CSIT121

Revision exercises

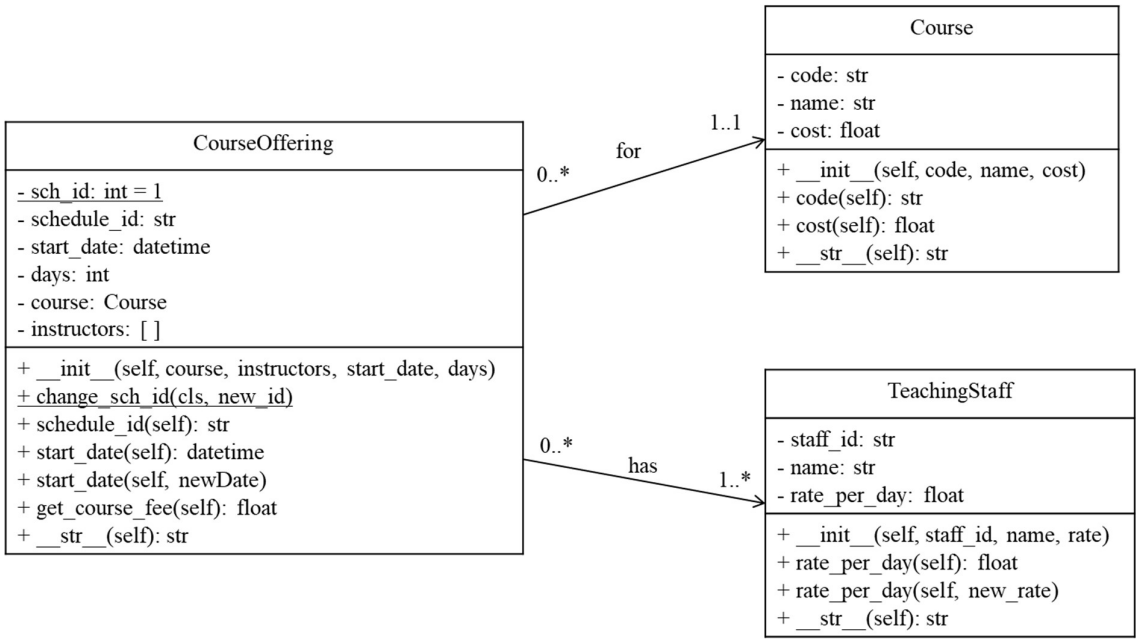
Objectives

- Revision of key OOP concepts.
- Practical applications of key OOP concepts.

Context:

Apart from students, UOW also provides training to the public, including both individuals and corporations. In this practice exercise, you will write python classes to support this business scenario.

1. The following classes model the courses, teaching staff and course offering by UOW.



The Course class has attributes code, name, and development cost. The TeachingStaff class models a teaching staff with staff_id, name, and how much the staff charges per day.

The CourseOffering class models the schedule of a course offered by UOW, for a course, taught by a group of instructors, with a start datetime and the duration in days.

a) Write the Course class according to the class diagram given, with the 3 attributes, a constructor, getters (properties) for attribute code and cost. The __str__() method returns a string in the following format:

```
Course: CSIT121         Name: Object Oriented Design & Programming
```

b) Write the TeachingStaff class according to the class diagram given, with the 3 attributes, a constructor, getter (properties) for attributes staff_id, rate_per_day and setter method for rate_per_day. The __str__() method returns a string in the following format:

