**Problem 1** Two thieves have robbed a warehouse and have to split a pile of items without price tags on them. How do they do this in a way that ensures that each thief believes that he has got at least one half of the value of the whole pile? *(You might want to try to solve this problem before reading any further.)*

The solution is that one of the two thieves splits the pile in two parts, so that he believes that both parts are of equal value. The other thief then chooses the part that he believes is at least one half.

Assume now that ten thieves have robbed a warehouse. How do they split the pile of items so that each thief believes that he got at least one tenth of the total value of the pile?
Problem 2  Tom and his wife Mary went to a party where nine more couples were present. Not every one knew every everyone else, so people who did not know each other introduced themselves and shook hands. People that knew each other from before did not shake hands. Later that evening Tom got bored, so he walked around and asked all other guests (including his wife) how many hands they had shaken that evening, and got 19 different answers. How many hands did Mary shake?

Problem 3  We are given 27 coins of the same denomination; we know that one of them is counterfeit and that it is lighter than the others. Find the counterfeit coin by weighing coins on a pan balance only three times.

Problem 4  We are given twelve coins and one of them is a counterfeit but we do not know if it is heavier or lighter. Determine which one is a counterfeit and if it is lighter or heavier by weighing coins on a pan balance three times only.

Problem 5  We have nine coins and three of them are heavier than the remaining six. Can you find the heavier coins by weighing coins on a pan balance only four times?
Problem 7  Consider a block of 7 X 7 houses

The inhabitant of each house thinks that all four houses around him (to the left, right, top and bottom) are nicer than his house and would like to move to any of the four. Can you move the inhabitants around to make them happier?

Problem 6  There are five pirates who have to split 100 bars of gold. They all line up and proceed as follows:

i)  The first pirate in line gets to propose a way to split up the gold (for example: everyone gets 20 bars)

ii) The pirates, including the one who proposed, vote on whether to accept the proposal. If the proposal is rejected, the pirate who made the proposal is killed.
iii) The next pirate in line then makes his proposal, and the 4 pirates vote again. If the vote is tied (2 vs 2) then the proposing pirate is still killed. Only majority can accept a proposal. The process continues until a proposal is accepted or there is only one pirate left. Assume that every pirate:

iv) above all wants to live;

v) given that he will be alive he wants to get as much gold as possible;

vi) given maximal possible amount of gold, he wants to see any other pirate killed, just for fun;

vii) each pirate knows his exact position in line;

viii) all of the pirates are excellent puzzle solvers.

**Question:** What proposal should the first pirate make?

**Problem 7** Assume now there are 10 pirates splitting 1000 pieces of gold. What should the first pirate propose?

**Problem 7** In Elbonia all cities have a circular one-way highway around the city (in blue on the map below). All streets in the cities are one-way, and they all start and end on the circular highway (see the map).
A block is a part of the city that is not intersected by any street.

Design an algorithm that, given a map of a city, finds a block that can be circumnavigated while respecting all one-way signs.

For example, the green block has such property, but the red one does not.