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Exam Technische Universität München Einführung in die Softwaretechnik (IN0006)

Einführung in die Softwaretechnik (IN0006) (Technische Universität München)

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Your submission to Graded Online Exercise (Weijie Shi)

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Date: Jul 21, 2021 **Time:** 08:00 - 09:40 **Duration (mm:ss):** 100:00

Examiner: Prof. Dr.-Ing. Bhatotia Pramod **Module number:** IN0006 **Course:** Introduction to Software Engineering / Einführung in die Softwaretechnik

Exercises: 10 **Points:** 100

Your result will be published here as soon as the correction is finished. You can get to this page by clicking on this exam in the exam overview of this course.

Exercise 1

Quiz [4 points]

1) Team vs. Group

Which of the following statements are correct?

Please choose all correct answer options

Points: 1

- [x] Participants in a team are tightly coupled.
- [ ] Group members work collectivly.
- [ ] Team members work individually.
- [ ] In a group, the participants tend to be loosely coupled.
- [ ] Every group is also a team.

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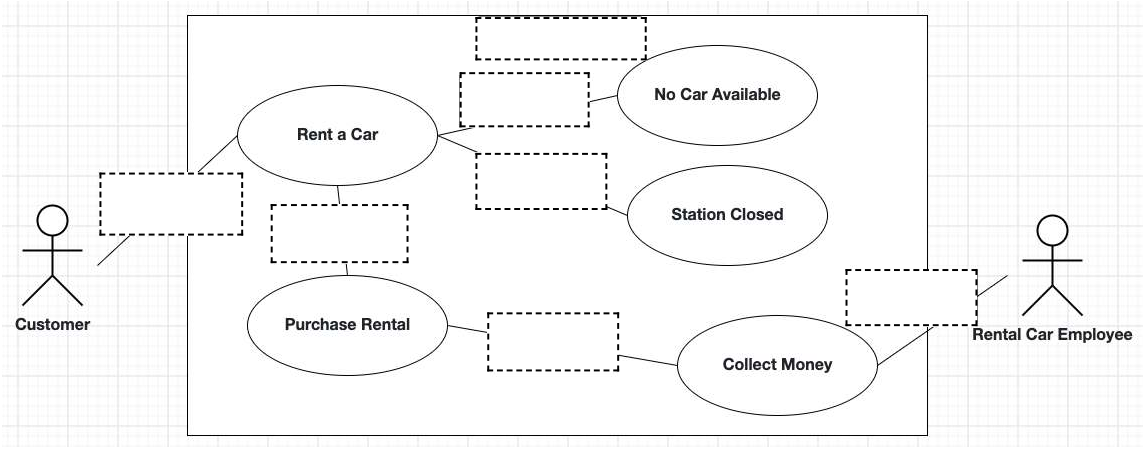
2) Use Case Diagrams

Finish the following use case diagram

Points: 2



Drag & Drop: Place the suitable items on the correct areas.

«include»	System	«extend»	«include»	Car Rental	«include»	«extend»
«extend»	«include»	«extend»				

3) Scrum

Which statements about Scrum are correct?

Please choose all correct answer options

Points: 1

- [ ] Developers are responsible for the prioritization of backlog items.
- [ ] The product owner should have application domain knowledge.
- [ ] The potentially shippable product increment only contains fully realized backlog items.
- [ ] The product owner should make sure that the development team follows the Scrum process.
- [ ] The development team includes members from different disciplines.

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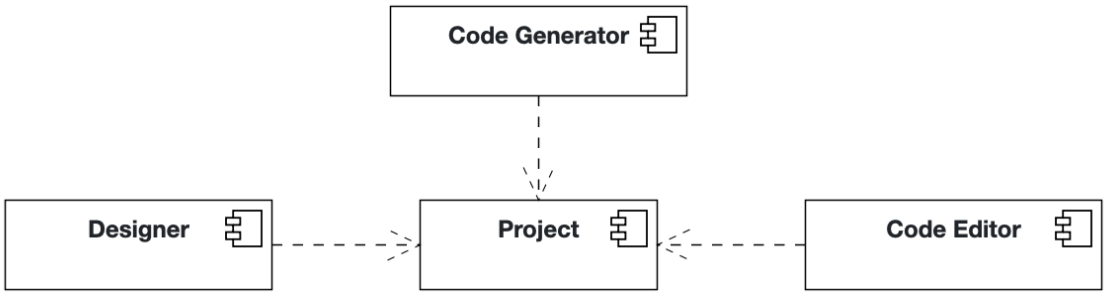
Exercise 2

Quiz [3 points]

1) Architectural Style

Select which architectural style is shown in the UML diagram.



