

Question 1

(a) False

Prim is for finding the MST, and Dijkstra is for solving single-source shortest path problem.

(b) True

Dijkstra and Prim both choose the "looks best" (min) by pq.

Prim gets the min to connect to the tree, and Dijkstra gets min distance from the S node.

(c) False

The greedy only provides the best solution. Different activities may have the same finishing time, but may have different best solutions.

(d) False

Having all distinct edge weights eliminates the situation (both issues) in MST construction, so it cannot have more than one minimum spanning tree.

(e) True

We can think about a graph as a triangle with edges 1, 2, 3, $1 + 2 = 3$, so we get more than one shortest paths between two vertices s and t.

Question 2

- (a)
1. get value-pr - weight for each,
 2. sort it from high to low
 3. Start from the large to small, if not full, continue

(b) $O(n \log n)$

(c) item 1 = 6, item 2 = 4, item 3 = 3, item 4 = 3.5, item 5 = 3.6

sort: 1, 2, 5, 4, 3

greedy pick step 1: $60 - 5 = 55$, value = 30

step 2: $55 - 10 = 45$, value = $30 + 40 = 70$

step 3: $45 - 25 = 20$, value = $70 + 90 = 160$

step 4: $20 - 22 = -2$, so we do $20 - 20 = 0$

value = $160 + 3.5 \times 20 = 230$

so, total value = 230