Exercise: Classes and Objects

Problems for exercise and homework for the Python OOP Course @SoftUni.
Submit your solutions in the SoftUni judge system at https://judge.softuni.org/Contests/1937.

1. Vet

Create a class called **Vet**. The **Vet** class represents a veterinary doctor in an animal clinic. Upon initialization, it should receive a **name** (string - the name of the vet doctor). It should also have an **instance attribute** called **animals** (empty list by default). There should also be **2 class attributes**: **animals** (empty list) which will store the total amount of **animals for all vet doctors**; and **space** (5 by default, representing the total capacity of the clinic). You should create **3 additional instance methods:**

- **register_animal(animal_name)**
  - If there **is available space** in the vet clinic, add the animal to **both animals' lists** and return a message: **"{name} registered in the clinic"**
  - Otherwise, return **"Not enough space"**
- **unregister_animal(animal_name)**
  - If the animal is **in the clinic**, **remove** it from **both animals'** lists and return **"{animal} unregistered successfully"**
  - Otherwise, return **"{animal} not in the clinic"**
- **info()**
  - Return info about the vet doctor, the number of animals in his/her list, and the available space left in the clinic:
    "{vet_name} has {number_animals} animals. {space_left_in_clinic} space left in clinic"

Examples

Test Code	Output

`peter = Vet("Peter")`
`george = Vet("George")`
`print(peter.register_animal("Tom"))`
`print(george.register_animal("Cory"))`
`print(peter.register_animal("Fishy"))`
`print(peter.register_animal("Bobby"))`
`print(george.register_animal("Kay"))`
`print(george.unregister_animal("Cory"))`
`print(peter.register_animal("Silky"))`
`print(peter.unregister_animal("Molly"))`
`print(peter.unregister_animal("Tom"))`
`print(peter.info())`
`print(george.info())`
	`Tom registered in the clinic`
	`Cory registered in the clinic`
	`Fishy registered in the clinic`
	`Bobby registered in the clinic`
	`Kay registered in the clinic`
	`Cory unregistered successfully`
	`Silky registered in the clinic`
	`Molly not in the clinic`
	`Tom unregistered successfully`
	`Peter has 3 animals. 1 space left in clinic`
	`George has 1 animals. 1 space left in clinic`

2. Time

Create a class called **Time**. Upon initialization, it should receive **hours**, **minutes**, and **seconds** (integers). The class should also have **class attributes max_hours** equal to **23**, **max_minutes** equal to **59**, and **max_seconds** equal to **59**. You should also create **3 additional instance methods**:

- **set_time(hours, minutes, seconds)** - updates the time with the new values
- **get_time()** - returns **"{hh}:{mm}:{ss}"**

- **`next_second()`** - updates the time with one second (use the **class attributes** for validation) and returns the new time (use the **`get_time()`** method)

Examples

Test Code	Output
`time = Time(9, 30, 59)` `print(time.next_second())`	`09:31:00`
`time = Time(10, 59, 59)` `print(time.next_second())`	`11:00:00`
`time = Time(23, 59, 59)` `print(time.next_second())`	`00:00:00`

3. Account

Create a class called **`Account`**. Upon initialization, it should receive an **`id`** (number), a **`name`** (string), and a **`balance`** (integer; **optional**; **0** by default). The class should also have **3 additional instance methods**:

- **`credit(amount)`** - **adds** the **amount** to the balance and **returns** the **new balance**
- **`debit(amount)`** - if the amount is **less** than or **equal** to the balance, **reduces** the balance by the amount and **returns** the new balance. Otherwise, return **`"Amount exceeded balance"`**
- **`info()`** - returns **`"User {name} with account {id} has {balance} balance"`**

Examples

Test Code	Output

`account = Account(1234, "George", 1000)`
`print(account.credit(500))`
`print(account.debit(1500))`
`print(account.info())`
	`1500`
	`0`
	`User George with account 1234 has 0 balance`

`account = Account(5411256, "Peter")`
`print(account.debit(500))`
`print(account.credit(1000))`
`print(account.debit(500))`
`print(account.info())`
	`Amount exceeded balance`
	`1000`
	`500`
	`User Peter with account 5411256 has 500 balance`

4. Pizza Delivery

Create a class called **`PizzaDelivery`**. Upon initialization, it should receive a **`name`** (string), a **`price`** (float), and **`ingredients`** (dictionary). The class should also have an instance attribute **`ordered`** set to **`False`** by default. You should also create **3 additional instance methods**:

