Basic Examples

1 Problems

Problem 1: A Wolf, a Goat, and a Cabbage

A woman finds herself on a riverbank with a wolf, a goat, and a head of cabbage. She needs to transport all three to the other side of the river in her boat. However, the boat has room for only the woman herself and one other item (either the wolf, the goat, or the cabbage). In her absence, the wolf would eat the goat, and the goat would eat the cabbage. Show how the woman can get all these passengers to the other side.

Problem 2: Glove Selection

There are 20 gloves in a drawer: 5 pairs of black gloves, 3 pairs of brown, and 2 pairs of gray. You select the gloves in the dark and can check them only after a selection has been made. What is the smallest number of gloves you need to select to guarantee getting the following?

1. At least one matching pair
2. At least one matching pair of each color

Problem 3: Rectangle Dissection

Find all values of $n > 1$ for which one can dissect a rectangle into n right triangles, and outline an algorithm for doing such a dissection.

Problem 4: Making Pancakes

You have to make $n \geq 1$ pancakes using a skillet that can hold only two pancakes at a time. Each pancake has to be fried on both sides; frying one side of a pancake takes 1 minute, regardless of whether one or two pancakes are fried at the same time. Design an algorithm to do this job in the minimum amount of time. What is the minimum amount of time as a function of n?

Problem 5: Jumping into Pairs

There are n coins placed in a row. The goal is to form $n/2$ pairs of them by a sequence of moves. On each move a single coin can jump right or left over two coins adjacent to it (i.e., over either two single coins or one previously formed pair), to land on the next single coin; no triples are allowed. Any empty space between adjacent coins is ignored. Determine all the values of n for which the puzzle has a solution and devise an algorithm that solves the puzzle in the minimum number of moves for such ns.

Problem 6: Blocked Paths

Find the number of different shortest paths from the starting point S to the destination D in a city with perfectly horizontal streets and vertical avenues as shown in Figure **??**. No path can cross the fenced off area shown in grey in the figure.

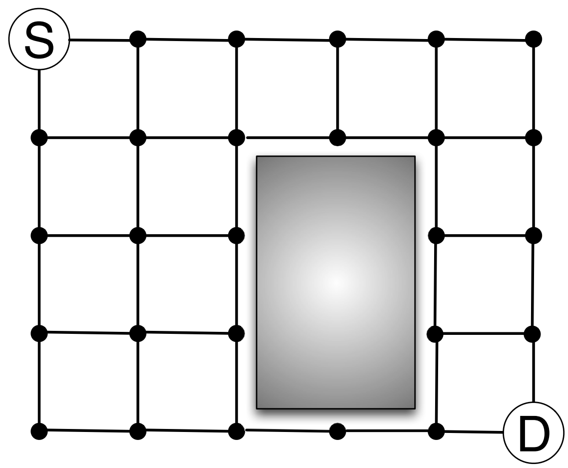

Figure 1: The city streets of the Blocked Paths problem.