

DAT171 - Computer assignment 2

(2023-02-01)

This assignment will focus on Object-Oriented Programming (OOP). The objective is to write a general library for standard playing cards (52 card decks). This library will be used in assignment 3 to build a simple Texas Hold'em poker game.

The OOP-part of the assignment will try out the possibilities for:

1. Writing classes
2. Using inheritance and abstract functions
3. Operator overloading
4. String conversion methods

Please read through the whole assignment before you start working!

The specific requirements of what you are supposed to include in your code are described in the following text. Though you are not required to follow the provided task order, the suggested procedure for tackling this assignment is following these steps:

1. Create the suit and card classes
2. Create a class to represent the deck
3. Create a basic hand class (skip the `best_poker_hand` method for now)
4. Create a class to represent poker hands (with poker hand we mean for example a pair, flush or straight)
5. Implement `best_poker_hand` which uses the class from 4. to computes the best poker hand for the active cards

In addition to creating the library itself, you will generate a manual from your written docstrings, and write tests to ensure functionality does not regress as you keep making changes to the code. *It is best to work on documentation and testing continuously while you work on the assignment, not as a last step.* Guides on documentation and testing are provided later in this document.

Optional step: You do not have to create a playable game in this assignment but feel free to try if you want to. It can be a very simple game where you make up the rules for yourself.

Optional step: Create a class to represent a **Player** for a Texas Hold'em poker game (e.g. containing a **Hand**, name and betting money + associated methods). *This question overlaps with the next assignment, where such a Player class will be put into use.*

Requirements

The library must be called “cardlib.py” and should contain classes with associated methods and functions that are helpful for creating many types of card games. In particular, it must contain **classes** that according to what is listed below. However, note that you are recommended to implement the classes in the order described previously.

- A. The class representing the suit of a card must be named **Suit**, with the suits named **Hearts**, **Spades**, **Clubs** and **Diamonds** (in that order), . The **Suit** class must be of an **Enum** type.
- B. The playing cards: The classes listed below **must** inherit from an abstract base class **PlayingCard**. They must be comparable with the `<` and `==` operators, and a method `get_value()` must be overloaded in each subclass using an abstract method. The following constructors **must** exist:
 - a. `NumberedCard(value: int, suit: Suit)`
 - b. `JackCard(suit: Suit)`
 - c. `QueenCard(suit: Suit)`
 - d. `KingCard(suit: Suit)`
 - e. `AceCard(suit: Suit)`

Implement `<` (and `==`) so that it gives a strict, sensible ordering, but you will have to decide what to do with Aces suits yourself (hint: look at how tuples handle `<`).

The method `get_value` is intended to help you practice implementing an abstract method, i.e. it is mandatory (and can be put to good use here!).

- C. The deck: The class `StandardDeck()` must create a full deck of (52) cards. There must be functions for shuffling (named `shuffle`) and taking the top card (named `draw`, which also removes the card from the deck).
- D. A class representing the hand, `Hand`, which must have methods for
 - a. adding a new card (named `add_card`)
 - b. dropping several cards based on an `index` list (named `drop_cards`)
 - c. sorting the cards (named `sort`)
 - d. There must also be a method `best_poker_hand(self, cards=[])` which computes the best hand out of the cards in the hand and the cards in the input argument. The `best_poker_hand` method returns a `PokerHand` object. It must be able to handle a total of more than 5 cards (as is the case in Texas Hold 'em). Note that the `Hand` class represents the playing cards in your hand and the `PokerHand` class what poker hand you make of these playing cards.
- E. A `PokerHand` class constructed as follows:
 - a. A `PokerHand` must contain a hand type (high card, one pair, two pair, three of a kind, straight, flush, full house, four of a kind, straight flush) and the value(s) needed to distinguish between two hands of the same type. See *Wikipedia List of poker hands*
 - b. The `PokerHand` must take a list of cards as argument for its constructor.
 - c. The `PokerHand` must overload the `<` and `==` operators to be able to compare two `PokerHand` objects.
- F. Testing code for most of the functions you have written (see below for tutorial). A sample testing code is available in Canvas. Your code should pass these tests and in addition, you must *at least* add tests for:
 - a. More card types and their methods
 - b. More hand methods
 - c. Further testing the deck and its methods
 - d. Card combinations giving the different poker hands
 - e. Comparison between different poker-hands
 - f. Comparison between hands with card combinations giving the same poker hand, but different card values for both the cards making up the poker hand (for example 2 kings in a pair of kings) and the remaining 3 cards
- G. HTML-documentation for everything above generated using Sphinx (see below for tutorial). This documentation must include documentation of *all the required and classes and methods*, including a brief description, input parameters, and return values. Also, include documentation for major classes/methods you add.