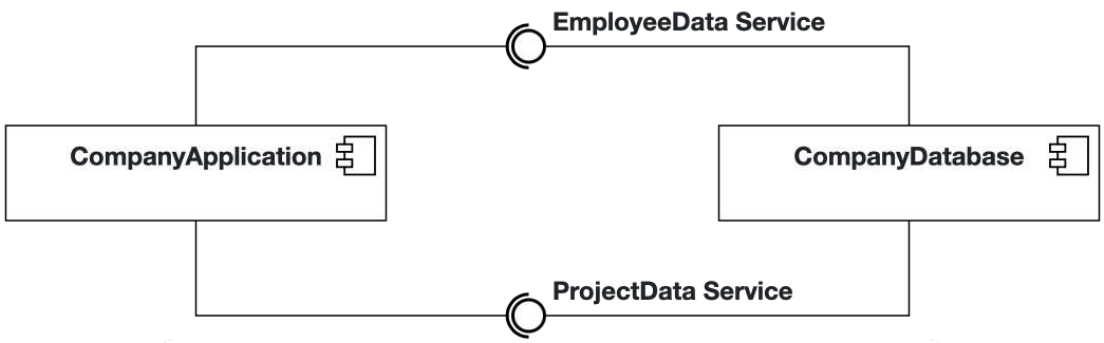
Please choose all correct answer options

Points: 1

- [ ] Repository
- [ ] Facade
- [ ] Model view controller (push notification)
- [ ] Peer to peer
- [ ] Model view controller (pull notification)

2) Architectural Style

Select which architectural style is shown in the UML diagram.



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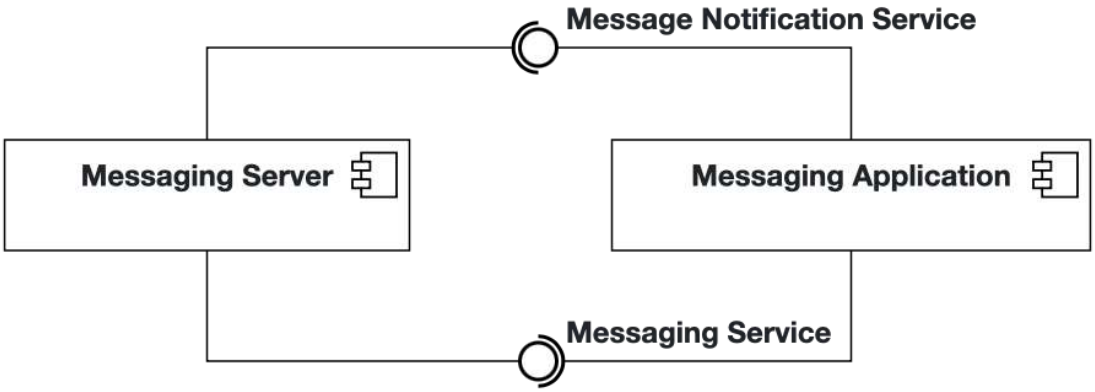
Please choose all correct answer options

Points: 1

- [ ] Facade
- [ ] Layer
- [ ] Peer to peer
- [ ] Model view controller
- [ ] Client server

3) Architectural Style

Select which architectural style is shown in the UML diagram.



