Informatics for Astronomers - WS2021

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Exercise sheet 7 - Python classes and Web technologies

The following will be also part of the assessment:

(1) Try to present exercises in a way that everyone can understand (even those who didn't do the exercises), so please explain the vital parts of your solution in a clear way.

(2) Try to also include some background information where applicable, and/or explain the possible context/motivation for the given exercise.

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1. Consider a `class` that represents a circumference.

   ```python
   class Circle:
       def __init__(self, radius):
           self.radius = radius
   ```

   Besides radius, a circumference should have attached the following properties/attributes that are derived from the radius:

   - perimeter
   - area

   Please implement them. Save the the class in a `.py` file and import it from a `Jupyter notebook` and show how the class works by doing a few calculations.

2. For the `class Circle` also implement the `__eq__()` and `__lt__()` methods so that:

   ```python
   c1 = Circle(radius=1)
   c2 = Circle(radius=1.0)
   c3 = Circle(radius=2)

   c1 < c3
   > True
   c2 > c1
   > False
   c1 == c2
   > True
   ```

   (this exercise can be implemented independently from the previous example)

3. During the *tutorium*, functions to calculate the distance between vectors and the dot ($\cdot$) and the cross ($\times$) products were implemented. Please transform these functions into class methods of a new class `Vector` so we can perform the following operations as:

```
list1 = [-2.4, 0.1, 5.3]
list2 = [4.7, -3.0, 1.7]

v1 = Vector(list1)
v2 = Vector(list2)
value1 = v1.distance(v2)   # a float
value2 = v1.dot(v2)        # another float
v3 = v1.cross(v2)          # another Vector check with
isinstance(v3, Vector)
> True
```

4. Please create (with an editor) a simple webpage that includes some pictures, text and links to your favorite website.

   - Open the webpage with your browser and show us the source.

   - Now go to http://www.google.com and show us the source code.

   Opinions?

5. Install in your computer the `python`-based blog engine Pelican in your computer and follow the instructions to create a first simple post. What do you think about it in comparison with plain html?

6. The Sloan Digital Sky Survey has produced catalogs of millions of objects on the sky. The catalogs are stored in `SQL` databases and are easily accessible through their webpages.

   For example, http://skyserver.sdss.org/dr15/en/tools/search/radial.aspx allows to search of objects within a certain distance from the central position. In reality that web page execute a `SQL` command, which is also shown along the results of the query.

   Using the `SQL` form http://skyserver.sdss.org/dr15/en/tools/search/sql.aspx is possible to execute arbitrary queries. Copy the previous command here and execute it again. Play a bit with the parameters.

   - What is the advantage of the "pure" `SQL` form in comparison with the radial form used at the beginning?

   - What do you think about the `SQL` syntax?

   - Is possible to access `SQL` databases with `python`?