1. (a) Exercise 21.2-2 (page 567). (b) Exercise 21.3-1 (page 572).
2. Exercise 22.4-5 (page 615).
3. Problem 22-3 (page 623)
4. Consider the maze shown below. We try to find a shortest path from $s$ to $t$. Formulate this problem as a graph-search problem and give an efficient algorithm for this problem.
5. Leonhard Euler in 1736 first considered the following mathematical puzzle: The city of Königsberg has seven bridges $b_i, i = 1, ..., 7$, with two river banks $A$ and $B$ and two islands $C$ and $D$, as shown in the figure below. Euler wondered if it is possible to start at some place in the city, cross every bridge exactly once, and return to the starting place.
   (a) Model this problem as a graph problem.
   (b) Does such a tour exist? Why?
6. Find the depth-first spanning forest for the following directed graph. Then find the strongly connected components. Show your work.
7. Exercise 23.2-7 (page 637).
11. Exercise 24.4-2 (page 669).
12. Problem 24-3 (page 679).
13. Exercise 25.2-1 (page 699). (Please work on the subgraph with all edges related to vertices \(v_1, v_2, v_4, \text{ and } v_5.\))
15. In the graph \(G = (V, E)\) we associate a reliability \(0 < \mu_{ij} \leq 1\) with every edge \((i, j) \in E\); the reliability measures the probability that the edge will be operational. We define the reliability of a directed path \(P\) as the product of the reliability of edges in the path (i.e., \(\mu(P) = \Pi_{(i,j) \in P} \mu_{ij}\)). The maximum reliability path problem is to identify a directed path of maximum reliability from the source node \(s\) to every other node in the graph.

   (a) Suppose you are not allowed to take logarithms because they might yield irrational data. Specify an efficient algorithm for solving the maximum reliability path problem by modifying Dijkstra’s algorithm. You only need to give the modified code with the line numbers in Dijkstra’s algorithm listed in the textbook/lecture notes. What is the time complexity of your algorithm?

   (b) If we permit \(\mu_{ij}\) to be arbitrary positive numbers, then the maximum reliability path problem becomes the maximum multiplier path problem. Modify the Floyd-Warshall all-pairs shortest path algorithm to determine maximum multiplier paths between all pairs of nodes.

16. (DIY Problem) For this problem, you are asked to design a problem set related to Chapter(s) 21, 22, 23, 24, and/or 25 and give a sample solution to your problem set. Grading on this problem will be based upon the quality of the designed problem as well as the correctness of your sample solution.