CS5800: Algorithms — Virgil Pavlu

Homework 10

Name:
Collaborators:

Instructions:

- Make sure to put your name on the first page. If you are using the LaTeX template we provided, then you can make sure it appears by filling in the `yourname` command.
- Please review the grading policy outlined in the course information page.
- You must also write down with whom you worked on the assignment. If this changes from problem to problem, then you should write down this information separately with each problem.
- Problem numbers (like Exercise 3.1-1) are corresponding to CLRS 4^{th} edition. While the 3^{rd} edition has similar problems with similar numbers, the actual exercises and their solutions are different, so make sure you are using the 4^{th} edition.

1. **(15 points)** Exercise 20.1-5.

Solution:

2. **(15 points)** Exercise 20.2-6.

Solution:

3. **(15 points)** Exercise 20.2-7.

Solution:

4. **(10 points)** Exercise 20.3-6.

Solution:

5. **(10 points)** Exercise 20.3-9.

Solution:

6. **(15 points)** Exercise 20.3-12.

Solution:

7. **(20 points)** Exercise 20.4-5.

Solution:

8. **(15 points)** Two special vertices s and t in the undirected graph $G = (V, E)$ have the following property: any path from s to t has at least $1 + |V|/2$ edges. Show that all paths from s to t must have a common vertex v (not equal to either s or t) and give an algorithm with running time $O(V + E)$ to find such a node v.

Solution:

9. **(Extra Credit 25 points)** Problem 20-3.

10. **(Extra Credit 25 points)** Problem 20-4.

11. **(25 points)** Exercise 21.1-3.

Solution:

12. **(25 points)** Exercise 21.2-2.

Solution:

13. **(25 points)** Exercise 21.2-4.

Solution:

14. (25 points) Exercise 21.2-5.

Solution:

15. (Extra Credit 40 points) Problem 21-1.

16. (Extra Credit 30 points) Exercise 21.1-11.

17. (Extra Credit 30 points) Write the code for Kruskal algorithm in a language of your choice. You will first have to read on the disjoint sets datastructures and operations (Chapter 21 in the book) for an efficient implementation of Kruskal trees.