

CSE 3500: Problem Set 2
Due by 11:59 PM on Monday, Sept 25.

Please note:

- *Students are permitted to discuss general concepts and questions concerning the homework assignments, but sharing written solutions with others or using solutions provided by others, in part or in whole, is prohibited.*
- *Whenever a question asks you to give an algorithm for a problem, be sure to also prove its correctness and analyze its time complexity.*
- *If you consult an outside resource (e.g., web page, book, or research paper) to arrive at your solution, be sure to cite that resource.*

Suggested reading: Chapter 3 from textbook.

Homework questions:

Question 1. (10 points) Exercise 2 from Chapter 3, page 107 of the textbook. You may assume that the input graph is given to you as an adjacency list.

Question 2. (10 points) Exercise 7 from Chapter 3, pages 108-109 of the textbook.

Question 3. (10 points) Consider the pseudocode for BFS given in the slides of Lecture 6. How would the running time of this algorithm change if the input graph is represented as an adjacency matrix? Justify your answer.

Question 4. (10 points) Suppose we have three containers whose sizes are 10, 7, and 4 gallons, respectively. The 7-gallon and 4-gallon containers start out full of water, while the 10-gallon container starts out empty. We are allowed one type of operation: pouring the contents of one container into another, stopping only when the source container is empty or the destination container is full. We would like to figure out if there is a sequence of such operations that leaves exactly 2 gallons in the 7- or 4-gallon container. Show how to model this problem as a graph problem: give a precise definition of the graph involved and state the specific question about this graph that needs to be answered to solve the original problem. Justify your answer. (Hint: You may think of possible container configurations as vertices).

Question 5. (10 points) Exercise 12 from Chapter 3, page 112 of the textbook. (Hint: you may use vertices to represent dates, i.e., (unknown) birth and death dates for each person.)