You are free to introduce additional methods and classes as you see fit. Simple types, like the `Suit` and the type of poker hand, **must** be represented by an `Enum` type, not raw integers or strings. All classes should be printable in a nice way. Hint: Unicode characters can be used: *Wikipedia*.

You should hand in a **.zip file** with your library, your tests, and your manual (both the generated manual and the source files needed to run Sphinx to generate the output). Try to avoid non-essential/scrap files in the zip file.

Appendix A: Testing guide

As the code-base you (and your collaborator) are working on becomes bigger, automatic testing becomes more important. As you make changes, if there are no tests, it is easy that things that previously worked stops working.

In this assignment, you should create a set of tests that can be run automatically and report back if there are any errors. This is easier than it might sound due to powerful testing toolkits like *pytest* that comes with Anaconda and is integrated into PyCharm.

Below are a few steps to help you get started.

- Create a new folder in your project called “test”.
- Create a Python file in the new folder, call it for example “test_cardlib.py”
- To start, put the following in the file

```
import pytest

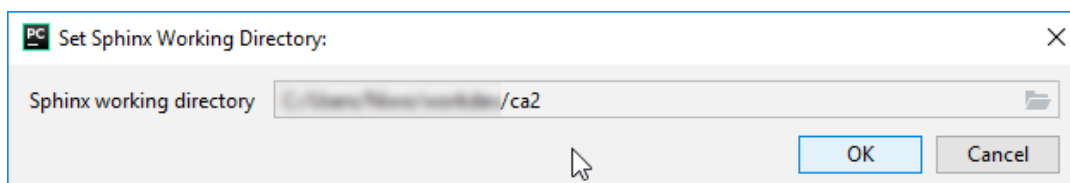
def test_math():
    assert 1 + 1 == 2
    assert 2 * 2 + 3 == 7
    # It is important to also test strange inputs,
    # like dividing with zero and see that good exceptions are thrown.
    # What happens if you try to create a card with a numerical value 0 or -1?
    with pytest.raises(ZeroDivisionError):
        1 / 0
```

