Algorithms Third Quiz

10:10 ~ 11:00

(2023/11/3)

(**Note that if you design an algorithm, you must have pseudo code to show your algorithm and analyze the algorithm's time complexity in the worst case. It would help to put comments after your pseudo code to clarify your algorithm.**)

1. (10%) Show how to determine the median of a 5-element set using only 6 comparisons.

2. (10%) In Chapter 9, the SELECT algorithm works with groups of 5 elements. Prove that SELECT cannot work in worst-case linear time with groups of 3 elements.

3. (15%) There is a staircase with n steps. Your friend, Jack, wants to count how many ways he can walk up this staircase. Because John is quite tall, in one move, he can walk up one, two, or three steps. Let F_k denote the number of ways John can walk up a staircase with k steps. Derive a recurrence for F_k and show that F_n can be computed in $O(n)$ time.

4. (15%) Consider a modification of the rod-cutting problem in which, in addition to price p_i for each rod, each cut incurs a fixed cost of c. The revenue associated with a solution is now the sum of the prices of the pieces minus the costs of making the cuts. Give a dynamic programming algorithm to solve the modified problem.