BERGISCHE UNIVERSITÄT WUPPERTAL

University of Wuppertal
School of Mathematics and Natural Sciences
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Tools

Summer Term 2022

Exercise Sheet 2

Exercise 5 (Python 3, Class for Glasses, 5 p.)

Implement a class `Glass` in Python 3. Requirements:

- attributes: volume and content
- constructor that can be called with 0, 1, or 2 parameters (default values: volume = 250, content = 0); throw an exception if the content is greater than the volume
- method `fillIn` (The amount is passed as a parameter; if it does not fit in, throw an exception.)
- method `drink` (The amount is passed as a paramter; if the content is too small, throw an exception.)
- method for conversion into a string

Add a test script that creates some glasses, calls each method at least once, and checks all possible exceptions.

Exercise 6 (Python 3, Regular Expressions, Rooms and Members of Mathematics Department, 5 p.)

a) (5 p.) Create a class `Room` with attributes `building`, `floor`, and `number` to store rooms like "G.14.16".

Then create a class `Occupant` with attributes `familyname`, `givenname`, and `room`. Both classes need a constructor and a method for conversion to string.

The file `/home/tools/Exercises/06/fbc_math.txt` (also available in Moodle) contains a (halfway up to date) list of all members of the Department of Mathematics and Informatics and their offices. (The lines look like "`Arndt, Holger G.14.16`". Note that some people have two given names or two family names.) Load the information from this file into an array of `Occupants` and print this array. When reading the input, use a regular expression to split each line of the input file into its components.

b) (1 extra-point) Look up the documentation of the function `sorted` to find out how to sort the array with respect to the room. Print the sorted array again.

Exercise 7 (Regular Expressions, 4 p.)

For each of the following regular expressions, give three strings of *different* lengths that match the expression.

a) `\D1\W\dz`

b) `^45+6*7$`

c) `^ef{3,4}g?h$`

d) `^(A|BB)C(DDD|EEEEE)$`

e) `^[^987]+[963]$`

f) `^.\b\w+\b.$`

g) `^(\w+):\1$`

h) `^(\d)(?:\d)(\d+):\2\1$`

Write the 24 strings into a text file and send this file by email.

Exercise 8 (SymPy, Curve Discussion, 4 p.)

Perform a curve discussion using SymPy following these steps:

- Let $f(x) = 2x + 8 + \frac{66}{x-8}$.
- (optional) Plot $f(x)$ for $x \in [0; 4]$ and $x \in [0; 20]$.
- Compute all zeros.
- Compute the derivative.
- Compute the position of the extrema.
- Compute the integral of f between both zeros.

Compute all values above symbolically first, simplify them if necessary, and convert them into floating point numbers afterwards.

There are several ways to solve this task—choose one:

- interactively in a Jupyter Notebook: Save the notebook and send it by email.
- interactively in a Jupyter QtConsole: Save to an html file and send it by email. (Via SSH saving with plots might fail, in that case do it without plots.)
- interactively with isympy: Copy the content of the console window, paste it into a text file, and send that file by email.
- non-interactively as a Python script: Send the script by email. If you do not want to omit the plots, do the following:

```
import matplotlib
import matplotlib.pyplot as plt
…
matplotlib.use('Qt5Agg')
plt.ion() # interactive mode on
# plot command
```

Hand in by: Mon., 16.05.2022 until 14:00 by email to tools@studs.math.uni-wuppertal.de.