Session 5 worksheet

Names:

Register to a group

Please form a pair together with your best friend. Select a group in Moodle and register yourself and your companion to it. Make sure that both of you are registered in the same group.

1. Product

Please compare your solutions to the first homework exercise (home1.py). Explain your solution to your partner. Compare your approaches and write below: in what respect do your approaches to solving this exercise differ?

Please analyze the algorithms of your programs.
   a) Given input $n$, how many times will be the body of the loop executed?

   b) What result will the program give if $n = 0$? Is this the result it should be?

   c) Test your program with large inputs. What is the largest $n$ for which your program can finish the work in a reasonable time (say, 1 second) – is it hundreds, thousands, etc?

   d) What do you think, what is the number that the value of this expression tends to, as $n$ increases?

2. Dragons, snakes, and dinosaurs

Compare and explain your solutions of the third homework exercise (home3.py). How did both of you handle the situation where at some point there is food for some but not for all animals of one kind?

   a) Open the debugger in your IDE. In Thonny you can find it in the “Run” menu; there are three versions of it, you can choose any of them, for example, the first one. Also open the variables window: in Thonny select “View” and then “Variables”.
Run the program with the following inputs: number of dragons = 13, number of snakes = 23, number of dinosaurs = 17, and see how the values of the variables that represent the numbers of dragons, snakes, and dinosaurs, change. In the table below, write the values of these variables after each change.

<table>
<thead>
<tr>
<th>Number of dragons</th>
<th>Number of snakes</th>
<th>Number of dinosaurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>23</td>
<td>17</td>
</tr>
</tbody>
</table>

b) Can you find initial values for numbers of dragons, snakes, and dinosaurs, for which the eating process lasts exactly 365 days?

number of dragons =
number of snakes =
number of dinosaurs =

Test your answer with your program.

*Hint.* Try to work backwards.

3. Paprika soup

In a minute, a bowl of paprika soup cools by 19% of the difference between soup and room temperatures. Write a program that prints the temperature of the soup for each minute, if its initial temperature is 90 °C. Room temperature is 20 °C.

Modify the program in such a way that numeric inputs (percentage and two temperatures) are entered by the user.

Try to arrive to a version of your program that doesn't loop infinitely.
4. Guessing game

Number guessing game is played by two players. One player thinks a secret number between 1 and 1000 and the other player tries to find it out by offering guesses. To each guess the first player answers whether the secret number is larger than, smaller than or equal to the number guessed. Write a program that allows to play this game with the computer.

_Easier version_. The computer selects a number and the user guesses. The number is generated randomly and the user is prompted to enter a number until the guess is correct. Finally the program prints the number of guesses the user needed to find out the number.

_Harder version_. The user selects a number and the computer guesses. One strategy to guess the number is, for example, to divide the search interval in two halves and find out in which half the user’s number lies. Then divide this half again in two halves etc.

You can also write a common program that switches the roles after each round.

To draw lots, you can use the `randint` function from Python’s `random` module ([https://docs.python.org/3.7/library/random.html](https://docs.python.org/3.7/library/random.html)).

5. Hermit

A hermit lives on a private island. His house has two doors. At each door there are \( n \) pairs of shoes. When the hermit wants to leave the house, he draws lots, out of which door he should go, and puts on the shoes at that door. Coming back, he again draws lots, through which door he should enter, and leaves the shoes behind that door. On average, after what number of times the hermit has to leave the house barefoot, because there are no shoes at the selected door?

The average number, that depends on \( n \), can be found by an experiment. Write a program that simulates this process large number of times and computes the average at the end.

Based on your experiment, what is the average for \( n = 5 \)?