National Institute of Technology Hamirpur

Department of Computer Science & Engineering

End Semester Examination

Course: Design & Analysis of Algorithms *(CS-311)*   **Total Marks:** 50

Date: 22-11-2023   **Time:** 3 hrs.

Q1. What is time complexity? Why should we care about time complexity? Explain Best case, Average case, and worst-case analysis of algorithms.

(10 points)

Q2. Solve the following recurrence relations using Master's theorem:-

1. $T(n) = 3T\left(\frac{n}{2}\right) + n^2$
2. $T(n) = 8T\left(\frac{n}{2}\right) + n\log n$
3. $T(n) = 8T\left(\frac{n}{2}\right) + n^2$
4. $T(n) = 4T\left(\frac{n}{2}\right) + n^2$
5. $T(n) = 2T\left(\frac{n}{2}\right) + \frac{n}{\log n}$

(10 points)

Q3. Explain Insertion sort with the help of an example. Write an algorithm of Insertion sort.

(10 points)

Q4.

- Explain linear probing and quadratic probing in detail?

- Suppose we are given the following set of keys to insert into hash table that is initially empty and holds exactly 10 values, **13, 107, 49, 50, 64, 98, 16, 33**. Construct the hash table with using linear probing *x mod 10*.

(5+5 points)

Q5.

- Explain with the help of an example the worst case input for quick sort algorithm?

- Suppose you are designing a simple website where you display a website for every keyword entry made by the user. Which data structure would you use for store the information for keyword-website mapping. Also design the algorithm for taking keyword as input and displaying website as an output, which search algorithm would you use to minimize the time required for searching?

(5+5 points)