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B. E. (Third Semester) Examination, April-May 2021

(New Scheme)

(IT Engg. Branch)

DISCRETE STRUCTURES

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Answers all questions. Part (a) is compulsory and carries 2 marks. Answer any* **two** *parts from (b), (c) and (d). Part (a) carry 2 marks & rest of carries 7 marks each.*

Unit-I

1. (a) Write the converse of the following statement :

"If $2+2=4$ then 9 am prime minister of India."

(b) Identify the given proposition is a tautology or contradiction by truth table :

$$(P \leftrightarrow q) \leftrightarrow (p \rightarrow q) \wedge (q \rightarrow p)$$

(c) Define boolean algebra. Proof the following :

(i) $a + a = a$

(ii) $a + (a.b) = a$

(d) Draw the switching circuit for the switching function

$$F(x, y, z) = x.y.z + (x + y).(x + z)$$

Unit-II

2. (a) If the ordered pairs $(2x-1, -5)$ and $(x+1, y)$ are equal, find the value of x and y.

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

$$A \times (B \cup C) = (A \times B) \cup (A \times C)$$

(c) Define the following :

(i) Range of relation

(ii) Identity relation

(iii) Partial order relation

(d) If $f : R \rightarrow R$ is defined by $f(x) = x + 2 \nvdash x \in R$ and $g : R \rightarrow R$ is defined by $g(x) = x^3 \nvdash x \in R$ then find $(f \circ g)(x)$ and $(g \circ f)(x)$ and show that $f \circ g \neq g \circ f$.

Unit-III

3. (a) State Lagrange's theorem.

(b) State and prove uniqueness of the identity element.

(c) If R be the group of real numbers under addition and let R^+ be the group of real positive numbers under multiplication.

Let $f : R^+ \rightarrow R$ be defined by

$$f(x) = \log x, \nvdash x \in R^+,$$

then show that f is an isomorphism. 7

(d) Consider the encoding function $E : B^2 \rightarrow B^5$ defined by

E (00) = 00000

E (10) = 10110

E (01) = 01101

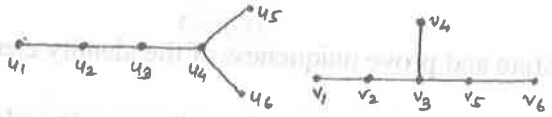
E (11) = 11011

How many errors will E detect and correct.

Unit-IV

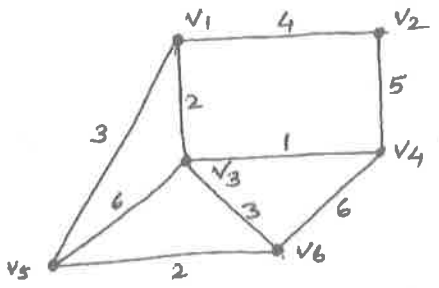
4. (a) State the Handshaking Lemma.

(b) Define isomorphism of two graphs. Show that the graphs given below are not isomorphic.



(a) (b)

(c) Define shortest distance spanning free in a weighted graph. Find the shortest distance spanning tree for the graph given below by Kruskal's algorithm.



(d) State and prove Max-Flow min-cut theorem.

Unit-V

5. (a) Show that if seven colours are used to paint 50 cars, atleast eight cars will have the same colour.

(b) Show that :

$$^{2n+2}C_{n+1} = {}^{2n}C_{n+1} + 2\,{}^{2n}C_{n} + {}^{2n}C_{n-1}$$

(c) How many integer solutions are there to the equation :

$$x_1 + x_2 + x_3 + x_4 = 13,\ 0 \le x_i \le 5$$

(d) Solve the recurrence relation :

$a_r - 4a_{r-1} + 4a_{r-2} = 0$ given that $a_0 = 1$ and $a_1 = 3$.