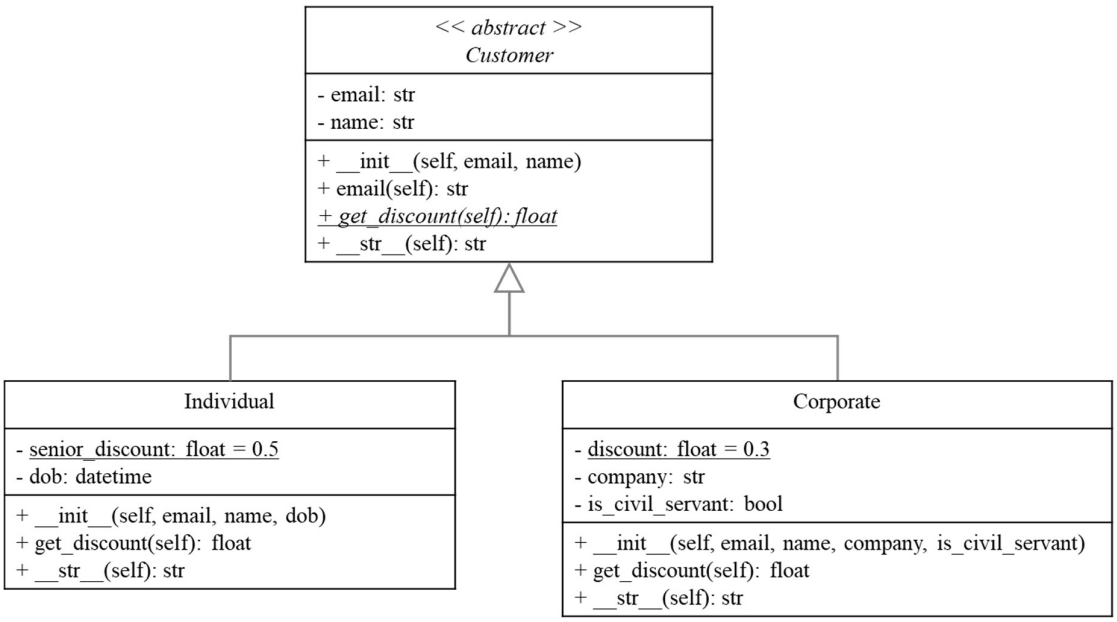
```
Staff ID: IT0101    Name: Jed Lee
```

c) Write the CourseOffering class with the following requirements:

- The schedule_id attribute is obtained by concatenating the course code with the class variable _sch_id
    - For example, if the course code is CSIT121, then the schedule_id is CSIT121_1. If there is another course, then the schedule_id is CSIT114_2 etc.
    - The class variable _sch_id should increment by 1 for every CourseOffering object created.
- The course attribute is the Course object.
- The instructors attribute is a list containing TeachingStaff objects.
- The start_date attribute is the starting datetime of the course offering. It is a datetime object.
- Attribute days is an integer value representing the duration in days.
- Besides the constructor, define a property getter for schedule_id and define property getter and setter for attribute start_date.
- The class method change_sch_id() modifies the class variable _sch_id to the new_id in the parameter.
- The get_course_fee() method computes and returns the course fee by taking the development cost of the course, plus the duration in days multiply by the instructors' rate per day.
- The __str__() method returns a string in the following format:

```
Schedule ID: CSIT121_1     Start Date: 1/6/2024     Duration: 5 days
Course: CSIT121     Name: Object Oriented Design & Programming
Staff ID: IT0101    Name: Jed Lee
Staff ID: IT0103    Name: James Wong
Basic Cost: $699.00
```

2. The following classes model customers who enrolled with UOW.



a) Write the Customer class, which is an abstract class, with the following attributes and methods as shown in the class diagram:
   - Two instance variables: email and name
   - The constructor initialises the email and name.
   - Define an email property that return the customer email.
   - An abstract method, *get_discount()* which returns the discount that customer is entitled to. It has no implementation.
   - The __str__() method which returns a string of the following instance variables:

```
Email: joelim@email.com     Name: Joe Lim
```

b) Write the Individual class, which is a subclass of Customer class:
   - An additional instance variable: skill_upgrade. This value is True if the individual qualifies for skill upgrade.
   - One class variable, senior_discount = 0.5
   - Implement the get_discount() method which returns the discount entitled. Customers who are 55 years old and above, enjoys a discount of 50% as indicated in the class variable. Any individual under 55 years old, there is no discount.
   - The __str()__ method includes the email, name, and skill upgrade status, which should be in this format:

