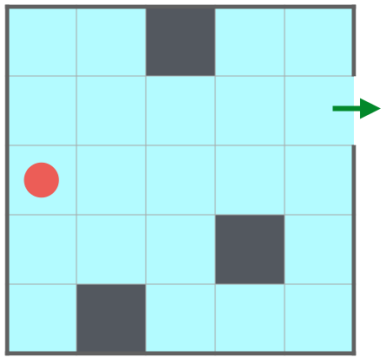
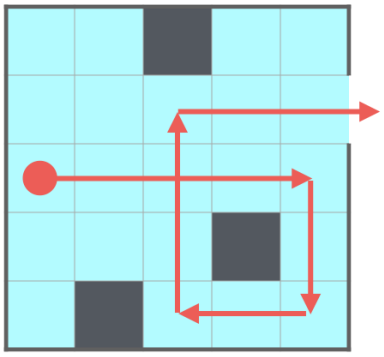
Computational Problem Solving CSCI-603
Get Off the Ice! Lab 9

1 Introduction

It's winter in Rochester, and you have been trapped on a frozen pond! You would like to escape but the ice is slippery so you can only move in a straight line until you run in to a rock or the edge of the pond. To make things worse, there is only one exit from the pond. Of course, there are many different ponds out there that you might get trapped in, so you need a general strategy to escape.

Here (on the left) is one such pond that you might find yourself in, and (on the right) how you could escape — the darkened squares represent rocks in the pond against which you can stop, and the gap in the border of the pond is your escape.

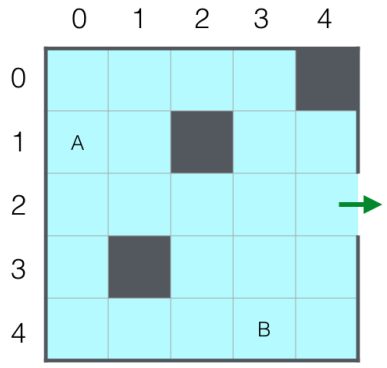


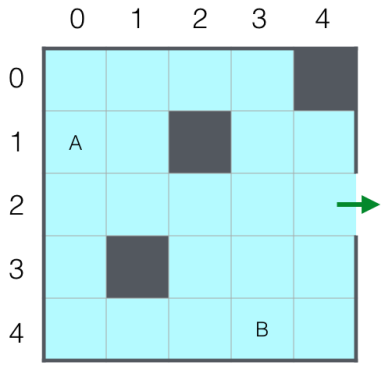


In this assignment, you will be given a pond and must figure out the *quickest* way to escape the pond from any possible starting location. You must also discover how many places you could start from where you cannot escape at all!

2 Problem Solving

Consider the following frozen pond (ignore the numbers on the outside until question 5):





Use these for questions 3 and 4.

1. If you start on the square marked A, can you get off the ice? If so, how?

2. If you start on the square marked B, can you get off the ice? If so, how?

3. In this question, we will consider all possible moves starting from the square marked A. On one of the provided copies of this pond, write a 1 in all of the squares that you can stop in after one motion, a 2 in all of the remaining squares that you can reach (and stop in) after two motions, and a 3 in all of the remaining squares that you can reach (and stop in) after three motions. Here a motion means a single move in a straight line from the starting square until running in to a rock or the edge of the pond.

4. On the other provided copy of this pond, write a 1 in each square from which you can escape in one move, and a 2 in each square from which you can escape in two moves.

5. Draw a graph of the squares that you can reach, starting with the square marked A. For this question, represent each square as a vertex labeled with its (x,y) coordinates, and each **complete** move as an edge. Include all edges, being sure to note whether they are directed or undirected. If you need to include the escape point, this should be an appropriately labeled vertex.