

Programmierpraktikum

Exercise Sheet #9

WS, 2012/2013

Complex Numbers

The task is to create a class to practice object oriented programming and what you can do with the `serializable` interface.

- Implement a class `Complex` corresponding to the mathematical complex domain.
- Provide the most necessary functions: addition (+), subtraction (-), multiplication (.), division (/), absolute value ($|\cdot|$), argument (`arg()`), and conjugation (*).
- Make the class `serializable` and store the result of the above operations over a pair of complex numbers into a file using the advantages of the `Serializable` interface.

IO and OOP

Write a program for object oriented input/output.

Use the data file found in:

<http://itp.uni-frankfurt.de/~gros/Vorlesungen/ProgPrak/Java-IO.html#%2811%29>

and the code:

<http://itp.uni-frankfurt.de/~gros/Vorlesungen/ProgPrak/Java-IO.html#%2812%29>

to write a program which does

- Define a `Planet` class to store the properties in the file;
- Reads the data file containing the planet properties;
- Creates an instantiation of `Planet` for every planet, and store the corresponding information from the file to each planet object;
- Prints the information stored in each planet to standard input in a human readable way, to check that the information was stored properly.

Integration of differential equations

Write a program for integrating the Kepler problem,

<http://itp.uni-frankfurt.de/~gros/Vorlesungen/ProgPrak/methods-integration.html#%289%29>

using:

- Euler's integration method;
- one-step Runge-Kutta;
- classical Runge-Kutta
- Plot some of the trajectories you obtained, compare the trajectories obtained from different methods with the same parameters.

What happens if the potential scales like $V(r) \propto r^{-\alpha}$ and $\alpha \neq 3$?