

BIOINFORMATICS

Lab Assignment 1

Q. Implement the 10 + 10 game

- Imagine Alice, Bob, and two piles of ten rocks.
- Alice and Bob are bored one Saturday afternoon so they play the following game:
 - In each turn a player may either take one rock from a single pile, or one rock from both piles.
 - Once the rocks are taken, they are removed from play; the player that takes the last rock wins the game.
 - Alice moves first. It is not immediately clear what the winning strategy is, or even if there is one.
 - Does the first player (or the second) always have an advantage?
 - Bob tries to analyse the game and realizes that there are too many variants in the game with two piles of ten rocks (which we will refer to as the 10+10 game).

Using a reductionist approach, he first tries to find a strategy for the simpler 2+2 game. He quickly sees that the second player—himself, in this case—wins any 2+2 game, so he decides to write the “winning recipe”.

Write the winning recipe and implement it in any programming language of your choice.

Winning Recipe for 10+10 game

Solution:

Pile B

Pile A

	0	1	2	3	4	5	6	7	8	9	10
0	*	←	*	←	*	←	*	←	*	←	*
1	↑	↖	↑	↖	↑	↖	↑	↖	↑	↖	↑
2	*	←	*	←	*	←	*	←	*	←	*
3	↑	↖	↑	↖	↑	↖	↑	↖	↑	↖	↑
4	*	←	*	←	*	←	*	←	*	←	*
5	↑	↖	↑	↖	↑	↖	↑	↖	↑	↖	↑
6	*	←	*	←	*	←	*	←	*	←	*
7	↑	↖	↑	↖	↑	↖	↑	↖	↑	↖	↑
8	*	←	*	←	*	←	*	←	*	←	*
9	↑	↖	↑	↖	↑	↖	↑	↖	↑	↖	↑
10	*	←	*	←	*	←	*	←	*	←	*

Left arrow: one rock from pile B

Up arrow: one rock from pile A

*****: No matter what, other wins

What happens for $n+n$?

What if piles are 3?

10+10+10