Roll No: | | | | | | | | | | | | | |

MTECH
(SEM I) THEORY EXAMINATIC N 2024-25
ADVANCED ALGORITHM

TIME: 3 HRS M.MARKS: 70

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

Q no.	Question
a.	How do asymptotic notations assist in describing the performance of algorithms?
b.	Discuss the relevance of worst-case analyses in algorithm design.
c.	What are the key differences between comparison-based sorting and non-comparison-based algorithms?
d.	Explain the divide-and-conquer approach in Merge Sort.
e.	Discuss the advantages of B+ Trees in sequential access of data.
f.	What are the challenges in implementing Red-Black Trees?
g.	What are the challenges in implementing parallel sorting algorithms?

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a.	What is the significance of analyzing algorithms, and how does it help in understanding the efficiency of computational solutions?
b.	How does Quick Sort achieve efficient sorting using the partitioning method, and what are the challenges in selecting an optimal pivot?
c.	What are the key differences between B-Trees and B+ Trees, and how do these differences impact their performance in database indexing?
d.	How do parallel searching algorithms achieve faster search times, and what are the trade-offs compared to sequential searching?
e.	How does the greedy algorithm approach handle fractional knapsack problems, and what makes it unsuitable for 0/1 knapsack problems?

SECTION C

3. Attempt any *one* part of the following: **7x1=7**

a.	How does Master's Theorem simplify the analysis of divide-and-conquer algorithms, and what are its limitations?
b.	Describe the process of evaluating the time complexity of an algorithm and explain how it impacts the choice of an algorithm in real-world applications.

4. Attempt any *one* part of the following: **7x1=7**

a.	Explain the time and space complexities of Merge Sort, and discuss its suitability for sorting large datasets stored on external devices.
b.	How does the in-place nature of Quick Sort make it a preferred choice for memory-constrained environments?

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5. Attempt any *one* part of the following: 7x1=7

a.	What is the significance of Red-Black Trees in maintaining balanced binary search trees, and how do they ensure logarithmic time complexity for operations?
b.	Explain the properties of Red-Black Trees, and discuss how these properties ensure balanced tree structures during insertions and deletions.

6. Attempt any *one* part of the following: 7x1=7

a.	What are the performance measures of parallel algorithms, and how do they differ from those of sequential algorithms?
b.	Explain the concepts of speedup and efficiency in parallel algorithms, and discuss their significance in evaluating parallel performance.

7. Attempt any *one* part of the following: 7x1=7

a.	What is the difference between dynamic programming and greedy algorithms, and how do these techniques address optimization problems differently?
b.	Explain the principle of optimality in dynamic programming, and discuss its significance in solving complex problems.