(2 ½ Hours) [Total Marks: 75]

N.B. 1) **All** questions are **compulsory.**

2) **Figures** to the **right** indicate marks.

3) **Draw** suitable **diagrams** and illustrations **wherever necessary**.

4) **Mixing** of sub-questions is **not allowed.**

Q. 1 Attempt All the Questions

A) **Choose the correct alternative** **(5M)**

i) Ω-notation provides an asymptotic _____ bound.

    a) upper   b) both upper and lower

    c) lower   d) none of these

ii) Which of the following statement is true.

    i. Quicksort, like merge sort, is based on the divide-and-conquer paradigm.

    ii. ω-notation to denote a lower bound that is asymptotically tight.

    a) i-true, ii-false   b) i-true, ii-true

    c) i-false, ii-true   d) i-false, ii-true

iii) In binary search trees, _____ tree walk prints the key of the root of a subtree between the values in its left subtree and those in its right subtree.

    a) postorder   b) preorder

    c) inorder   d) none of these

iv) Which of the following holds true for Prims algorithm?

    i. The edges in the set *A* always form a single tree.

    ii. It follows a greedy strategy.

    a) Only i   b) Both i and ii

    c) Only ii   d) Neither i nor ii

v) An acyclic graph contains _____ cycles.

    a) no   b) many

    c) one   d) none of these

B) **Fill in the blanks:** **(5M)**

{ lower, halts, upper, moves, recurrence, efficient, $\Omega(n^2)$, $\Theta(n^2)$ }

i) *O*-notation describes a _____ bound.

ii) An algorithm is said to be correct if, for every input instance, it _____ with the correct output.

iii) An algorithm that is asymptotically more _____ will be the best choice for all but very small inputs.

iv) A _____ is an equation or inequality that describes a function in terms of its value on smaller inputs.

v) The worst-case running time of insertion sort is _____.

C) Explain the following terms in one or two lines **(5M)**
   i) Rate of growth
  ii) Running time of Algorithm
 iii) Correctness of Algorithm
  iv) Expression Trees
   v) Weighted graphs

Q.2 Attempt the following: (Any THREE) **(15M)**

A Define Algorithm. Explain why analysis of algorithm important?

B Briefly describe the Master method for solving recurrences of the form
$T(n) = aT(n/b) + f(n)$

C How do we compare two algorithms? Explain.

D Write a note on Method of Guessing and Confirming.

E Briefly describe the "Big-Omega" and "little-omega" in algorithmic analysis.

F Write a note on divide-and-conquer approach.

Q.3 Attempt the following: (Any THREE) **(15M)**

A What are the type of binary tree? Explain any two.

B Write a note on binary tree traversal.

C What is an AVL tree? Explain.

D Define Graph. What are its applications? Explain.

E What is a minimum spanning tree? Explain with suitable example.

F Write a note on median-of-median algorithm.

Q.4 Attempt the following: (Any THREE) **(15M)**

A What is greedy technique? What are its advantages and disadvantages?

B Write a note on computer algorithms that are based on divide-and-conquer programming
approach. What are the advantages of divide and conquer based algorithms?

C Write a note on Master theorem.

D Briefly describe Dynamic Programming Strategy. Also give the Steps of Dynamic
Programming Approach.

E Briefly describe the longest common subsequence (LCS) problem.

F State the examples of Dynamic Programming Algorithms. Explain any one.

Q.5 Attempt the following: (Any THREE) **(15M)**

A What is Analysis of Algorithm? Why is it important? Explain.

B List the various properties of binary tree.

C What is a threaded binary tree? Explain.

D Write a note on Partition-based Selection Algorithm.

E What is a Topological Sort? Explain it with a suitable example.

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