CSCI 3104 Spring 2022
Instructor: Profs. Chen and Layer

Quiz 9 - Prim's Algorithm

Due Date ..... February 18
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Contents

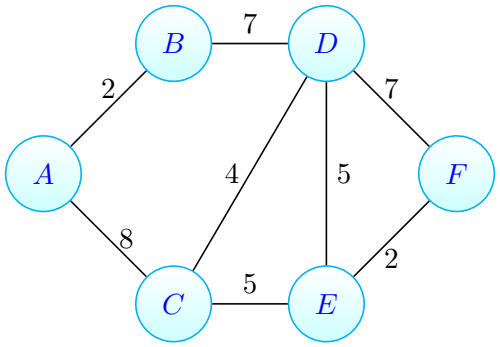
1 Instructions

- 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 9 - Prim's Algorithm

2.1 Problem 1

Problem 1. Consider the following graph $G(V, E, w)$. Clearly indicate the order in which Prim's algorithm adds the edges to the minimum-weight spanning tree **using F as the source vertex**. You may simply list the order of the edges; it is not necessary to exhibit the state of the algorithm at each iteration.



Answer. Prims algorithm works by initializing the intermediate spanning forest, $\mathcal{F}$, to contain all of the vertices of G, but no edges. Then initialize the priority queue to contain the edges incident to the source vertex F. The priority queue will order the edges from lowest to highest weights.
As each edge is examined, the unprocessed edges incident to that vertex is added to the priority queue, so Prim's take a more local perspective to creating an MST than Kruskals.
An edge is added to $\mathcal{F}$ if the edge has an endpoint in the component containing the source vertex, and is the minimum weight edge connecting two distinct components, hence a safe edge.

For this graph Prim's will add the edges in the following order:

1. $(\{F, E\}, 2)$
2. $(\{E, D\}, 5)$
3. $(\{C, D\}, 4)$
4. $(\{B, D\}, 7)$
5. $(\{B, A\}, 2)$.

□