# CS3230
# Tutorial 7

1. Consider the following coin denominations. For each part, say whether the greedy algorithm done in class gives an optimal answer. If so, give an argument to justify your answer. If not, then give a counterexample.

   (a) 1, 5, 7

   (b) 1, 5, 15

   (c) 1, 4, 9

   (d) 1, 3, 5

2. Consider the following undirected graph.

   $G = (V, E)$, where the set of vertices is $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$, and the edges and their weights are given as follows:

   $wt(1, 2) = 3$, $wt(1, 5) = 2$, $wt(1, 4) = 10$, $wt(2, 3) = 4$, $wt(2, 5) = 9$, $wt(3, 5) = 6$,

   $wt(3, 6) = 5$, $wt(4, 5) = 4$, $wt(4, 7) = 4$, $wt(5, 6) = 3$, $wt(5, 7) = 6$, $wt(5, 8) = 2$,

   $wt(5, 9) = 6$, $wt(6, 9) = 6$, $wt(7, 8) = 8$, $wt(7, 10) = 3$, $wt(8, 9) = 8$, $wt(8, 10) = 3$,

   $wt(8, 11) = 5$, $wt(8, 12) = 7$, $wt(9, 12) = 4$, $wt(10, 11) = 5$, $wt(11, 12) = 2$

   (a) Use Kruskal's algorithm to find a minimal spanning tree for the graph. Show your working by giving the order in which edges are selected.

   (b) Use Prim's algorithm to find a minimal spanning tree for the graph. Start with node 1. Show your working by giving how the array $D$ and set Rem are modified in each round/loop of the algorithm.

3. Does Dijkstra's algorithm work if the weights can be negative?

   Either give an argument that it works, or give a counterexample that it does not work.

4. Suppose we modify the continuous knapsack problem done in class to the discrete version as follows:

   > Either take all of item $i$ or none of item $i$ (that is, we cannot take only a part of item $i$ as done for the continuous knapsack problem done in class).

   Appropriately modify the greedy algorithm for continuous knapsack problem to the discrete knapsack problem.

   Is the modified greedy algorithm still optimal? If so, give an argument. If not, give a counterexample.

5. Using the algorithm done in class, give Huffman tree and code if the frequencies of the letters are as follows:

   $freq(a) = 25,\ freq(b) = 2,\ freq(c) = 5,\ freq(d) = 6,\ freq(e) = 6,\ freq(f) = 6$