- **`add_extra(ingredient: str, quantity: int, price_per_quantity: float)`:**
  - If we already **have this ingredient** in our pizza, **increase the ingredient quantity** with the given one and **update the pizza price** by adding the ingredient price for the given quantity
  - If we **do not have this ingredient** in our pizza, we should **add it** and **update the pizza price**
- **`remove_ingredient(ingredient: str, quantity: int, price_per_quantity: float):`**
  - If we **do not have this ingredient** in our pizza, we should **return** the following message **`"Wrong ingredient selected! We do not use {ingredient} in {pizza_name}!"`**
  - If we **have the ingredient**, but we try to remove **more than we have available,** we should **return** the following message **`"Please check again the desired quantity of {ingredient}!"`**

- Otherwise, **remove** the given quantity of the ingredient and update the pizza price by removing the ingredient price for the given quantity

- **`make_order()`**
  - Set the attribute **`ordered`** to **`True`** and **return** the following message **`"You've ordered pizza {pizza_name} prepared with {ingredient: quantity} and the price will be {price}lv."`**. The ingredients should be separated by a comma and a space **`", "`**
  - Keep in mind that once the pizza is ordered, no further changes are allowed. We should return the following message if the customer tries to change it: **`"Pizza {name} already prepared, and we can't make any changes!"`**

Examples

Test Code

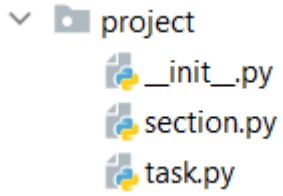
`margarita = PizzaDelivery('Margarita', 11, {'cheese': 2, 'tomatoes': 1})`
`margarita.add_extra('mozzarella', 1, 0.5)`
`margarita.add_extra('cheese', 1, 1)`
`margarita.remove_ingredient('cheese', 1, 1)`
`print(margarita.remove_ingredient('bacon', 1, 2.5))`
`print(margarita.remove_ingredient('tomatoes', 2, 0.5))`
`margarita.remove_ingredient('cheese', 2, 1)`
`print(margarita.make_order())`
`print(margarita.add_extra('cheese', 1, 1))`

Output

`Wrong ingredient selected! We do not use bacon in Margarita!`
`Please check again the desired quantity of tomatoes!`
`You've ordered pizza Margarita prepared with cheese: 0, tomatoes: 1, mozzarella: 1 and the price will be 9.5lv.`
`Pizza Margarita already prepared, and we can't make any changes!`

5. To-do List

In this exercise, we are going to create a whole project step-by-step, starting with the project structure:



Create separate files for each class, as shown above. You are tasked to create **two classes**: **a `Task`** class and **a `Section`** class.

The **`Task`** class should receive a **`name`** (string) and a **`due_date`** (str) upon initialization. A task also has **two attributes**: **`comments`** (empty list) and **`completed`** set to **`False`** by default.

The **`Task`** class should also have **five additional methods**:

- **`change_name(new_name: str)`**
  - Changes **the name of the task** and returns **the new name**.
  - If the new name **is the same as the current name**, returns **`"Name cannot be the same."`**
- **`change_due_date(new_date: str)`**
  - Changes **the due date of the task** and returns **the new date**.

- If the new **date is the same as the current date**, returns **`"Date cannot be the same."`**

- **`add_comment(comment: str)`**
  - Adds a comment to the task.
- **`edit_comment(comment_number: int, new_comment: str)`**
  - The **comment number** value represents the **index** of the comment we want to edit. The method should **change the comment** and **return all the comments**, separated **by comma and space** (**`", "`**)
  - If the comment number **is out of range**, returns **`"Cannot find comment."`**
- **`details()`**
  - Returns the task's details in this format:

```
"Name: {task_name} - Due Date: {due_date}"
```

The **`Section`** class should receive a **`name`** (string) upon initialization. The task also has **one instance attribute**: **`tasks`** (empty list)

The Section class should also have **four methods**:

- **`add_task(new_task: Task)`**
  - Adds a **new task** to the collection and r**eturns `"Task {task details} is added to the section"`**
  - If the task **is already in the collection**, returns **`"Task is already in the section {section_name}"`**
- **`complete_task(task_name: str)`**
  - Changes the task to completed (**`True`**) and returns **`"Completed task {task_name}"`**
  - If the task is not found, returns **`"Could not find task with the name {task_name}"`**
- **`clean_section()`**
  - Removes all the **completed tasks** and returns **`"Cleared {amount of removed tasks} tasks."`**
- **`view_section()`**
  - Returns information about the section and its tasks in this format:

```
"Section {section_name}:
 {details of the first task}
 {details of the second task}
 …
 {details of the n task}"
```

