Computer Science 243 Spring 2025 Homework 12

Due: 11:59 p.m., Monday, 4/28/25

Answer the following questions and show your work. Your final submission must be completely your own work.

1. [4 points] For the graphs below, find the degree or in-degree/out-degree of each vertex.



2. [4 points] State whether each graph is bipartite. If so, list the elements in each vertex set.



- 3. [2 points] Represent the following graph with
 - a. an adjacency list (in alphabetical order of the vertices and the list for each vertex)
 - b. an adjacency matrix



Points: 50

4. [3 points] Determine whether the following two graphs are isomorphic. If so, provide a mapping from one vertex set to the other. If not, state why not.



5. [2 points] Determine whether each of the following graphs is strongly connected, and if not, whether it is weakly connected.



6. [2 points] Find the strongly connected components in the graph below.



7. [4 points] For each graph below, construct an Euler circuit if it exists. If not, construct an Euler path if it exists.





8. [3 points] Transform the following diagram into a graph and determine if someone can cross all of the bridges shown in this map exactly once and return to the starting point. Label your graph and show a path, if possible, or explain why it cannot be done.



9. [2 points] Determine whether the graph below has a Hamilton circuit. If it does, find such a circuit. If it does not, determine if it has a Hamilton path and find such a path.



10. [8 points] Answer the following questions for the tree shown below:



- a. Which vertex is the root?
- b. Which vertices are internal?
- c. Which vertices are leaves?
- d. Which vertices are children of *b*?
- e. Which vertex is the parent of *h*?
- f. Which vertices are siblings of *o*?
- g. Which vertices are ancestors of *m*?
- h. Which vertices are descendants of *b*?

- 11. [6 points] For the tree in the previous problem, list the vertices in the order that they would be visited in a(n):
 - a. preorder traversal
 - b. inorder traversal
 - c. postorder traversal
- 12. [6 points] Consider the following infix expression:

$$((x+2)^3) * (y - (3+x)) - 5$$

- a. Draw a binary expression tree for the expression.
- b. Write this expression in prefix notation.
- c. Write this expression in postfix notation.
- 13. [2 points] Compute the value of each of the following:
 - a. the prefix expression: + +4 * 2385
 - b. the postfix expression: 521 314 + +*
- 14. [2 points] Find a spanning tree for the graph below by removing edges in simple circuits:

