CS251 - Data Structures and Algorithms
Fall 2024

PSO 2, Week 3

Question 1

(Recursion Tree) Give a big-O closed form for each of the following recurrences. (Assume that $T(x) = 1$ for any $x \leq 1$.)

(1) $T(n) = 2T(n/4) + \sqrt{n}$

(2) $T(n) = T(n/2) + T(n/3) + T(n/6) + n$

Question 2

(Change a Variable) Give a big-O closed form for the following recurrence.

$$T(n) = 2T(\sqrt{n}) + \log n$$

Question 3

(Algorithm Design) Describe a $\Theta(n \log n)$ algorithm that, given a set S of n integers and another integer x, determines whether or not there exist two elements in S whose sum is exactly x.

Question 4

(Linked List) Consider a sorted circular doubly linked list of N numbers where the head element points to the smallest element in the list. Provide the asymptotic complexity in big-Θ with a brief explanation (including assumptions and analysis for each case, if there is more than one) for the following operations.

1. Inserting an element in its sorted position.
2. Finding the smallest element in the list.
3. Finding the 3^{rd} - largest element in the list.
4. Finding the median in the list.