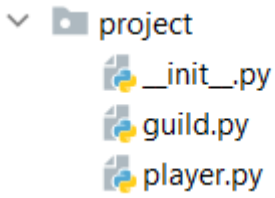
Examples

Test Code	Output

`task = Task("Make bed", "27/05/2020")`
`print(task.change_name("Go to University"))`
`print(task.change_due_date("28.05.2020"))`
`task.add_comment("Don't forget laptop")`
`print(task.edit_comment(0, "Don't forget laptop and notebook"))`
`print(task.details())`
`section = Section("Daily tasks")`
`print(section.add_task(task))`
`second_task = Task("Make bed", "27/05/2020")`
`section.add_task(second_task)`
`print(section.clean_section())`
`print(section.view_section())`
	`Go to University`
	`28.05.2020`
	`Don't forget laptop and notebook`
	`Name: Go to University - Due Date: 28.05.2020`
	`Task Name: Go to University - Due Date: 28.05.2020 is added to the section`
	`Cleared 0 tasks.`
	`Section Daily tasks:`
	`Name: Go to University - Due Date: 28.05.2020`
	`Name: Make bed - Due Date: 27/05/2020`

6. Guild System

You are tasked to create **two classes**: a **`Player`** class and a **`Guild`** class.



The **`Player`** class should receive a **`name`** (string), a **`hp`** (int), and a **`mp`** (int) upon initialization. The **`Player`** also has 2 instance attributes: **`skills`** (an empty dictionary that will contain the skills of each player and its mana cost) and a **`guild`** set to **`"Unaffiliated"`** by default.

The Player class should also have **two additional methods**:

- **`add_skill(skill_name, mana_cost)`**
  - Adds the skill and the corresponding mana cost to the dictionary of skills. Returns **`"Skill {skill_name} added to the collection of the player {player_name}"`**
  - If the skill is already in the collection, returns **`"Skill already added"`**
- **`player_info()`**
  - Returns the player's information, including their skills, in this format:

```
"Name: {player_name}
Guild: {guild_name}
HP: {hp}
MP: {mp}
===={skill_name_1} - {skill_mana_cost}
===={skill_name_2} - {skill_mana_cost}
…
===={skill_name_N} - {skill_mana_cost}"
```

The **`Guild`** class receives a **`name`** (string). The **`Guild`** should also have one instance attribute **`players`** (an empty list which will contain the players of the guild). The class also has **3 additional methods**:

- **`assign_player(player: Player)`**
  - Adds the player to the guild and returns **`"Welcome player {player_name} to the guild {guild_name}"`**. Remember to change the player's guild in the player class.
  - If he is already in the guild, returns **`"Player {player_name} is already in the guild."`**
  - If the player is in another guild, returns **`"Player {player_name} is in another guild."`**
- **`kick_player(player_name: str)`**
  - Removes the player from the guild and returns **`"Player {player_name} has been removed from the guild."`**. Remember to change the player's guild in the player class to **`"Unaffiliated"`**.
  - If there is no such player in the guild, returns **`"Player {player_name} is not in the guild."`**
- **`guild_info()`**
  - Returns the guild's information, including the players in the guild, in the format:

```
"Guild: {guild_name}
{first_player's info}
…
{Nplayer's info}"
```

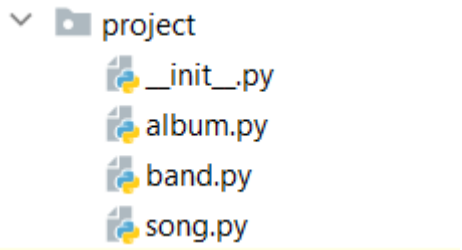
Examples

Test Code	Output

`player = Player("George", 50, 100)`
`print(player.add_skill("Shield Break", 20))`
`print(player.player_info())`
`guild = Guild("UGT")`
`print(guild.assign_player(player))`
`print(guild.guild_info())`
	`Skill Shield Break added to the collection of the player George`
	`Name: George`
	`Guild: Unaffiliated`
	`HP: 50`
	`MP: 100`
	`===Shield Break - 20`
	
	`Welcome player George to the guild UGT`
	`Guild: UGT`
	`Name: George`
	`Guild: UGT`
	`HP: 50`
	`MP: 100`
	`===Shield Break - 20`

7. Spoopify

You are tasked to create **three classes**: **a Song** class, **an Album** class, and **a Band** class.



