1. Is this argument valid?

Let $T$ be a spanning tree that does not contain $e$. Let the weights of $e$ and $f$ be related: $c_e < c_f$. Since $T$ is a spanning tree, it must contain an edge $f$ with one end in $S$ and the other in $V-S$. Since $e$ is the cheapest edge with this property, we have $c_e < c_f$, and so $T-\{f\} \cup \{e\}$ is a spanning tree that is cheaper than $T$.

A. Yes

B. No
1. Is this argument valid?

Let $T$ be a spanning tree that does not contain $e$. Let the weights of $e$ and $f$ be related: $c_e < c_f$. Since $T$ is a spanning tree, it must contain an edge $f$ with one end in $S$ and the other in $V-S$. Since $e$ is the cheapest edge with this property, we have $c_e < c_f$, and so $T-e \cup \{e\}$ is a spanning tree that is cheaper than $T$.

A. Yes  
B. No
2. Which is a valid MST?

A. 

B. 

C. 

D. All of them 

E. A and B
2. We’ve seen 2 examples where we had had edges with the same weights. What happens if we consider them in different order?

A. Nothing. We get the same MST.
B. We may get different trees, but they are still valid MSTs.
C. We get totally different trees, which may not be MSTs.
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3. Think about ways that you could modify edges slightly to get rid of the exact same weights/costs, and still come up with an overall weight of the tree that is close to what we’d get if we used the original weights/costs. Which of these could be used?

A. Randomly perturb the weights of all edges using a large integer (e.g. 10 up to the number of edges).

B. Don’t consider multiple edges with the same cost.

C. Add 1 to the first duplicate edge, 2 to the next, and so on.

D. Randomly perturb the costs of all edges just a little.

E. None of the above.
Answers

Kruskal:
1. B - No, because unless we talk about f being on a path from v to w, we cannot be sure that e replacing f will make a spanning tree. (See 2nd slide of this question.)
2. A, because C has a cycle – NOT A TREE, and B isn’t minimal

Prim:
2. B
3. D – the problem with A is that the overall weight would be very different from the original, problem with B is you would only get a single tree, and it could be that you wouldn’t get a complete spanning tree since you aren’t considering all the edges, problem with C is that you aren’t preserving the relation among weights in the whole graph which might mean you didn’t get an MST of the original graph. To have replicable perturbations use the same seed.