

**CR-2591**

**M. Sc. (First Semester) Examination,  
Nov.-Dec. 2018**

**COMPUTER SCIENCE**

*Paper : First*

**(Discrete Mathematical Structures)**

*Time Allowed : Three hours*

*Maximum Marks : 40*

*Note : Attempt questions of all two sections as directed.*

**Section--'A'**

**(Short Answer Type Questions)      5×3=15**

*Note : Attempt all the five questions. Each question carries 3 marks.*

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**Unit-I**

1. A partially ordered set is called well-ordered if every non-empty subset of it has a least member. Explain.

**Or**

Define partial order relations and composition of relation with suitable example.

**Unit-II**

2. Define cardinality, one-to-one and onto function.

**Or**

Let  $f(x) = x + 2$ ,  $g(x) = x - 2$  and  $h(x) = 3x$  for  $x \in R$ , where  $R$  is the set of real numbers. Find  $g \circ f$ ,  $f \circ g$ ,  $f \circ f$ ,  $h \circ g$ ,  $h \circ f$  and  $f \circ h \circ g$ .

**Unit-III**

3. Explain the use of binomial coefficients in normal life.

**Or**

Explain factorial notation and use of basic counting principles.

**Unit-IV**

4. Define multigraphs, walk, path and circuit.

**Or**

Define Depth first and Breadth first searches.

**Unit-V**

5. A spanning tree  $T$  is a shortest spanning tree (of  $G$ ) if and only if  $\exists$  no other spanning tree (of  $G$ ) at a distance of one from  $T$  whose weight is smaller than ~~that~~ of  $T$ .

**Or**

Define path lengths in rooted trees and define binary search trees.

**Section-'B'**

**(Long Answer Type Questions) 5×5=25**

*Note : Attempt all the questions. One question from each unit is compulsory. Each question carries 5 marks.*

6. Given  $S = \{1, 2, \dots, 10\}$  and a relation  $R$  on  $S$  where,

$$R = \{ \langle x, y \rangle, x + y = 10 \}$$

what are the properties of the relation  $R$ .

**Or**

Let  $X = \{2, 3, 6, 12, 24, 36\}$  and the relation  $\leq_{bc}$ , such that  $x \leq y$  if  $x$  divides  $y$ . Draw the Hass diagram of  $\langle X, \leq \rangle$ .

**Unit-II**

7. Obtain the principal conjunctive normal form of the formula  $S$  given by  $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$  without using truth table.

**Or**

- (a)  $H_1, H_2, \dots, H_m$  and  $P$  imply  $Q$ , then

$$H_1, H_2, \dots, H_m \text{ imply } P \rightarrow Q.$$

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(b) Show without using truth tables :

$$\neg(Q \wedge R) \rightarrow (\neg P \vee (\neg P \vee Q)) \Leftrightarrow (\neg P \vee Q)$$

### Unit-III

8. Define permutation and combinations. Give an algorithm for permutation and find the number of permutation in a letter "VISHWAVIDYALAYA".

Or

Explain functions and Pigeon hole principle.

### Unit-IV

9. For the graph given below, find its :

- (i) Adjacency matrix
- (ii) Path matrix using Warshall's algorithm

Or

Explain directed graphs with example, and also explain subgraphs, and connectivity.

### Unit-V

10. Show that how an arithmetic expression may be stored in a Binary tree.

Or

Explain spanning tree and Hamiltonian paths with example.

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