Introduction to Artificial Intelligence

Exercise Sheet 5

Handed out: 12.01.2021 — Prof. Dr. Susanne Biundo-Stephan
Due: 26.01.2021 — Conny Olz

Exercise 1 (4 points)

Finish the quiz on games which you can find in Moodle. As usual, please submit only **one** solution per group.

Exercise 2 (5 points)

The two players Stan and Ollie play Euclid's game. It has the following rules: They start with two natural numbers. The first player, Stan, subtracts an arbitrary (positive) multiple of the smaller number from the larger number. However, the result must not be negative. Then Ollie, the second player, does the same with the resulting numbers. The players now take turns. A player wins if he manages to reach a value of 0 at the end of his move.

Consider the following example in which the players begin with the numbers 25 and 7:

```
25 7 -> 11 7 (Stan's move: he subtracts 2*7 from 25)
11 7 ->  4 7 (Ollie's move)
 4 7 ->  4 3 (Stan's move)
 4 3 ->  1 3 (Ollie's move)
 1 3 ->  1 0 (Stan's move)
```

Therefore Stan has won the game.

Write a program that determines which player wins if both players play perfectly. Do that by using the techniques known from the lecture.

As input you get a line containing the two numbers the game begins with. As a result output either 'Stan wins' or 'Ollie wins'.

Exercise 3 (4 *bonus* points)

This exercise builds on exercise 2.

Solve the problem using Minimax Search. Adapt the standard procedure in the following way:

For the described game, many intermediate results are computed several times, which – depending on the test case – leads to poor runtime performance. Modify the algorithm so that it reuses results that have been calculated before so that this problem does not occur anymore.