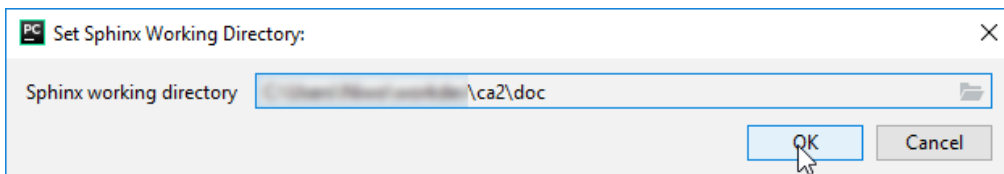
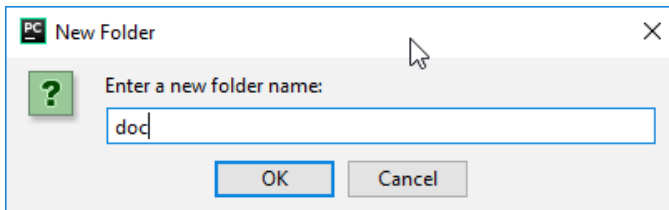
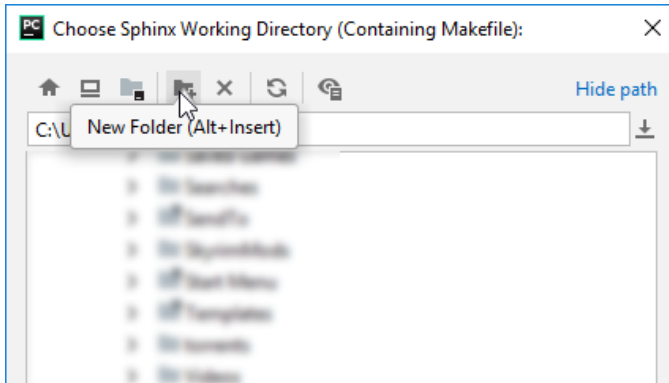
- To run the tests, right-click the test folder and choose “Run pytest in test”. You should get the output that it worked. (If you don’t find “Run pytest in test” in the menu, please go to File -> Settings -> Tools -> Python Integrated Tools (Windows) or PyCharm -> Preferences -> Tools -> Python Integrated Tools (Mac) and make sure Default test runner is set to *pytest*.)
- Try to make a test fail (by asserting `1 == 2` for example) and see what happens.
- For the computer assignment, we want most methods you implement to have a test. Be evil towards yourself! Try to break your code.
- Add your own tests as you progress with your card library.
- There are other testing tools, like nose, nose2, unittest, unittest2, which basically achieve the same thing.

Appendix B: Documentation guide

In addition to the normal documentation of the code, you must also generate a HTML (or PDF) manual for the API of your library, using the tool *Sphinx*. This section will give a short tutorial on how to generate such a manual from within PyCharm.

Start by going to Tools -> Sphinx Quickstart (you might need to install the Sphinx package through Anaconda Navigator). The first time you run this in a project, it will ask for a working directory. For this project, choose “[project directory]/doc” by creating a new folder.





Next, Sphinx Quickstart will ask some questions in a terminal. Most of them can be answered with the default answer (by pressing Enter), but the following questions should be answered like this:

```
> Separate source and build directories (y/n) [n]: y
> autodoc: automatically insert docstrings from modules (y/n) [n]: y
```

If you do not get the second question, please go to `doc/source/conf.py`, find the lines

```
extensions = [
]
```

and change them to read:

```
extensions = ['sphinx.ext.autodoc']
```

If you do not get the `doc/source/conf.py` folder or file, continue to the next page and run the Sphinx task to generate the file, then edit the file as described above and continue the tutorial from here.

We now need to tell Sphinx what to document. Here we will do the simplest possible and just ask Sphinx to generate documentation for the whole module. Go to `doc/source/index.rst` and enter:

```
.. automodule:: <your module name> (cardlib in this case)
   :members:
   :show-inheritance:
```

```

Welcome to CardPy's documentation!
=====

Contents:

.. toctree::
   :maxdepth: 2

.. automodule:: cardpy
   :members:
   :show-inheritance:

Indices and tables
=====

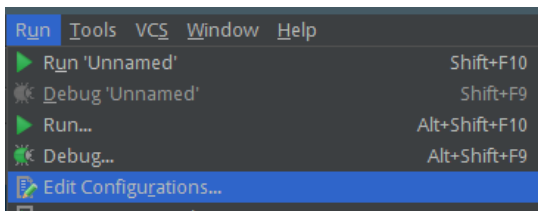
* :ref:`genindex`

```

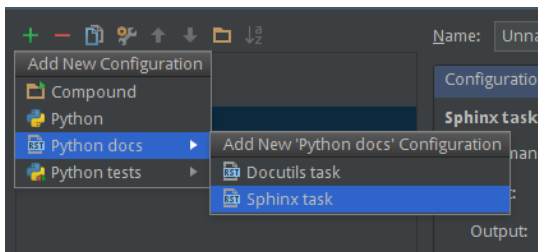
Feel free to add some introduction, examples, whatever.

