CodeCrunch

CS1010E Practice Exercise: Sticks

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Pick Up Sticks

The game of *Pick Up Sticks* is played between two players with an initial pile of `n` sticks. Each player takes turns in picking out `1` to `m (< n)` sticks from the pile. Whoever takes the last stick loses the game.

There is a strategy to win the game. We illustrate it with an example below. Suppose we start off with `n=5` sticks and take a maximum of `m=3` sticks. Further assume that the opponent starts first.

- If the opponent takes `1` stick, then we take `3` sticks, leaving the last stick for the opponent and we win.
- If the opponent takes `2` sticks, then we take `2` sticks, leaving the last stick for the opponent and we win.
- If the opponent takes `3` sticks, then we take `1` stick, leaving the last stick for the opponent and we win.

Realize that for `5` sticks, letting the opponent play first will result in a win for us. Now let us start off with `9` sticks instead of `5`.

- If the opponent takes `1` stick, then we take `3` sticks, leaving `5` sticks for the opponent.
- If the opponent takes `2` sticks, then we take `2` sticks, leaving `5` sticks for the opponent.
- If the opponent takes `3` sticks, then we take `1` stick, leaving `5` sticks for the opponent.

By leaving `5` sticks for the opponent, it can be seen earlier that we will eventually win. So with respect to `m=3`, a pile of `n={5,9,13,17,21,..}` will be disadvantageous to the one starting the game, so we have to avoid it at all costs!

Write a program to reads `n` and `m` as user input, and decides who starts first, as well as the correct number of sticks to pick. Note the following assumptions:

- `n > 2`
- `0 < m < n`
- the user follows the rules of the game, and does not take all sticks (to commit suicide)

Sample Runs

The following are sample runs of the program. User input is underlined. Ensure that the last line of output is followed by a newline character.

- Sample run #1:

```
Enter n: 20
Enter m: 3

I start first

I pick 3 stick(s) with 17 left

How many stick(s) to pick? 1
16 sticks left

I pick 3 stick(s) with 13 left
```

```
How many stick(s) to pick? 2
11 sticks left

I pick 2 stick(s) with 9 left

How many stick(s) to pick? 3
6 sticks left

I pick 1 stick(s) with 5 left

How many stick(s) to pick? 1
4 sticks left

I pick 3 stick(s) with 1 left

I WIN
```

- Sample run #2:

```
Enter n: 97
Enter m: 23

You start first

How many stick(s) to pick? 23
74 sticks left

I pick 1 stick(s) with 73 left

How many stick(s) to pick? 4
69 sticks left

I pick 20 stick(s) with 49 left

How many stick(s) to pick? 20
29 sticks left

I pick 4 stick(s) with 25 left

How many stick(s) to pick? 4
21 sticks left

I pick 20 stick(s) with 1 left

I WIN
```

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