The **Song** class should receive a **name** (string), a **length** (float), and a **single** (bool) upon initialization. It has **one** method:

- **get_info()**
  - Returns the information of the song in this format: **"{song_name} - {song_length}"**

The **Album** class should receive a **name** (string) upon initialization and might receive **one or more songs**. It also has **instance attributes: published** (**False** by default) and **songs** (an **empty list**). It has **four** methods:

- **add_song(song: Song)**
  - Adds the **song to the album** and returns **"Song {song_name} has been added to the album {name}."**
  - If the song is **single**, returns **"Cannot add {song_name}. It's a single"**
  - If the album is **published**, returns **"Cannot add songs. Album is published."**
  - If the song is **already added**, return **"Song is already in the album."**
- **remove_song(song_name: str)**
  - Removes the song with the given name and returns **"Removed song {song_name} from album {album_name}."**
  - If the song is not in the album, returns **"Song is not in the album."**
  - If the album is published, returns **"Cannot remove songs. Album is published."**

- **publish()**
  - Publishes the album (set to **True**) and returns **"Album {name} has been published."**
  - If the album is published, returns **"Album {name} is already published."**
- **details()**
  - Returns the information of the album, with the songs in it, in the format:

```
"Album {name}
 == {first_song_info}
 == {second_song_info}
 …
 == {n_song_info}"
```

The **Band** class should receive a **name** (string) upon initialization. It also has an **attribute albums** (an **empty list**).

The class has **three** methods:

- **add_album(album: Album)**
  - Adds an **album to the collection** and returns **"Band {band_name} has added their newest album {album_name}."**
  - If the album **is already added**, returns **"Band {band_name} already has {album_name} in their library."**
- **remove_album(album_name: str)**
  - Removes the album from the collection and returns **"Album {name} has been removed."**
  - If the album is **published**, returns **"Album has been published. It cannot be removed."**
  - If the album is **not in the collection**, returns **"Album {name} is not found."**
- **details()**
  - Returns the information of the band, with their albums, in this format:

```
"Band {name}
 {album details}
 ...
 {album details}"
```

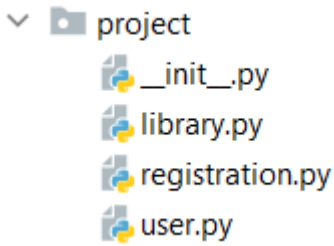
Examples

Test Code	Output

`song = Song("Running in the 90s", 3.45, False)`
`print(song.get_info())`
`album = Album("Initial D", song)`
`second_song = Song("Around the World", 2.34, False)`
`print(album.add_song(second_song))`
`print(album.details())`
`print(album.publish())`
`band = Band("Manuel")`
`print(band.add_album(album))`
`print(band.remove_album("Initial D"))`
`print(band.details())`
	`Running in the 90s - 3.45`
	`Song Around the World has been added to the album Initial D.`
	`Album Initial D`
	`== Running in the 90s - 3.45`
	`== Around the World - 2.34`
	
	`Album Initial D has been published.`
	`Band Manuel has added their newest album Initial D.`
	`Album has been published. It cannot be removed.`
	`Band Manuel`
	`Album Initial D`
	`== Running in the 90s - 3.45`
	`== Around the World - 2.34`

8. Library*

Create a class called **`Library`**, where the information regarding the users and books rented/available will be stored. Create another one called **`User`**, where the information for each of the library users will be stored, and **`Registration`** class, where user information will be administrated (created/edited/deleted) and stored in the **`Library`** records.



Class User

In the **`user.py`** file, create class **`User`**. Upon initialization, it should receive **`user_id`** (int) and **`username`** (string). The class should also have an instance attribute **`books`** that is an empty list. You should also create 2 **instance methods**:

- **`info()`** - **returns** a string containing the books currently rented by the user in ascending order separated by comma and space**`.`**
- **`__str__()`** - override the method to get a string in the following format **`"{user_id}, {username}, {list of rented books}"`**

Class Library

In the **`library.py`** create a class **`Library`**. Upon initialization, it will not receive anything, but it should have the following instance attributes:

- **`user_records`** - an empty list that will store the users (users objects) of the library
- **`books_available`** - an empty dictionary that will keep information regarding the authors (key: str) and the books available for each of the authors (list of strings)
- **`rented_books`** - an empty dictionary that will keep information regarding the **usernames** (key: str) and **nested dictionary** as a value in which will keep information regarding the **book names** (key: str) and **days left** before returning the book to the library (int) - (**`{usernames: {book names: days to return}}`**).

