Department of Computer Science and Engineering
National Sun Yat-sen University
First Semester of 2024 PhD Qualifying Exam

Subject： Algorithms

1. Please explain P, NP-hard, NP-complete problems as well as reduction. Then, prove that the clique problem is NP-complete. (20%)
2. Please explain how to use simple divide-and-conquer and Strassen's algorithms to solve the matrix multiplication problem that should include pseudocodes, examples, and descriptions for both algorithms. (20%)
3. Please give the definitions of the fractional and 0/1 knapsack problems. Please also present the greedy and dynamic programming algorithms for solving these two knapsack problems. (20%)
4. Please explain the longest common subsequence (LCS) problem and show how to use the dynamic programming method to solve the LCS and its time complexity. (20%)
5. Please explain the searching strategies of breadth-first search, depth-first search, and best-first search. Also, please explain how to use hill climbing to solve the 8-puzzle problem. (10%)
6. Please explain the minimum spanning tree (MST) and how to solve it by using the Kruskal's and Prim's algorithms. (10%)