Please choose all correct answer options

Points: 1

- [ ] Peer to peer
- [ ] Repository
- [ ] Client server
- [ ] Layer

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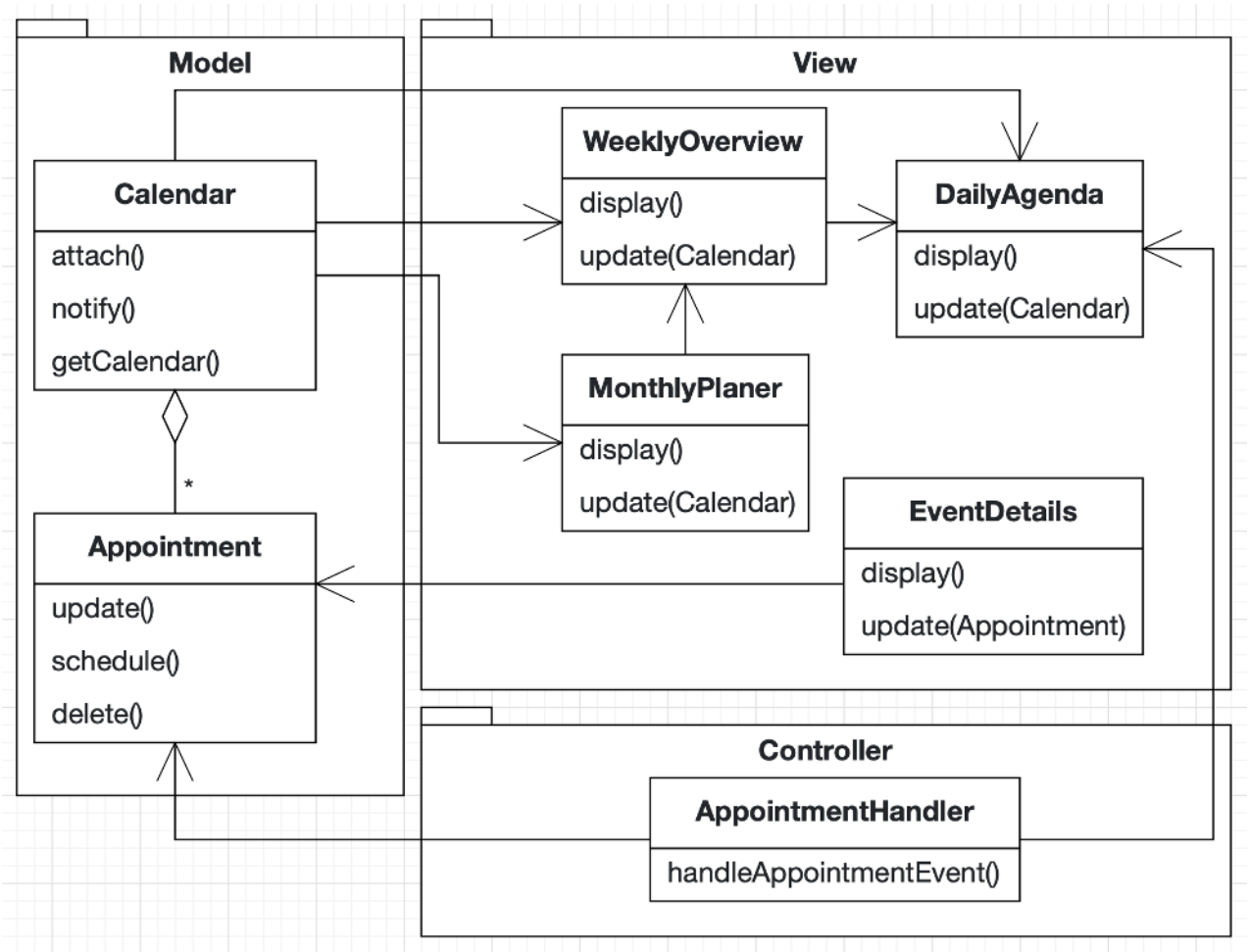
Model view controller ☐

A Exercise 3

System Design Model Review [9 points]

The following UML class diagram models the `MVC` architectural style using the `pull notification` variant for a calendar system. The calendar system should show appointments in different views that should be synchronized with each other. Users can schedule, update and delete appointments. However, the UML class diagram contains several violations with respect to `MVC` and common system design principles.



Your tasks

- Identify at least 3 violations in the UML class diagram above.
- Explain each violation in detail.
- For each violation, propose a refactoring to improve the system design!

Hints

- Make sure that your answer clearly references specific model elements.
- `Important: Use your own words!`