This document uses the restructured text format, see <http://www.sphinx-doc.org/en/stable/rest.html>.

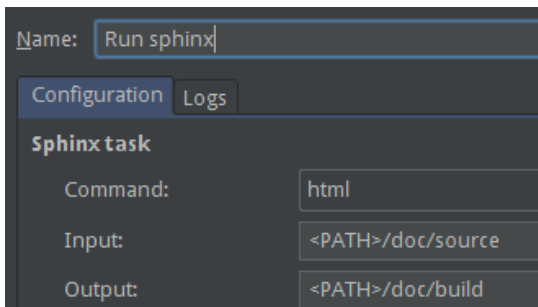
Now to actually creating the manual. Create a new run configuration by going to **Run -> Edit configuration**.



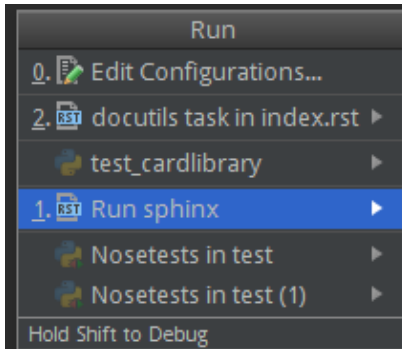
Press the + and chose **Python docs -> Sphinx task**.



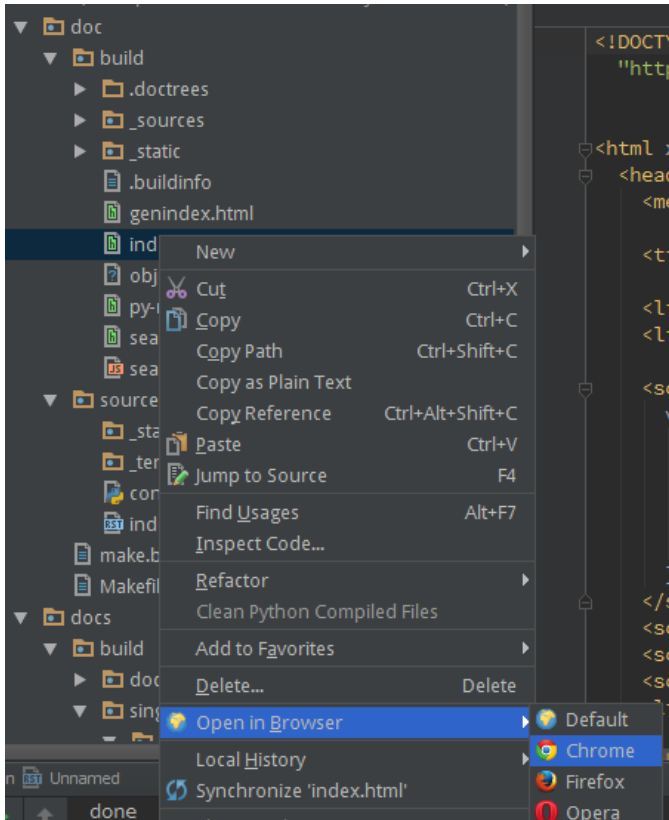
Give the task a name and enter the paths for the input (source) and output (build) inside the doc folder. Here you can choose if you want to generate HTML or PDF (or many other formats) for the documentation. The easiest is HTML but if you have latex installed, feel free to try the PDF version.



Finally, go to **Run -> Run...** and run the Sphinx task to generate the documentation.



To view the generated documentation, open the `doc/build/index.html` file in a web browser. This can be done by finding the file in the PyCharm file tree, right-clicking, and choosing **Open in Browser**.



Note! If you need to restart your Sphinx environment, try and remove the `doc`-directory, then go to **File -> Settings -> Tools -> Python Integrated Tools (Windows)** or **PyCharm -> Preferences -> Tools -> Python Integrated Tools (Mac)** and clear the field `Sphinx working directory`.