CSCI 3104 Spring 2022
Instructor: Profs. Chen and Layer

Quiz 8 – Kruskal's Algorithm

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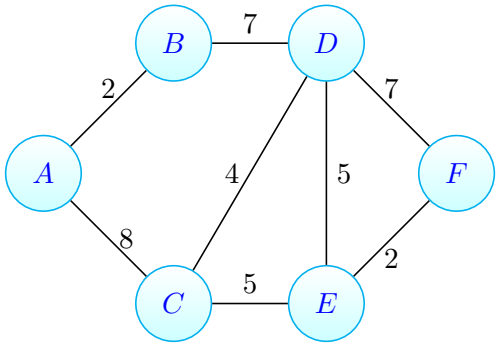
1 Instructions

- The solutions **should be typed**, using proper mathematical notation. We cannot accept hand-written solutions. Here's a short intro to LaTeX.
- You should submit your work through the **class Canvas page** only. Please submit one PDF file, compiled using this LaTeX template.
- You may not need a full page for your solutions; pagebreaks are there to help Gradescope automatically find where each problem is. Even if you do not attempt every problem, please submit this document with no fewer pages than the blank template (or Gradescope has issues with it).
- You **may not collaborate with other students**. **Copying from any source is an Honor Code violation. Furthermore, all submissions must be in your own words and reflect your understanding of the material.** If there is any confusion about this policy, it is your responsibility to clarify before the due date.
- Posting to **any** service including, but not limited to Chegg, Discord, Reddit, StackExchange, etc., for help on an assignment is a violation of the Honor Code.

2 Standard 8- Kruskal's Algorithm

2.1 Problem 1

Problem 1. Consider the following graph $G(V, E, w)$. Clearly indicate the order in which Kruskal's algorithm adds the edges to the minimum-weight spanning tree. You may simply list the order of the edges; it is not necessary to exhibit the state of the algorithm (i.e., the disjoint-set data structure) at each iteration.



Answer.

- We initialize the intermediate spanning forest $\mathcal{F}$ to be the empty graph (the graph on no edges). We also place the edges of G into a priority queue, which we call Q.
  Q = [({A,B },2), ({E,F },2), ({C,D },4), ({C,E },5), ({D,E },5), ({B,D },7), ({D,F },7), ({A,C},8)]
- We poll the edge {A, B} from Q. As {A, B} does not create a cycle, we add {A, B} to our spanning forest.
- We poll the edge {E, F} from Q. As {E, F} does not create a cycle, we add {E, F} to our spanning forest.
- We poll the edge {C, D} from Q. As {C, D} does not create a cycle, we add {C, D} to our spanning forest.
- We poll the edge {C, E} from Q. As {C, E} does not create a cycle, we add {C, E} to our spanning forest.
- We poll the edge {D, E} from Q. As {D, E} creates a cycle in our spanning forest (with {C, D} and {C, E}).we do not add {D, E} to our spanning forest.
- We poll the edge {B, D} from Q. As {B, D} does not create a cycle, we add {B, D} to our spanning forest.
- We poll the edge {D, F} from Q. As {D, F} creates a cycle in our spanning forest (with {C, D} ,{C, E} and {E,F}).we do not add {D, F} to our spanning.forest.
- We poll the edge {A, C} from Q. As {A, C} creates a cycle in our spanning forest (with {A, B} ,{B, D} and {C,D}).we do not add {A, C} to our spanning.forest.
- As we have 6 vertex and 5 edges on $\mathcal{F}$, the algorithm terminates and return $\mathcal{F}$ as minimum-weight spanning tree.

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