Greedy algorithm

1. Solve the following 0/1 knapsack problem using k-optimal greedy algorithm. Let $k = 2$.

   n=4,c=20, w=(10,15,6,9), p=(2,5,8,1)

2. The fractional knapsack problem is a generalized case of 0/1 knapsack problem, in which items can be broken into smaller piece, i.e. to determine a fraction $x_i (0 \leq x_i \leq 1)$ of item $i (i = [1..n])$ to be included.

   Prove that the greedy strategy of profit density first for fractional knapsack problem can obtain an optimal solution.

3. Prove that any weighted connected graph with distinct weights has exactly one minimum spanning tree.

Divide and conqure

4. Design an iterative algorithm for quicksort using stack data structures, and prove that it only needs $O(\lg n)$ space for the stack.

5. An inverse order is a tuple (x_i, x_j) in the given permutation Y of $X = \{1, 2, \cdots, n\}$ such that $x_i > x_j$, $i < j$ and $x_i \in X, x_j \in X$.

   Design a divide-conqure algorithm for calculating the number of inverse orders in Y and analyse its running time.