

Name: Michael Rogers

ID: 105667404

CSCI 3104, Algorithms
Problem Set 5a (11 points)

Profs. Hoenigman & Agrawal
Fall 2019, CU-Boulder

Instructions for submitting your solution:

- The solutions **should be typed** and we cannot accept hand-written solutions. Here's a short intro to Latex.
- You should submit your work through **Gradescope** only.
- If you don't have an account on it, sign up for one using your CU email. You should have gotten an email to sign up. If your name based CU email doesn't work, try the identikey@colorado.edu version.
- Gradescope will only accept **.pdf** files (except for code files that should be submitted separately on Gradescope if a problem set has them) and **try to fit your work in the box provided**.
- You cannot submit a pdf which has less pages than what we provided you as Gradescope won't allow it.
- Verbal reasoning is typically insufficient for full credit. Instead, write a logical argument, in the style of a mathematical proof.
- For every problem in this class, you must justify your answer: show how you arrived at it and why it is correct. If there are assumptions you need to make along the way, state those clearly.
- You may work with other students. However, **all solutions must be written independently and in your own words**. Referencing solutions of any sort is strictly prohibited. You must explicitly cite any sources, as well as any collaborators.

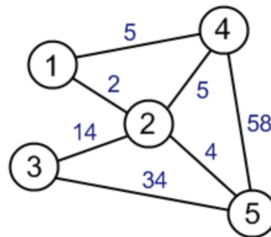
Name: Michael Rogers

ID: 105667404

CSCI 3104, Algorithms
Problem Set 5a (11 points)

Profs. Hoenigman & Agrawal
Fall 2019, CU-Boulder

1. (7 pts) Consider the following weighted graph.



- (a) (2 pts) Run Dijkstra's algorithm on this graph to obtain a tree of shortest paths. Use vertex 1 as the source vertex.

Solution.

Name: Michael Rogers

ID: 105667404

CSCI 3104, Algorithms
Problem Set 5a (11 points)

Profs. Hoenigman & Agrawal
Fall 2019, CU-Boulder

- (b) (2 pts) Run Kruskal's algorithm on this graph to obtain a minimum spanning tree.

Solution.

- (c) (1 pts) Is the tree of shortest paths produced by Dijkstra's algorithm a minimum spanning tree? Justify your answer.

Solution.

- (d) (2 pts) Find two vertices u and v , where the $u - v$ path in the Kruskal tree is not a shortest $u - v$ path.

Solution.

Name: Michael Rogers

ID: 105667404

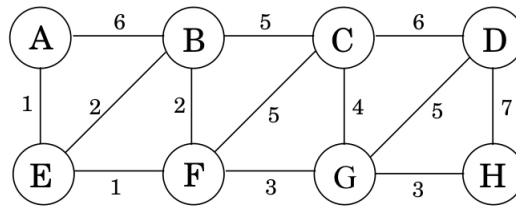
CSCI 3104, Algorithms
Problem Set 5a (11 points)

Profs. Hoenigman & Agrawal
Fall 2019, CU-Boulder

2. (1 pt) Provide a brief description of what the $find(v)$ and $union(A,B)$ features of the union-find algorithm produce.

Solution.

3. (3 pts) Identify three edges in the following graph G that won't be included in any MST of G . Provide a 3-4 sentence explanation of your answer.



Solution.