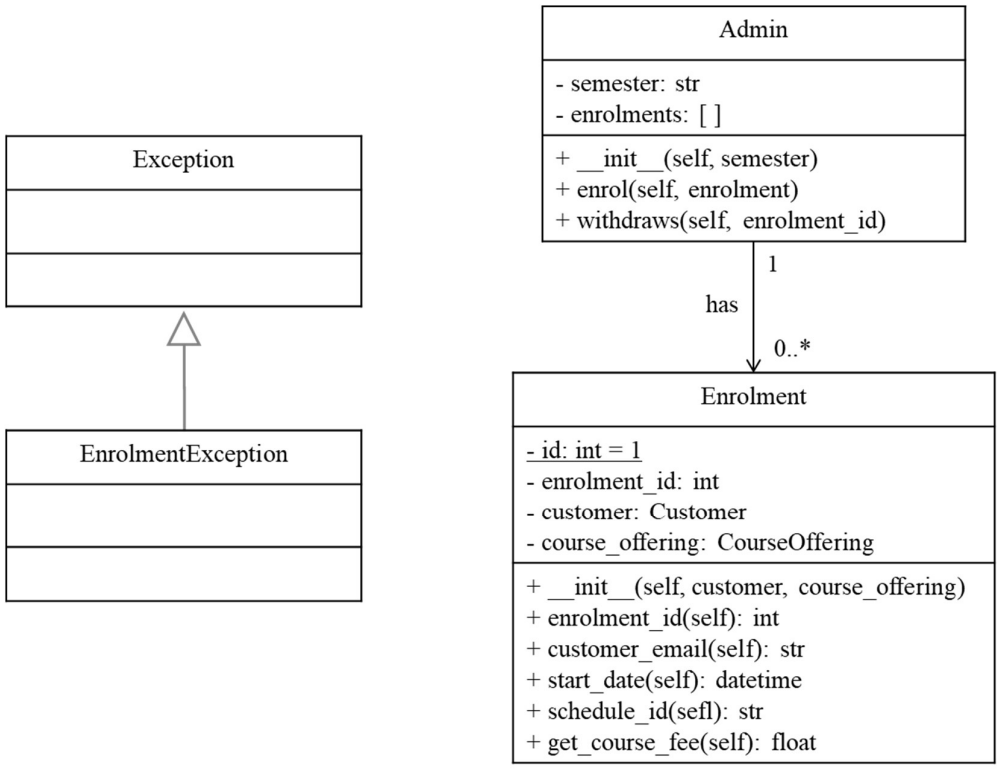
```
Email: joelim@email.com     Name: Joe Lim     Senior: Yes
```

c) Write the Corporate class, which is also a subclass of Customer class:
   - Two additional instance variables: company and is_civil_servant
   - One class variable, discount = 0.3

- For the get_discount() method, all Corporate customers will enjoy 30% discount on course fees as indicated by the class variable, but a civil servant get an additional 10% more (i.e. 40%).
- The __str()__ method includes the email, name, company and is_SME status as follows:

```
Email: as@email.com     Name: Ali Shan     Company: ANZ    Civil Servant: No
```

3. The class diagrams model an Enrolment that is tracked by the UOW Admin.



a) Create the class EnrolmentException, which is a subclass of Exception.

b) Write the Enrolment class, which captures a Customer enrolling for a CourseOffering.
- The Enrolment class has enrolment id (starts from 1 from the class variable id = 1, and increments by 1), customer and course_offering as instance variables.
- In the constructor, check the followings:
  - If this enrolment (use current datetime) is later than the course_offering's start date, raise an EnrolmentException with message "Course start date cannot be earlier than enrolment date".
  - This enrolment must be at least 3 days before the course offering start date, failing which an EnrolmentException should be raised, with message "Can only enrol a course at least 3 days in advance".
- Create getters/properties for the followings:
  - enrolment id for this enrolment
  - customer_email that returns the email of the enrolled customer

    - start_date that returns the course offering's start_date
    - schedule_id that returns the course offering's schedule_id
- The get_course_fee() method computes and returns final course fee, which is the course fee from the CourseOffering, taking into consideration the discount the Customer is entitled to.

c) Write the Admin class, which mimic the admission administration for a semester.
- The class has Two instance variables: semester and a list to store the enrolments.
- It has method enrol(self, enrolment: Enrolment), that adds an Enrolment object to the list, provided that
    - the same Customer cannot enrol to the same course offering
    - one customer cannot enrol more than 2 course offerings in one semester
    - raise EnrolmentException with appropriate message if any of the above 2 conditions is violated
- The method withdraws(self, enrolment_id: int) removes an enrolment from the list given the enrolment id.
    - If the enrolment id is not found, raise an EnrolmentException with the message "Enrolment not found!".
    - If the course has started, i.e. the start date of the course offering is on the same day as the withdrawal date or earlier, raise an EnrolmentException with appropriate message.

