CIS 23: Data Structures and Algorithms

Homework 12
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Problem 1
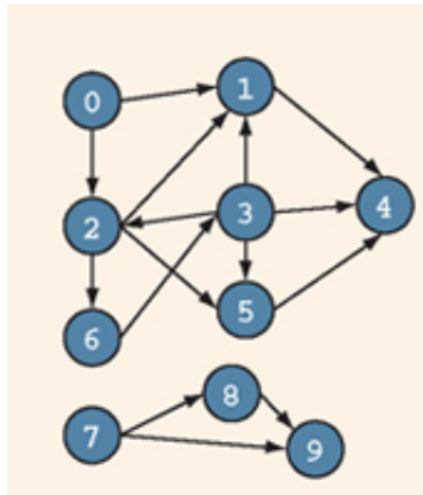
Consider the following graph

Figure 1: Problem 1

1. Draw the adjacency matrix for this graph.
2. Draw the adjacency list for this graph.
3. List the nodes of the graph in a depth-first order.
4. List the nodes of the graph in a breadth-first order.

Solution

Problem 2

Consider the following graph

Let the vertex with 0 be the source. Using Dijkstra's algorithm, find the minimum path from the source to every other vertex. List out the vertices in the order they are examined.
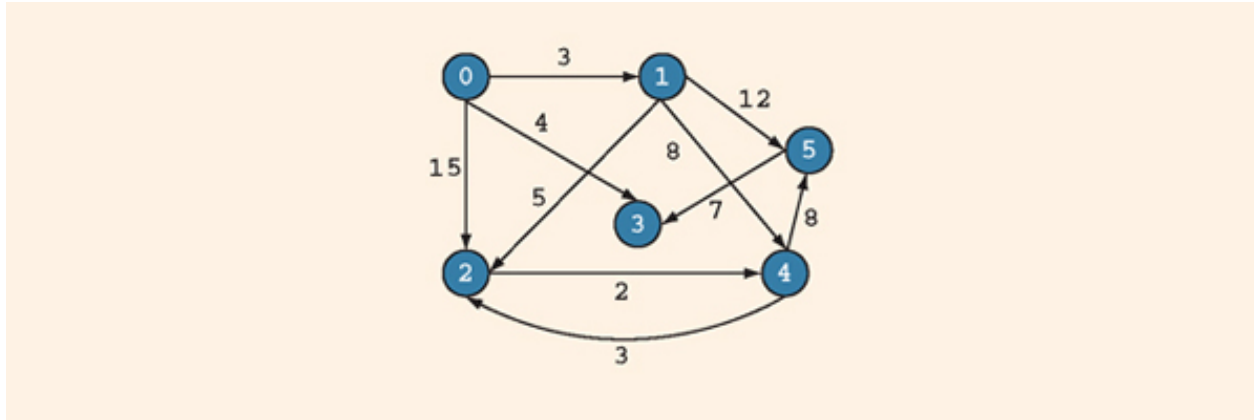
Solution

Figure 2: Problem 2

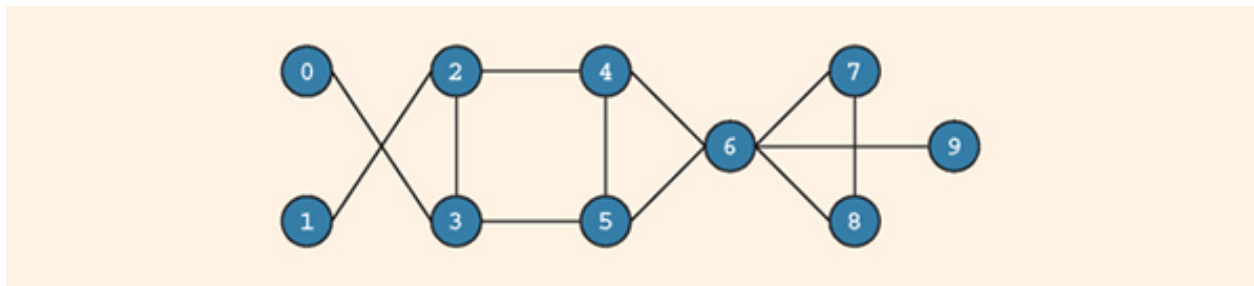## Problem 3

Consider the following graph

Figure 3: Problem 3

Draw *a* spanning tree for this graph.

Solution

Problem 4

Consider the following graph

Using Prim's algorithm, find the minimum spanning tree. List all the edges and weights added to the tree. What is the weight of the tree?

Solution

Problem 5

A cycle in G is a simple path in which the first and last vertices are the same. Describe an algorithm for determining if a cycle exists in a graph G.
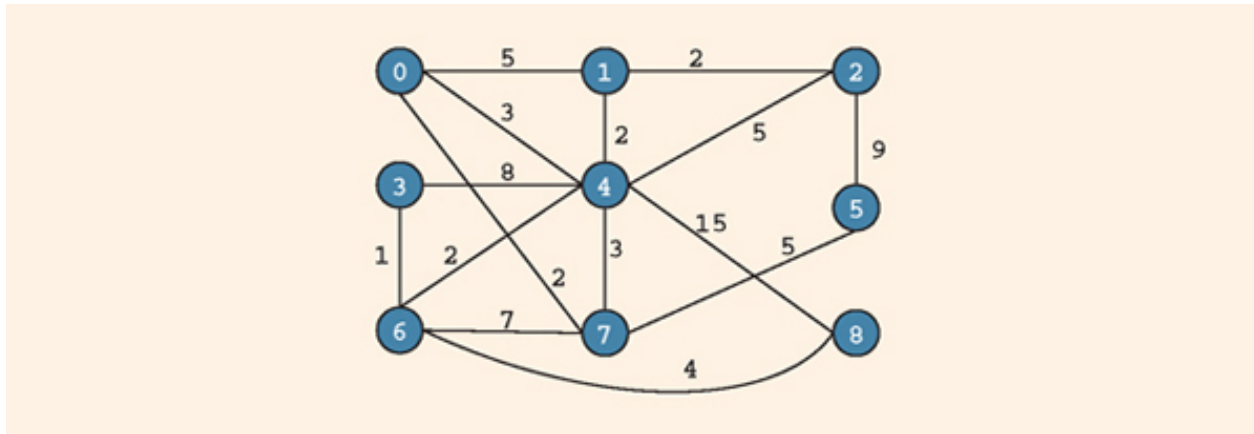
Figure 4: Problem 4

Solution

Problem 6

Dijkstra's algorithm only works on a graph in which all edges are positive numbers. Suppose you have a weighted graph where the smallest edge has weight M where $M < 0$. If you add $M + 1$ to the weight of every edge, can you then run Dijkstra's algorithm to find the minimum path from a source vertex to all other vertices? Why or why not? If not, use an example to demonstrate.

Solution

Problem 7

Using the code provided in the textbook (`Files -> Lecture Code -> Graphs`), write a short program that will read in a (unweighted) graph information from a text file and then print out the depth first traversal and breadth first traversal. Use your program to test your answer to Problem 1.

Solution

See `main.cpp`.