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Your Roll No. .....

1971

B.Sc. (Hons.) Computer Science/I Sem. C

Paper 102—DISCRETE STRUCTURES

(Admissions of 2001 and onwards)

Time : 3 *Hours* *Maximum Marks* : 75

(Write your Roll No on the top immediately on receipt of this question paper.)

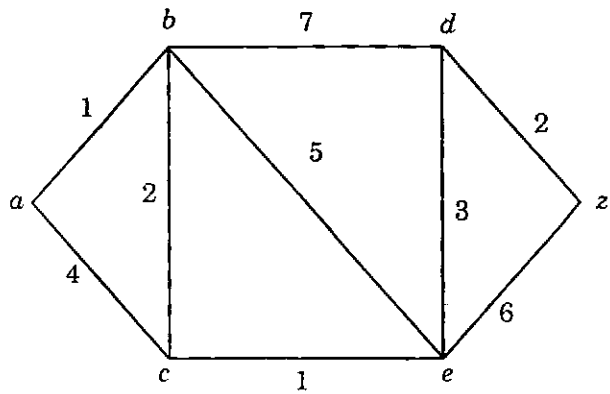
Attempt *all* questions.

Parts of a question should be attempted together.

1. (*a*) How many ways can the letters in the word MISSISSIPPI be arranged ? 3

   (*b*) How many ways are there to select five players from a 10-member tennis team ? 2

2. (*a*) Find the shortest path from '*a*' to '*z*' in the graph below : 5



P.T.O.

(*b*) Define Euler path and Euler circuit. Draw a graph that has an Euler path and Euler circuit. 5

3. (*a*) A tree has two vertices of degree 2, one vertex of degree 3 and three vertices of degree 4. How many vertices does it have of degree 1 ? 4

(*b*) Design a Huffman code for the set of letters (and their frequency) given below. Attempt to use short bit code for the most frequently used letters : 6

I : 7.5, U : 20.0, B : 2.5, S : 27.5, C : 5.0, H : 10.0, M : 2.5, P : 25.0.

4. (*a*) Let '*a*' be a numeric function such that : 5

$$a_r = \begin{cases} 0 & 0 \le r \le 2 \\ 2^{-r} + 5 & r \ge 3 \end{cases}$$

(*i*) Determine Δa

(*ii*) ∇a.

(*b*) Find the total solution of the recurrence relation : 5

$a_n + 4a_{n-1} = 7$, where $a_0 = 3$.

5. (*a*) Show the equivalence ($\Leftrightarrow$) using Truth table method : 4

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

(*b*) Give the symbolic form of the following :

(*i*) The sun is bright and the humidity is not high.

(*ii*) The crop will be destroyed if there is a flood.

(*iii*) Mark is neither rich nor happy. 6

6. (*a*) Obtain the principal disjunctive normal form (disjunction of minterms) of : 5

$$(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R).$$

(*b*) Consider the predicate $P(x)$: x is greater than 2. Which of the following statements would be true for the universe of discourse is $\{-1, 0, 2, 6\}$? How ?

(*i*) $(x)P(x)$

(*ii*) $(\exists x)\, P(x)$. 5

7. (*a*) What do you mean by Θ—notation ? Show that : 5

$$3x^2 + 8x \text{ is } \Theta(x^2).$$

(*b*) Use Master's theorem to solve the following recurrences : 5

(*i*) $T(n) = 9\,T(n/3) + n$

(*ii*) $T(n) = 2T(n/2) + n^3$

8. (*a*) What does $\lceil x \rceil$ mean ? Show that : 5

$$\lceil x \rceil + \lceil y \rceil - \lceil x + y \rceil = 0 \text{ or } 1.$$

(*b*) Perform merge sort on the values given below and count the number of comparisons required to sort the numbers. Show all the steps. 5

56, 13, 35, 8, 23, 61