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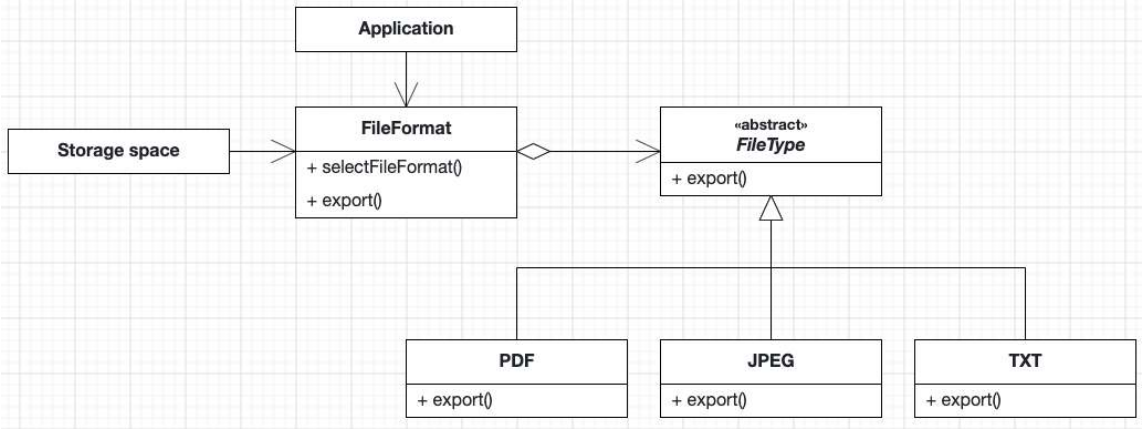
No submission

Exercise 4

Quiz [4 points]

1) Design Pattern

Select which design pattern is shown in the UML diagram.



Please choose all correct answer options

Points: 1

- [ ] Strategy
- [ ] Adapter
- [ ] Observer
- [ ] Bridge
- [ ] Composite

2) Design Pattern

Select which design pattern is shown in the UML diagram.

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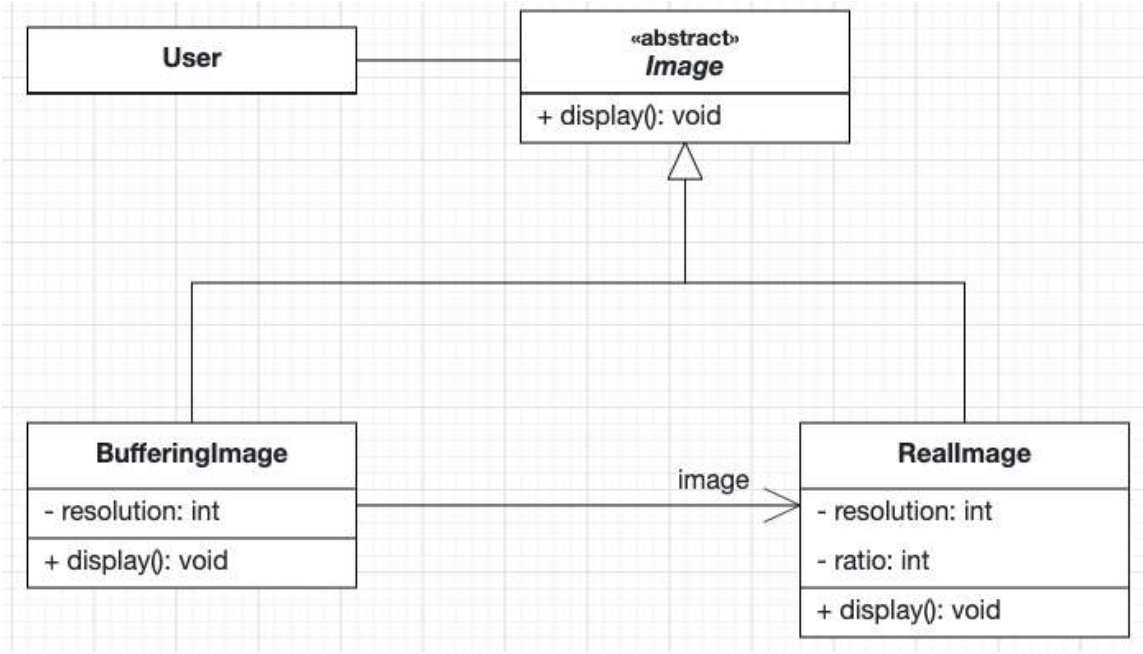


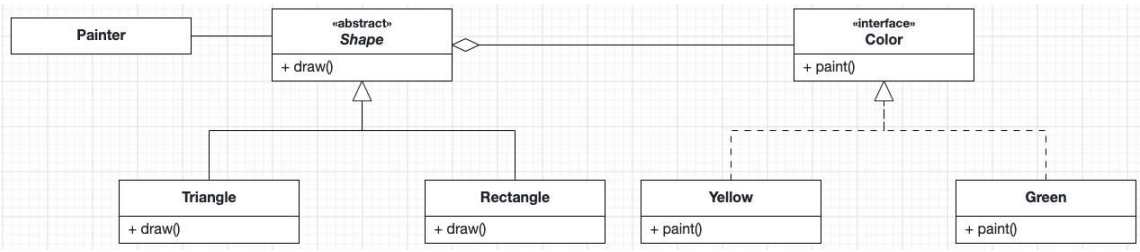
Please choose all correct answer options

Points: 1

- [ ] Proxy
- [ ] Adapter
- [ ] Observer
- [ ] Bridge
- [ ] Composite

3) Design Pattern

Select which design pattern is shown in the UML diagram.