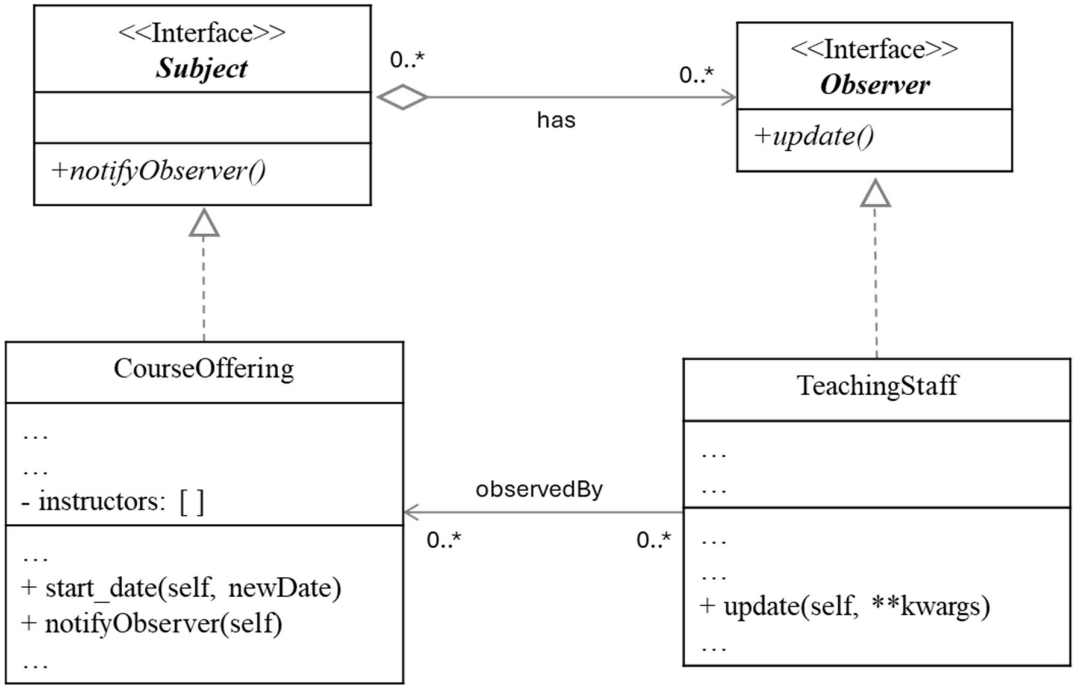
d) Test your classes with the basic setup as follows:

```
def main():
    try:
        ad = Admin("2024-Apr")
        c1 = Course("Prog101", "Python Programming", 2000)
        c2 = Course("DB102", "All about Database", 1800)
        inst1 = TeachingStaff("IT101","Jed Lee", 800)
        inst2 = TeachingStaff("IT103","James Wong", 850)
        co1 = CourseOffering(c1, [inst1, inst2], datetime(2024,11,23), 3)
        co2 = CourseOffering(c2, [inst2], datetime(2024,11,22), 5)
        cust1 = Individual("t1@email.com", "Test 1", datetime(1990,1,3))
        cust2 = Individual("t2@email.com", "Test 2", datetime(1965,4,5))
        cust3 = Corporate("t3@email.com", "Test 3","ThatCompany", True)
        cust4 = Corporate("t4@email.com", "Test 4","ThisCompany", False)
        for co in [co1, co2]:
            for c in [cust1, cust2, cust3, cust4]:
                e = Enrolment(c, co)
                ad.enrol(e)
                print(e.enrolment_id, e.schedule_id, e.customer_email, \
                                                    e.get_course_fee())

        ad.withdraws(11)
    except Exception as e:
       print(e)
```

Create more test scenarios such that your classes will raise exceptions. Ensure that all exceptions are properly handled.

4. UOW wants to apply a simplified observer pattern, such that when there are changes to the CourseOffering, the instructors can be informed.




```python
from abc import ABC, abstractmethod

class Observer(ABC):  # as an interface
    @abstractmethod
    def update(self, **kwargs):
        pass

class Subject(ABC):  # as an interface
    @abstractmethod
    def notifyObserver(self):
        pass
```

Given the above classes/codes, rewrite the CourseOffering and Instructor classes, showcasing the necessary changes only.

Test your classes with this main().

```python
def main():
    c1 = Course("Prog101", "Python Programming", 2000)
    c2 = Course("DB102", "All about Database", 1800)
    inst1 = TeachingStaff("IT101","Jed Lee", 800)
    inst2 = TeachingStaff("IT103","James Wong", 850)
    co1 = CourseOffering(c1, [inst1, inst2], datetime(2024,11,23), 3)
    co2 = CourseOffering(c2, [inst2], datetime(2024,11,22), 5)

    co1.start_date = datetime(2024,11,24)
    co2.start_date = datetime(2024,11,23)
```