

This question paper contains 5 printed pages.]

Your Roll No.

1726

A

MCA / II Sem.

Paper MCA - 202 - DISCRETE MATHEMATICS

(Admissions of 2009 and onwards)

Time : 2 Hours

Maximum Marks :50

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

Attempt *all* questions.

Parts of a question must be answered together.

1. (a) Find the values of 'c' & 'n_c' such that

$$n^2 + 3n - 4 = 0 (n^2 - 2n + 3) \quad 3$$

- (b) Prove or disprove

$$f(n) = \omega(g(n)) \Rightarrow g(n) = O(f(n)) \quad 2$$

- (c) Write a recurrence relation for the following :

FACTORIAL(n)

1. if $n=0$

2. return 1

[P.T.O.]

3. else

4. return $n * \text{FACTORIAL}(n - 1)$. 2

(d) Can the master's theorem be applied to the recurrence

$$T(n) = 9T(n/3) + \lg n ?$$

If yes, solve it. If not, why not? 3

2. (a) For the formulae

(7P

Obtain

(i) Principal conjunctive normal form.

(ii) Principal disjunctive normal form. 3

$$\rightarrow R) \wedge (Q \leftrightarrow R)$$

(b) Write the following formula in prefix and suffix form

$$P \wedge \neg R \rightarrow Q \leftrightarrow P \wedge Q \quad 2$$

(c) Let $\text{tian}(x)$ and $\text{campusite}(x)$ be the statements, " x is an II Tian" and " x stays in campus " respectively. Express each of the following statements using quantifiers, logical connectives and above predicates.

(i) Every II Tian stays in campus

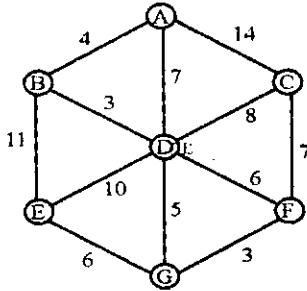
(ii) Some II Tian doesn't stay in campus. 2

(d) Are the following formulae equivalent ?

(i)

(ii) $\neg(P \leftrightarrow Q)$ and $(P \wedge \neg \theta) \vee (\neg P \vee \theta)$ 3

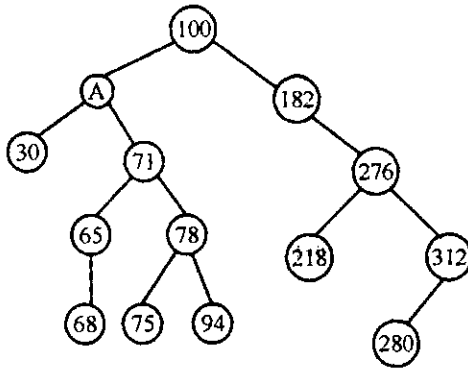
3. (a) Determine the minimum spanning tree using Prim's Algorithm for the graph given below using 'A' as the initial vertex. 6



- (b) Use Huffman's Algorithm to generate optimal binary prefix codes. The frequency of the characters are given below.

a: 32%, b: 10%, c: 4%, d: 14%, e: 38% and f: 2% $\frac{P \rightarrow (\theta \rightarrow P)}{4}$ and $\frac{\neg P \rightarrow (\theta \rightarrow P)}{4}$

4. (a) Given a binary search tree, answer the following questions.



- (i) Assuming that tree contains distinct values, what are the valid values for node 'A' ?

[P.T.O.]

- (ii) If we want to insert 250, how many comparisons take place ?
- (iii) Give the inorder traversal of the tree.
- (iv) Show the structure of the tree after deleting 71 from the tree.
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- (b) Prove that for any connected planar graph G ,

$$v - e + r = 2.$$

Is K_4 planar ? What about K_5 ? 4

- (c) State the necessary and sufficient condition for an undirected graph to possess an Eulerian path. Does K_4 possess Eulerian path ? What about K_5 ? 2
5. (a) Is the set of 'N by N' non-singular matrices from a group under matrix multiplication ? Does it form an Abelian group ? 3
- (b) How is a group different from a monoid ? Give an example of an algebraic system that forms $\begin{cases} \text{a monoid but not a group.} & 0 \leq r \leq 2 \\ 2^{-r} + 5; & r \geq 3 \end{cases}$ 2
- (c) Consider the following numeric functions.

$$ar =$$

$$br = \begin{cases} 3 - 2^r & ; 0 \leq r \leq 1 \\ r + 2 & ; r \geq 2 \end{cases}$$

Calculate the following :

- (i) ab
- (ii) $s^4 a$
- (iii) ∇a

- (d) An aircraft takes off after spending 15 minutes on the ground, climbs up at a uniform speed to a cruising altitude of 20,000 feet in 10 minutes, starts to descend uniformly after 110 minutes of flying time, and lands 10 minutes later. Write a numeric function a_r which denotes the altitude of an aircraft in thousands of feet, at the r^{th} minute.

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