Please choose all correct answer options

Points: 1

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Bridge ☐

Adapter ☐

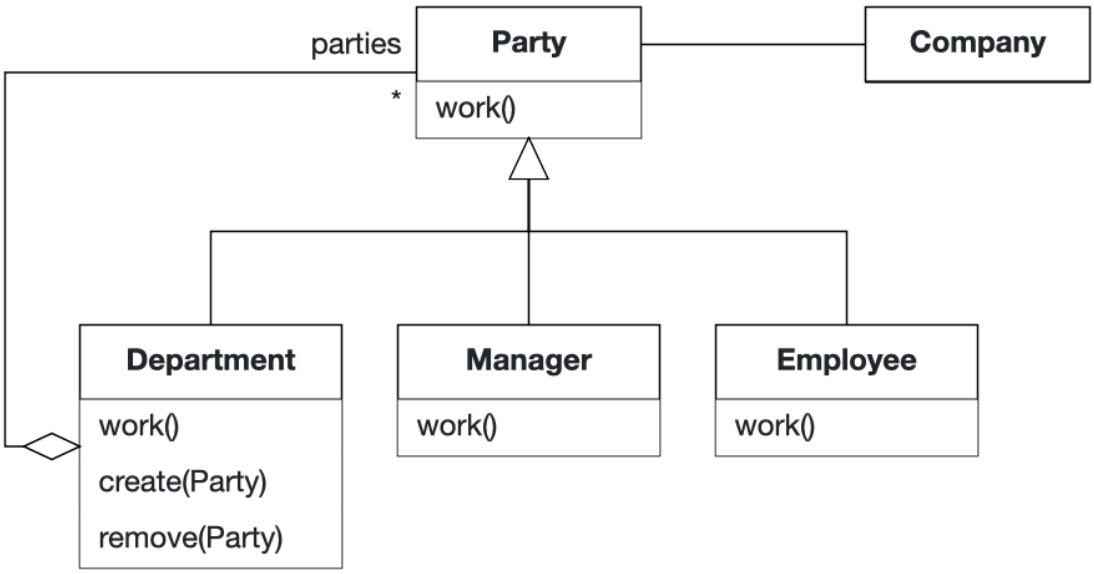
Observer ☐

Proxy ☐

Composite ☐

4) Design Pattern

Select which design pattern is shown in the UML diagram.



Please choose all correct answer options

Points: 1

Composite ☐

Adapter ☐

Observer ☐

Bridge ☐

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Proxy ☐

A Exercise 5

Use Cases [8 points]

The corona pandemic changed our everyday life. To help the local restaurants to recover, the government decided to implement a Corona tracking app. You are part of the development team and have to identify `use cases`.

To visit a beer garden, customers need to have a negative corona test. Therefore, customers have to be vaccinated. Before the vaccination, the customers have to schedule an appointment. Customers can make an appointment after being unlocked. For scheduling the appointments, the vaccination centers have a web application. After opening the application, the customer enters his preferred day. The application will display the available timeslots. The customer chooses the best fitting timeslot and enters his personal data. Afterward, the customers will receive an e-mail with their confirmed appointment.

The administrators placed a few check-in stations at the entrance of the vaccination center. Customers have to enter their personal appointment data. The system confirms the presence and prints a number for the customer. Afterward, the customer takes a seat and waits until his number is displayed on a screen. The system displays the number, and the customer heads towards the vaccination.

Your task

Based on the problem statement, create `2 use cases` for the appointment process and the vaccination process.