You should also create **2 additional instance methods**:

- **`get_book(author: str, book_name: str, days_to_return: int, user: User):`**
  - If the **book is available** in the library adds it to the **books list** for this user, **updates the library records (rented_books and available_books dicts)**, and returns the following message: **`"{book_name} successfully rented for the next {days_to_return} days!"`**
  - If it is **already rented,** returns the following message **`"The book "{book_name}" is already rented and will be available in {days_to_return provided by the user rented the book} days!"`**
- **`return_book(author:str, book_name:str, user: User):`**
  - If the **book is in the user's books list, returns it in the library** (update **books_available and rented_books** class attributes) and **removes it from the books list** for this user
  - Otherwise, **returns** the following message **`"{username} doesn't have this book in his/her records!"`**

Class Registration

In the **registration.py,** create a class called **Registration**. Upon initialization, It will not receive anything, but we'll have these three methods**.**

- **add_user(user: User, library: Library):**
  - Adds the user if we do not have them in the library's user records already
  - Otherwise, returns the message **"User with id = {user_id} already registered in the library!"**
- **remove_user(user: User, library: Library):**
  - Removes the user from the library records if present
  - Otherwise, returns the message **"We could not find such user to remove!"**
- **change_username(user_id: int, new_username: str, library: Library):**
  - If there is a record with the same user id in the library and the username is different than the provided one, changes the username with the new one provided and returns the message **"Username successfully changed to: {new_username} for user id: {user_id}"**. Changes his username in the **rented_books** dictionary as well (if present).
  - If the new username is the same for this id, returns the following message **"Please check again the provided username - it should be different than the username used so far!"**.
  - If there is no record for the provided id returns **"There is no user with id = {user_id}!"**

Examples

Test Code

`from project.library import Library`
`from project.user import User`
`from project.registration import Registration`
 	
`user = User(12, 'Peter')`
`library = Library()`
`registration = Registration()`
`registration.add_user(user, library)`
`print(registration.add_user(user, library))`
`registration.remove_user(user, library)`
`print(registration.remove_user(user, library))`
`registration.add_user(user, library)`
`print(registration.change_username(2, 'Igor', library))`
`print(registration.change_username(12, 'Peter', library))`
`print(registration.change_username(12, 'George', library))`
 	
`[print(f'{user_record.user_id}, {user_record.username}, {user_record.books}') for user_record in library.user_records]`
 	
`library.books_available.update({'J.K.Rowling': ['The Chamber of Secrets',`
`'The Prisoner of Azkaban',`
`'The Goblet of Fire',`
`'The Order of the Phoenix',`
`'The Half-Blood Prince',`
`'The Deathly Hallows']})`
`library.get_book('J.K.Rowling', 'The Deathly Hallows', 17, user)`
`print(library.books_available)`

```
print(library.rented_books)
print(user.books)
print(library.get_book('J.K.Rowling', 'The Deathly Hallows', 10, user))
print(library.return_book('J.K.Rowling', 'The Cursed Child', user))
library.return_book('J.K.Rowling', 'The Deathly Hallows', user)
print(library.books_available)
print(library.rented_books)
print(user.books)
```

Output

```
User with id = 12 already registered in the library!
We could not find such user to remove!
There is no user with id = 2!
Please check again the provided username - it should be different than the username used so far!
Username successfully changed to: George for user id: 12
12, George, []
{'J.K.Rowling': ['The Chamber of Secrets', 'The Prisoner of Azkaban', 'The Goblet of Fire', 'The Order of the Phoenix', 'The Half-Blood Prince']}
{'George': {'The Deathly Hallows': 17}}
['The Deathly Hallows']
The book "The Deathly Hallows" is already rented and will be available in 17 days!
George doesn't have this book in his/her records!
{'J.K.Rowling': ['The Chamber of Secrets', 'The Prisoner of Azkaban', 'The Goblet of Fire', 'The Order of the Phoenix', 'The Half-Blood Prince', 'The Deathly Hallows']}
{'George': {}}
[]
```

Test Code

```
from project.library import Library
from project.user import User
from project.registration import Registration


user = User(12, 'Peter')
library = Library()
registration = Registration()
registration.add_user(user, library)
library.books_available.update({'J.K.Rowling': ['The Chamber of Secrets',
                                                'The Prisoner of Azkaban',
                                                'The Goblet of Fire',
                                                'The Order of the Phoenix',
                                                'The Half-Blood Prince',
                                                'The Deathly Hallows']})
library.get_book('J.K.Rowling', 'The Deathly Hallows', 10, user)
print(user)
```

Output

```
12, Peter, ['The Deathly Hallows']
```