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(2063)

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B.Tech 4th Semester Examination

Discrete Mathematics & Logic Design

IT-4003

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/ continuation sheet will be issued.

Note : Attempt any one question from section A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) What is Disjunction normal form (DNF) and Conjunction normal form (CNF)? Give an algorithm to convert a given proposition into equivalent Disjunction normal form (DNF) or Conjunction normal form (CNF).

   (b) Using truth table and laws of logical equivalence, Prove that (p and q are propositions):

   (i) $\neg(p \vee q) \equiv \neg p \wedge \neg q$

   (ii) $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$ **(7½, 7½)**

2. (a) Express the following arguments/ statements as sentences of predicate logic:

   (i) Every irreflexive and transitive binary relation is asymmetric.

(ii) There is someone who is going to pay for all the breakages. Therefore, each of the breakages is going to be paid for by someone.

(iii) Amit and Ashok can solve exactly the same problems. If Amit can solve any of the problems, then he will get "A" grade. Ashok will not get "A grade". Therefore, Ashok cannot solve any of the problems.

(b) Verify that the compound proposition given as $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$, is tautology or not. **(3×3, 6)**

SECTION - B

3. (a) Write a short note on Job scheduling problem.

(b) In how many ways can the letters of the word ABACUS be rearranged such that the vowels always appear together? **(10,5)**

4. (a) Find the minimum number of students in the class to be sure that three of them are born in same month.

(b) Supermarket orders light bulbs from two suppliers, AA electronics and AB electronics. Supermarket purchases 30% of its light bulbs from AA and 70% from AB. 2% of light bulbs purchased from AA are defective, while 3% of light bulbs purchased from AB are defective. Find the probability that a randomly selected light bulb:

(i) was purchased from AA and is defective.

(ii) was purchased from AB and is not defective.

(iii) is defective.

(iv) was purchased from AA electronics. **(3,12)**

SECTION - C

5. (a) What is Binary Search Tree? Give an algorithm to perform Insertion, Deletion and Searching process on binary search trees using suitable example.

(b) Give an algorithm to find shortest path between any two vertices of weighted graphs using suitable example. **(8,7)**

6. (a) What is Minimum Spanning Tree? Discuss with help of an example, any method to find Minimum Spanning Tree.

(b) Discuss Travelling Salesperson Problem using suitable example. **(8,7)**

SECTION - D

7. (a) Find solution of recurrence relation for "Fibonacci" series with $a_0=0$, $a_1 = 1$ as initial conditions.

(b) Solve: $a_n = 2a_{n-1} - a_{n-2} + 2a_{n-3}$ with $a_0 = 1$, $a_1 = 0$ and $a_2 = -1$ using generating functions. **(10,5)**

8. (a) State and Prove Lagrange's theorem.

   (b) State and Prove Burnside theorem.

   (c) Define homomorphism, isomorphism, Quotient group, Rings and Fields. **(5,5,5)**

SECTION - E

9. *Answer all questions (4 marks each):*

   (a) What is prefix code? Give any one application area where prefix code is used.

   (b) What is Sorting? Give brief idea of any sorting algorithm.

   (c) Give truth table of conditional and biconditional statements.

   (d) What is the difference between relations and functions?

   (e) Give various rules of Inference for Predicate Calculus.

   (f) What are planar graphs? How total degree of maps of planar graphs is related to number of edges of planar graph?

   (g) For recurrence relation with roots $(-1 + i (3)^{1/2})/2$ and $(-1 - i (3)^{1/2})/2$, find homogenous solution.

   (h) What is equivalence relation?

   (i) Discuss main features of relational model of databases.

   (j) Define Hamiltonian path. How are they different from Euler paths?