Hints

- Define the name, actor, flow of events, entry and exit conditions for each use case.
- Include at least two system and actor steps within each use case.
- Use the following template for the use cases:

```
1) Name: <name>
2) Participating actors: <actors>
3) Flow of events:
   * User step 1: <step>
   * System step 1: <step>
   * . . .
4) Entry conditions: <entry>
5) Exit conditions: <exit>
```

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Exercise 6

Continuous Software Engineering [8 points]

Bob works at a car parts supplier company that develops special software in the area of engine management. As a certified automotive technician, Bob is currently involved in the hardware-software co-development of a new Engine Control Unit (ECU). First, Bob disconnects the negative side of the battery and manually installs the new version of the ECU software in the car. After making sure that the battery is charged over 12v, he reconnects the negative side of the battery and proceeds with the manual integration testing steps: he starts the car. He verifies that all engine functions are working correctly in the new version. Bob finishes the testing of the new version successfully. Finally, he manually deploys it and notifies the customer BMW, i.e., the OEM (Original Equipment Manufacturer).

Your task

Model the dynamic behavior of the described release management process using a UML communication diagram.

Hints

- The explanation for the model is not needed.
- Do `not` model the systems for version control, continuous integration, continuous delivery/deployment, issue tracking, and development (IDE) as objects.

No submission

Exercise 7

Testing [20 points]

Unit Testing and Mock Object Pattern

Imagine you are on an expedition in Antarctica and observing the behavior of penguins. You want to document all sighted penguins, including their attributes (e.g., age, wingspan, height), to your `Notebook` so that you can calculate the average wingspan or identify the oldest penguin.

You want to use an innovative camera that automatically identifies attributes of penguins based on machine learning. However, the camera is not yet implemented. The following UML diagram shows the current implementation of the system.

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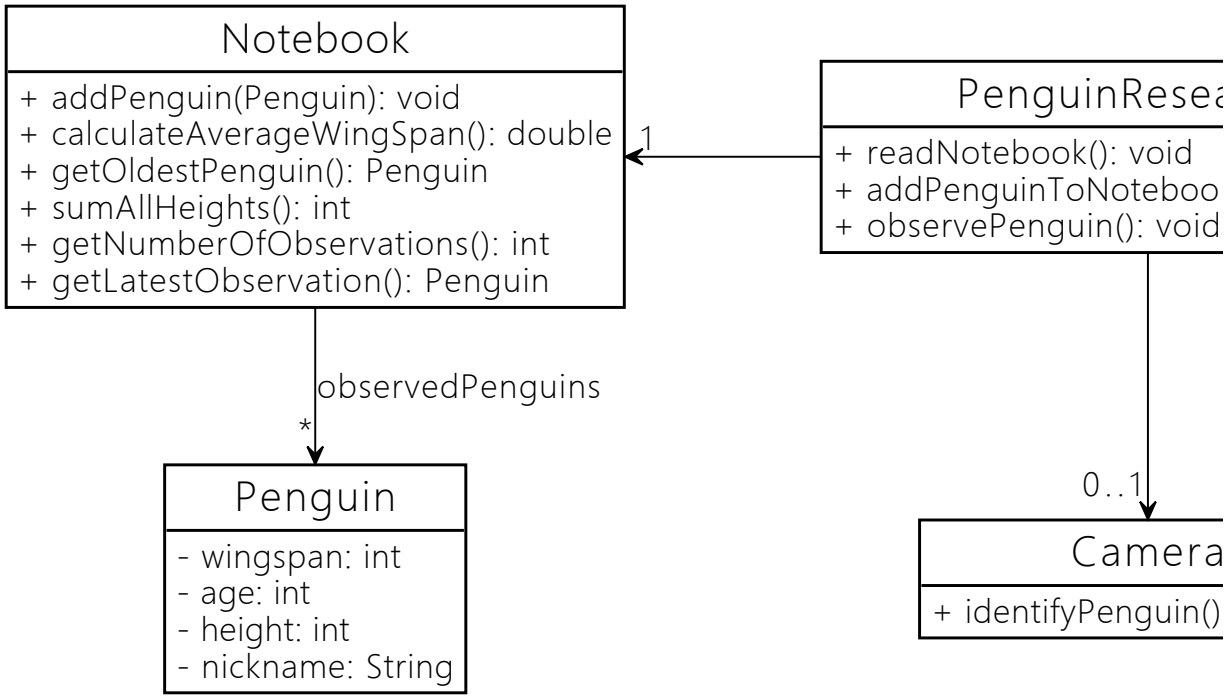

Your tasks

1. Test the average wingspan calculation in NotebookTest

- Implement `testCalculateAverage()` that tests the correct calculation of the average wingspan for **4** penguins with **distinct** wingspans.
- Implement `testCalculateAverageEmptyList()` that tests that the calculation fails with an `IllegalStateException` if the list of penguins is empty.

