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Program Structure and Algorithms (INFO 6205)
Quiz #5 − 30 points

Student NAME:

Student ID:

Question 1 (10 points)**.** *Please identify whether the following statements are* **True** *or* **False***. Please provide a brief justification to receive partial credits in case your answer is incorrect.*

(a) *(1 point) Prim's algorithm and Dijkstra's algorithm both solve the single-source shortest path problem.*

(b) *(2 points) Both Dijkstra's and Prim's algorithms choose a node from the priority queue that "looks best" at each step.*

(c) *(2 points) The unweighted activity selection problem is always guaranteed to have one unique solution.*

(d) *(2 points) A graph where all edges are distinct can have more than one minimum spanning trees.*

(e) *(3 points) A graph where all edge weights are positive and distinct can have more than one shortest paths between two vertices s and t?*

Question 2 (20 points)**.** *You are given a knapsack that can take a maximum weight W lbs. You are also given n items, each item i has a weight w_i and a value v_i.*

We will solve the **fractional knapsack problem** *where we want to maximize the value of items (either full or a fraction) in the knapsack such that the total weight of all items in the knapsack is $\leq W$.*

(a) *[7 points] What is a possible optimal greedy choice for this problem?*

(b) *[3 points] What is the running time of your greedy algorithm?*

(d) *[10 points] Let's say a thief has a knapsack that can carry a max weight W = 60 lbs. He has to choose from the following items. Please execute your greedy algorithm for this instance. Please clearly show the greedy choice for each iteration of your algorithm to receive full credit.*

Which items will be in his knapsack and will they have whole or a fraction of it? What is the total value of items in his knapsack?

Items	Weight (lbs)	Value ($)
1	5	30
2	10	40
3	15	45
4	22	77
5	25	90