Department of Computer Science and Engineering
National Sun Yat-sen University
Second Semester of 2021 PhD Qualifying Exam

Subject：<u>Algorithms</u>

1. Explain NP-hard, NP-complete. (10%)

2. (a) Please give the definition of an AVL tree. (7%)

   (b) Give the situation that an AVL tree will increase its height after a new element is inserted into the tree. (8%)

3. What data structures are used in the tree searching strategies with breadth-first search, depth-first search, and best-first search, respectively? (15%)

4. Please give the divide-and-conquer method for solving the closest pair problem on the 2-D plane. Analyze the time complexity. (15%)

5. (a) Please give the definition of the 0/1 knapsack problem. (5%)

   (b) Please present the dynamic programming for solving the 0/1 knapsack problem. (10%)

6. Prove that the partition decision problem polynomially reduces to the bin packing decision problem. (15%)

7. Please give the prune-and-search method to solve the selection problem (finding the the kth smallest elements among a set of n input numbers). (15%)