2. Test the observation of a penguin in PenguinResearcherTest

Implement one test that tests the method `observePenguin()` of `PenguinResearcher`.
This method relies on the camera, which is not yet available. Use the Mock Object Pattern with `EasyMock` to mock the `Camera`.
Test that after the observation of a **5** years old penguin:

- The notebook contains the **correct number of observations**.
- The **latest observation** is the same penguin as the one the `Camera` identified.
- The **correct nickname** got set for the penguin as specified in `observePenguin()`.

Hints

- Do not change anything in the `pom.xml` or the `src` folder!
- The Online Editor is not activated. Please use your local IDE.

Repository Link:
https://bitbucket.ase.in.tum.de/scm/EIST21TESTINGPANIMALS/eist21testingpanimals-ga92jom.git
Last Commit Hash: No commit was made

Exercise 8

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Quiz [5 points]

1) Quality Requirements

`TUM Stream` is a streaming platform for students.

For each requirement below, decide whether it is a good example of a `quality requirement`.

Please choose all correct answer options

Points: 2

- [ ] TUM Stream should have a high quality.
- [ ] TUM Stream should be coded in Java.
- [ ] Students should be able to watch lecture recordings with a latency of at most 1s.
- [ ] Students can watch a lecture recording with a maximum of 3 clicks after they have logged in.
- [ ] TUM Stream should be available 99% of the time.

2) Functional Requirements

Consider the development of a university system such as Moodle. Which of the following are functional requirements?

Please choose all correct answer options

Points: 2

- [ ] An unaurothized user should not be able to get information from the system.
- [ ] A student should be able to load Moodle quizzes in less than 1s.
- [ ] A student should be able to download course material.

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A student can upload homework solutions. ☐

An instructor can grade homeworks. ☐

3) Communication

You run into the client on the way to the coffee shop and ask him to clarify one of the requirements again. What type of communication is described?

Please choose all correct answer options

Points: 1

- Unplanned, synchronous, informal ☐
- Unplanned, asynchronous, informal ☐
- Unplanned, asynchronous, formal ☐
- Planned, asynchronous, informal ☐
- Planned, synchronous, formal ☐
- Planned, asynchronous, informal ☐

Exercise 9

Object Design [30 points]

The receptionist of a local hairdresser approaches you with an urgent request. Due to the Corona pandemic, she is obliged to register every customer who wants to visit the hairdresser. The customers can register themselves at the hairdresser shop by filling out the hairdresser registration form. However, this registration variant is criticized as not environmentally friendly and not compliant with data privacy rules. Therefore, more and more customers want to use the new and innovative CancelCoronaApp to register at the hairdresser shop.

