

[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2064)

14684

B. Tech 4th Semester Examination
Discrete Mathematics & Logic Design (O.S.)
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. Each question carries equal marks.

SECTION - A

1. (a) Convert $(p \wedge q) \vee \neg(\neg p \wedge (q \vee \neg r))$ into Disjunction normal form (DNF) and Conjunction normal form (CNF).
- (b) Prove the following Logical Equivalencies (P and Q are propositions):
 - (i) $(p \wedge q) \vee (\neg p \wedge \neg q) \equiv p \leftrightarrow q$.
 - (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.

14684/250

[P.T.O.]

- (iii) Amit and Ashok can solve exactly the same problems. If Amit can solve any of the problems, then he will get "A" grade. Amit will not get "A grade". Therefore, Ashok cannot solve any of the problems.
- (b) Verify that the given compound proposition is tautology or not.

$$((p \rightarrow q) \rightarrow r) \leftrightarrow ((p \rightarrow q) \wedge (p \rightarrow r)) \quad (3 \times 3 + 6)$$

SECTION - B

3. (a) Write a short note on Job scheduling problem.
- (b) Write a short note on relational model of databases. (10+5=15)
4. (a) Write a short note on Pigeonhole Principle. Let L be the list of 26 letters in English alphabets (which consists of 5 vowels, A, E, I, O, U, and 21 consonants). Now answer the questions that follows:
- (i) Show that L has a sublist consisting of four or more consecutive consonants.
- (ii) Assuming L begins with a vowel; say A, show that L has a sublist consisting of five or more consecutive consonants.
- (b) A class contains 10 students with 6 men and 4 women. Find the number n of ways to:
- (i) Select a 4-member committee from the students.
- (ii) Select a 4-member committee with 2 men and 2 women.
- (iii) Elect a president, vice president, and treasurer. (8+7=15)

SECTION - C

5. What is Binary Search Tree? Give an algorithm to perform Insertion, Deletion and Searching process on binary search trees using suitable example. (15)
6. What is weighted graph? Give an algorithm to find shortest path between any two vertices of weighted graphs using suitable example. (15)

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.
- (c) Solve: $a_{r+2} - 4a_r = r^2 + r + 2$. (7+5+3=15)
8. (a) State and Prove Lagrange's theorem.
- (b) What is sorting? Sort 22, 45, 21, 11, 03, 02, 76, 46, 42, 33, 31 using any sorting algorithm. (5+10=15)

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) Define conditional Probability.
- (c) Give truth table of conditional and biconditional statements.
- (d) Define homomorphism, isomorphism, Quotient group, Rings.

[P.T.O.]

- (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) Write a short note on Travelling Salesperson Problem.
- (i) What is Minimum Spanning Tree?
- (j) Give a method to check that whether graph has Euler path or not?