

Excercise

Issue: 06.12.2023
Submission: 23.12.2023
01:00 PM

Recursion with ChatGPT

Note:

- Solutions must not be copied from the script, the internet, or other sources. These sources may only be used with proper citations, and a significant amount of individual effort must be clearly evident in the solutions.

For this submission: You do not need to consider answers from ChatGPT!

- Digital submissions that are not in the format **.pdf** or **.txt** for text, or **.py** for code, will not be evaluated. In the case of multiple file submissions, they must be combined into a **.zip** file.
- Make sure to set the variable **__author__** correctly in all source code files (.py) (at the beginning of the source code): `__author__ = "<Matr-Nr>, <Last name>"`
Example: `__author__ = "1234567, Tolle"`
... Note spaces before and after the '=' sign, a space after the comma, and do not use angle brackets.
- Additionally, your name must be present in every submitted **.pdf** and **.txt** file. Submissions of documentation handwritten and scanned are only allowed in exceptional cases
- File and folder names should not contain umlauts, diacritics, or special characters, except for the underscore in the middle of the name!

Σ 8 Points

Note: Also, pay attention to the instructions provided by your tutor. Please check the group forum in the Moodle course for EPR as well!

Programming with ChatGPT

2 Points

For this exercise, we ask you to complete the tasks using ChatGPT via the free version available at <https://chat.openai.com/>.

How you use ChatGPT is up to you. **There will be no deduction of points for plagiarism or insufficient original work.**

You can find guidance here: <https://platform.openai.com/docs/guides/prompt-engineering>

After submission, please include all prompts and responses in Moodle. You will find a template with examples in the exercise distribution.

Following submission, please complete a brief survey in Moodle to receive the 2 points.

Task 1 – Recursion

2 Points

Consider the following code fragments. Indicate what the functions *return* and *how often they are called*. Additionally, specify whether the function is *linear recursive*, *tail-recursive*, or *multiple (non-linear) recursive*. Try it first without using the computer. All fragments should be executable!

a)

```
1  def f1(n, total=0):
2      if n == 0:
3          return total
4      else:
5          return f1(n // 10, total + n % 10)
6
7  y = f1(12345)
```

Return value: _____

Number of calls: _____

Type of recursion: _____

b)

```
1  def f2(x):
2      if len(x) == 0:
3          return []
4      return [x[-1]] + f2(x[:-1])
5
6  y = f2([9, 8, 7, 6])
```

Return value: _____

Number of calls: _____

Type of recursion: _____

c)

```
1  def f3(a, b):
2      if b == 0:
3          return 0
4      elif b > 0:
5          return a + f3(a, b - 1)
6      else:
7          return -f3(a, -b)
8
9  y = f3(4, 3)
```

Return value: _____

Number of calls: _____

Type of recursion: _____

d)

```
1  def f4(m, n):
2      if m == 0:
3          return n + 1
4      elif n == 0:
5          return f4(m - 1, 1)
6      else:
7          return f4(m - 1, f4(m, n - 1))
8
9  y = f4(1, 1)
```

Return value: _____

Number of calls: _____

Type of recursion: _____

Task 2 – Happy Strings

4 Points

A string consisting of digits is said to be „happy“ when it can be rearranged into (or already is) a repetition of some string twice.

For example:

The string 20230322 can be rearranged into 02320232, which is a repetition of 0232 twice.

Write a Python 3.X function that, for a given string S consisting of digits 0-9, finds the **number** of pairs of integers (l,r) satisfying the following conditions:

- $1 \leq l \leq r \leq |S|$. ($|S|$ is the length of S)
- The (contiguous) substring formed of the l -th through r -th characters of S is „happy“.

For example, for '20230322', there are a total of 4 pairs that meet this condition: (1, 6), (1, 8), (2, 7), and (7, 8).

1 out of 4 points: Find a recursive solution for the problem!

Remember to document your program appropriately (especially the problem analysis is important). Ensure to add docstrings and comments in your code. As previously mentioned, test your function in a `main()` function, which is executed only at the start of the module.