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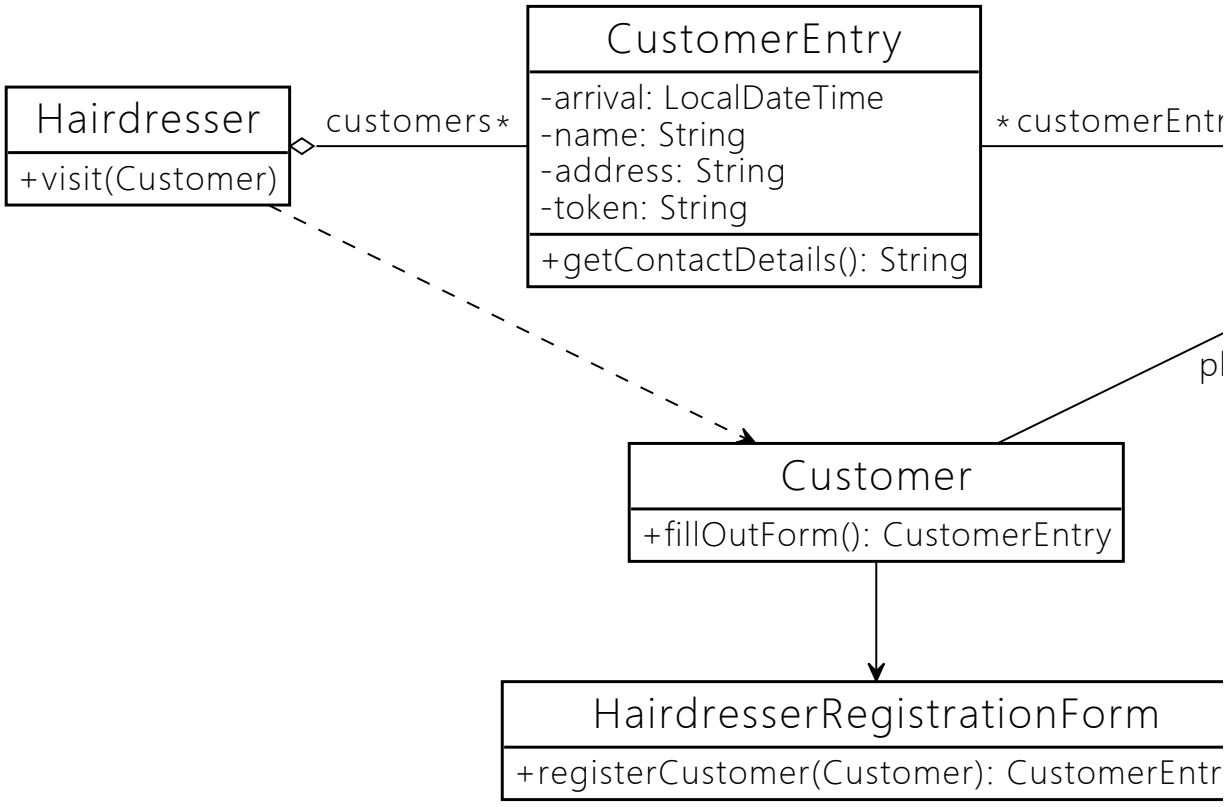
To not lose potential customers, the receptionist of the hairdresser wants to offer this registration option as well. With the new system, a customer registers either via the CancelCoronaApp or by filling out the hairdresser registration form. Regardless of the registration strategy, the customer information is added to the list of customer entries of the hairdresser. The following UML diagram shows the current system:



As the pandemic progresses, the system may require additional registration strategies. With this knowledge in mind, you decide to apply the `Strategy Pattern`.

Your Task

Implement the new registration based on the CancelCoronaApp and refactor the current system accordingly so that it follows the structure of the strategy pattern. Make sure to follow coding best practices.

1. Introduce an interface

Each strategy offers the method `registerCustomer(Customer)`. Once the customer completes the registration, the information is returned as a `CustomerEntry`. Abstract the method specification to the `RegistrationClient` interface.

2. Implement the new strategy

The registration through the `CancelCoronaApp` makes use of token generation, hiding the actual contact data of a `Customer`. For each registration, a new token is generated, which is used to create a `CustomerEntry` that is saved on the `Phone`. This procedure ensures that the receiver of the token can contact the provider of the `CancelCoronaApp` to issue warnings to affected users.

3. Implement a policy

Add a `HairdresserPolicy` that is responsible for selecting the most suitable strategy. Registering via the `CancelCoronaApp`, which is the preferred registration method, requires the

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phone to have the app installed. In other cases, `HairdresserRegistrationForm` is used.

4. Manage customers in Hairdresser

The method `visit(Customer)` makes sure that the correct strategy is used. The information of a customer who visits the hairdresser is added to the `customers` to react in case of an infection. Make sure to refactor the context where needed.

Repository Link:
https://bitbucket.ase.in.tum.de/scm/EIST21OBJECTHDESIGN/eist21objecthdesign-ga92jom.git
Last Commit Hash: No commit was made

Exercise 10

Analysis Object Model [9 points]

Oliver wants to attend the European Football Championship. He checks the available seats for the final match in London. He books a ticket in the VIP area of the Wembley stadium and receives a confirmation ticket containing the ticket ID, seat number, booking date and time. He checks the travel regulations based on COVID and realizes that in order to successfully enter the stadium, he must present a negative COVID test certificate, which must be validated at the stadium entry control. For this purpose, the PCR test procedure must not have been performed earlier than 24 hours and the test certificate must contain the personal identification number, name, age, date of birth of the tested person, the procedure used, and its result. He must also wear an FFP2 mask during the match at the stadium.

Your task

Create an analysis object model (UML class diagram) to model this problem statement.

Hints

- Make sure to include the relevant classes, attributes, methods and associations in your model.
- The explanation for the model is not needed.

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