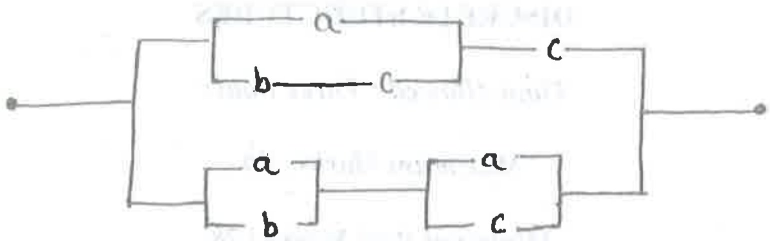

Fig.

Unit-II

2. (a) Define Lattice. 2

(b) If I is the set of integers and the relation $xRy \Rightarrow x - y$ is an even integer, then prove that R is an equivalence relation, where $x,\ y \in I$. 7

(c) Prove that if $f : A \to B$ is one-one onto mapping then $f^{-1} : B \to A$ will be one-one onto mapping. 7

(d) Explain composition of mappings. If $f : R \to R$, $f(x) = \cos x$ and $g : R \to R$, $g(x) = x^2$, then find $(g \circ f)(x)$ and $(f \circ g)(x)$. Is $f \circ g = g \circ f$? 7

Unit-III

3. (a) Define algebraic structure with example. 2

(b) Define Subgroup. Show that the necessary and sufficient conditions for a non empty subset H of a group $(G, *)$ to be subgroups is $a \in H,\ b \in H \Rightarrow a * b^{-1} \in H$. 7

(c) State and prove the Lagrange's theorem. 7

(d) Prove that every field is an integral domain. 7

Unit-IV

4. (a) Define cut set. 2

(b) Find shortest path from a to z in the graph shown in fig. where numbers associated with the edges are the weights. 7

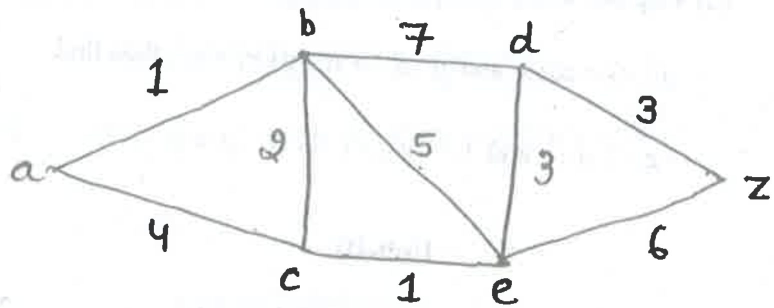

Fig.

(c) Find a minimum spanning tree of the following graph shown in fig. 7

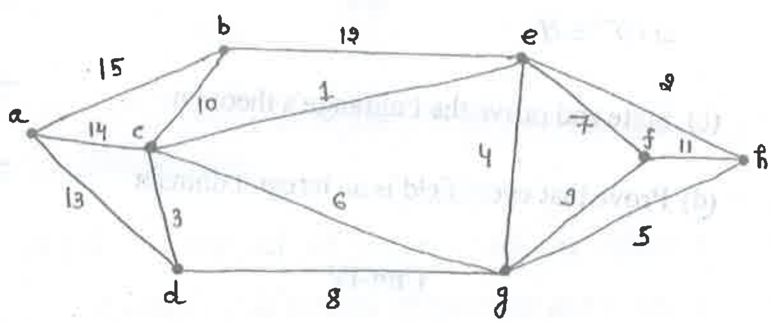

Fig.

(d) (i) Write the incidence matrix of the graph.

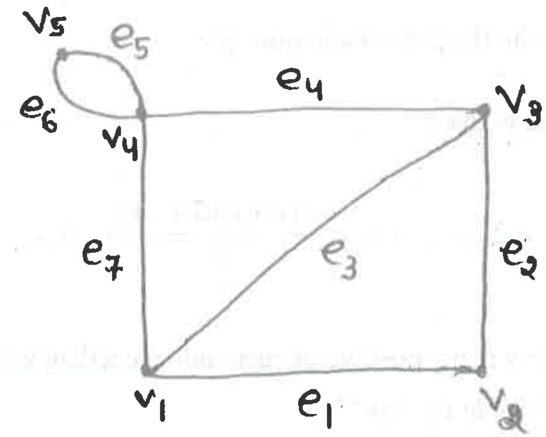

Fig.

(ii) Write the adjacency matrix of the graph. 7

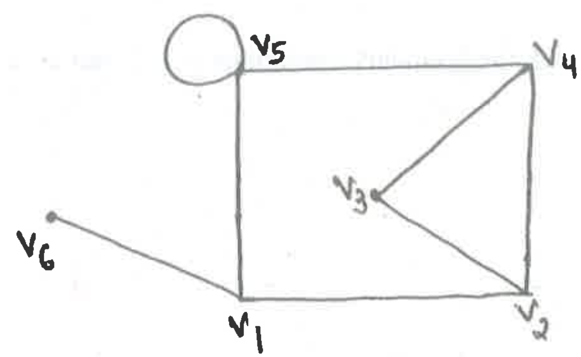

Fig.

Unit-V

5. (a) Write the pigeonhole principle. 2

(b) Show that : 7

$$1^2 + 2^2 + \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}, \quad n \geq 1$$

(c) How many positive integers not exceeding 500 are divisible by 7 or 11? 7

(d) Solve by the method of generating functions the recurrence relation.

$$a_r - 5a_{r-1} + 6a_{r-2} = 2, \quad r \geq 2$$

with the boundary conditions $a_0 = 1$ and $a_1 = 2$. 7