CS3101-1 Python, Fall 2014: Problem Set 4

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Total points: 20
Due date: Oct 7, 23:59pm EST

Submission instructions:

Place the files for all problems in a directory named `[your_uni]_week[`X`]`, where X is the number of the problem set. For instance if your uni is xy1234 and you are submitting the problem set for the first week, the directory should be called `xy1234_week1`. Either zip or tar and gzip the directory (using `tar -c xy1234_week1 | gzip > xy1234_week1.tgz`) and upload it to your Drop Box on the Courseworks page for this class.

Please pay attention to the general guidelines/homework policy on the course website.

Part1 (10 points) - Classes, Methods, Attributes, Instances

Create a file `restaurant.py` which contains the following classes:

(a) Create a class `Guest` that represents a hungry guest at a restaurant.

- `Guest` instances have an attribute `hunger`, which indicates how hungry the guest is (how many portions of food he can eat).
- `Guest` instances have an attribute `name`, which stores the name of the guest.
- `name` and the initial `hunger` value are passed as parameters when a `Guest` object is created, e.g.

  ```
  >>> g = Guest('John', 5)
  ```

  creates a `Guest` with a hunger value of 5 (the guest can eat 5 portions) .
- `Guest` instances have a method `eat(self)`. When this method is called, the guest eats one portion of food, decrementing his `hunger` attribute. After When the hunger value becomes 0, the `Guest` burps.

  ```
  >>> g.eat()
  John: Burp!
  ```

  The `eat(self)` method also returns the hunger value after eating.

(b) Create a class `Restaurant` with base class `list`. Each element in a `Restaurant` represents a table.

Each `Restaurant` instance has the following attributes:

- The attribute `size` stores the number of tables in a `Restaurant`. When the `Restaurant` instance is created, a `size` parameter is passed and `size` elements of the `Restaurant` are initialized to `None` to indicated that the corresponding table is not occupied.

- A method `seat(self, guest)` that seats an arriving guest (an instance of class `Guest`) at an empty table (i.e. adds the element into a free slot in the `Restaurant` instance – recall that `Restaurants` have base class `list`. If there is no available table, the method prints 'No free table!' and returns `False`. Otherwise it prints a message indicating which guest is seated to which table and returns `True`.
- A method `serve(self)`. Our `Restaurants` can only serve one small portion to one guest at a time (think of an up-scale sushi restaurant). The `serve(self)` method finds a hungry guest at any table, prints a message indicating which guest is being served, and calls the guest's `eat(self)` method. If the guest is not hungry any more she is removed from the table (the corresponding element is reset to `None`). If there is no guest to serve, the `serve(self)` method prints 'No guest to serve'.

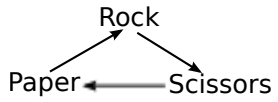
You can test your `Guest` and `Restaurant` classes by running `test_restaurant.py`, which imports `restaurant.py` (by putting your code in a file `restaurant.py` you defined a "module" named `restaurant`). The program creates a `Restaurant` of size 2 and three guests Mary (hunger 3), John (hunger 2) and Alice (hunger 1). It then repeatedly tries to seat a guest and serve until all guests have been seated. The script should produce the output:

```
Seating guest Mary at table 0.
Serving guest Mary.
Seating guest John at table 1.
Serving guest Mary.
No free table.
Serving guest Mary.
Mary: Burp!
Seating guest Alice at table 0.
Serving guest Alice.
Alice: Burp!
```

Part 2 (10 points) - Overloading Special Methods

In this problem you will implement a very basic version of the popular game Rock-Paper-Scissors using object oriented programming concepts. In this game two players show one of three hand gestures (called 'rock', 'paper', or 'scissors') on the count of three. The player whose gesture 'defeats' the gesture of his opponent wins. Each gesture defeats one other gesture and is defeated by the third. Specifically the following 'defeats' relation holds between the three gestures.

- Rock blunts scissors.
- Scissors cut paper.
- Paper covers rock.



(a) In a file 'gestures.py', define three classes `Rock`, `Scissors`, and `Paper`.

Make all `Rock`, `Scissors` and `Paper` instances comparable by overloading the classes' `__lt__(self, other)`, `__gt__(self, other)`, and `__eq__(self, other)` methods.

$x > y$ should return `True` if x defeats y. $x < y$ should return `True` if y defeats x.

For instance, your classes should support the following comparisons:

```
>>> Rock() > Scissors()
True
>>> Scissors() > Paper()
True
>>> Rock() < Paper()
False
```

Note that the lecture mentioned a `__cmp__(self, other)` method, which has been deprecated in Python 3. The slides have been updated.

(b) Create a class `Player`, with a method `play(self)` that returns an object of either `Rock`, `Paper`, or `Scissors`. Your method can randomly select one of the gestures.

(c) Implement a class `HumanPlayer`, that overloads `play(self)` to read in the user's choice of a gesture from the keyboard instead of randomly selecting a move.

(d) Write a main function that creates a `HumanPlayer` and a computer `Player`, repeatedly requests a guesture from each player instance, compares the result and keeps track of the score. The score and chosen gestures should be printed after each turn (hint: implement the gesture classes `__str__(self)` method .