MMIN: Modelos matemáticos para informática
Lectura: Acertijos Matemáticos
Semana 1
Tarea 1

Problems Solving

1. **THE GOLDEN COIN**
   Peter has 23 coins of equal value. Among the coins is one of gold and the others are of bronze (less weight). Using a weighing scale only three times, how do you find the gold coin?

2. **SHE-GOAT, WOLF AND CABBAGE**
   A farmer returns from the market, where he bought a she-goat, a cabbage, and a wolf (what a crazy market :-). He must cross a river on the way home, but his boat is small and won't fit more than one of his purchases. He cannot leave the she-goat alone with the cabbage (because the she-goat would eat it), nor he can leaves the she-goat alone with the wolf (because the she-goat would be eaten). How can the farmer get everything on the other side in this river crossing puzzle?

3. **HENS AND RABBITS**
   A farmer keeps hens and rabbits on his farm. These animals have 50 heads and 140 feet. How many hens and how many rabbits has the farmer?

4. **SALESMAN PROBLEM (TSP)**
   Given a list of cities and the distances between each pair of cities. What is the shortest route to visit each city and return to the origin city?

5. **MICRORGANISM**
   You must assume that a microorganism reproduces every second in two other identical microorganisms. These two microorganisms reproduce in the same way and so on, but they never die. When the microorganism is introduced in a test tube, it is completely filled in one hour. What time will the microorganism fill half of the test tube?

6. **TILING PROBLEM**
   Given a $2 \times n$ board and tiles of size 2×1, count the number of ways to tile the given board using the 2×1 tiles. A tile can either be placed horizontally i.e., as a 1×2 tile, or vertically i.e., as 2×1 tile.

7. **DOING LAUNDRY**
   Ann, Brian, Cathy, Dave each have one load of clothes to wash, dry, fold, and put away. Washer takes 30 minutes. Dryer takes 30 minutes. "Folder" takes 30 minutes. "Stasher" takes 30 minutes to put clothes into drawers. How long does it take to wash, dry and fold all the clothes?. Your solution must be efficient.

8. **EMPTY TANK**
   One pipe can fill a tank in 15 minutes, another pipe can fill it in 20 minutes, a third pipe in 30 minutes. With all three pipes open, how long will it take to fill the empty tank?

9. **IRON SPHERE**
   An iron sphere is floating in mercury. Water is poured over the mercury and covers the sphere. Will the sphere sink, rise, or remain at the same depth?

10. **DINING PHILOSOPHERS**
    Five silent philosophers sit at a round table with bowls of spaghetti. Forks are placed between each pair of adjacent philosophers. Each philosopher must alternately think and eat. However, a philosopher can only eat spaghetti when they have both left and right forks. Each fork can be held by only onephilosopher, and so a philosopher can use the fork only if another philosopher is not using it. After an individual philosopher finishes eating, they need to put down both forks so that the forks become available to others. A philosopher can take the fork on their right or the one on their left as they become available but cannot start eating before getting both forks.

    Eating is not limited by the remaining amounts of spaghetti or stomach space; an infinite supply and an infinite demand are assumed. The problem is how to design a process such that no philosopher will starve.