Formal Models of Design Patterns I

In this exercise we look at some approaches to formal modelling of design patterns. We begin with simple role models and advance to UML-based models. In the next exercise we will then increasingly formalize our specifications.

Task 1: Role Modelling

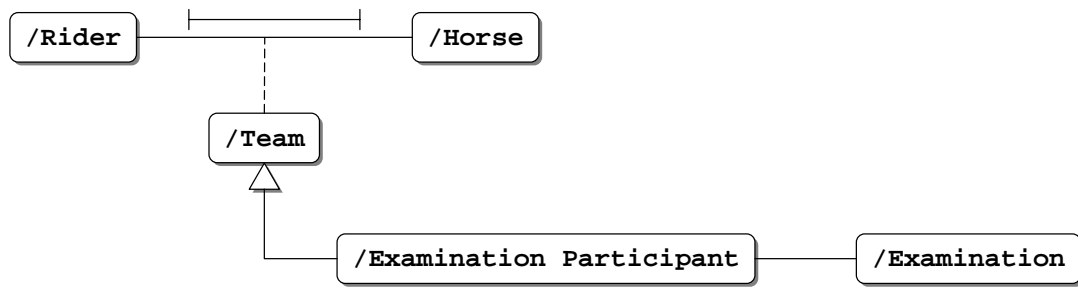You are to develop software for the management of horse shows.

In the world of horse shows, there are horses and riders who together obtain a starting number, with which they can inscribe for examinations. Of course, because the average horse show takes about two to three days, both horses and riders need a place to stay. It is one of the tasks of the organisation team to provide accommodation for horses and riders.

1a) **Task:**

Develop role models for the situations described above using the notation from the lectures. Use at least two role models: One for riders and horses and their relations to examinations, and one for the management of accommodations.
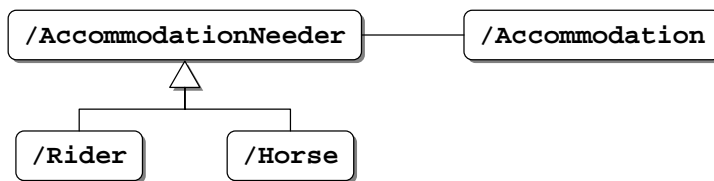
Solution:

Participants/Examinations

```
  ┌─────────┐    ├─────────┤    ┌─────────┐
  │ /Rider  │───────────────────│ /Horse  │
  └─────────┘         ┊         └─────────┘
                      ┊
                 ┌─────────┐
                 │ /Team   │
                 └─────────┘
                      △
                      │
         ┌────────────────────────────┐         ┌────────────────┐
         │ /Examination Participant    │─────────│ /Examination   │
         └────────────────────────────┘         └────────────────┘
```

– –

Accomodations

```
  ┌──────────────────────┐         ┌──────────────────┐
  │ /AccommodationNeeder  │─────────│ /Accommodation   │
  └──────────────────────┘         └──────────────────┘
              △
      ┌───────┴───────┐
  ┌─────────┐     ┌─────────┐
  │ /Rider  │     │ /Horse  │
  └─────────┘     └─────────┘
```
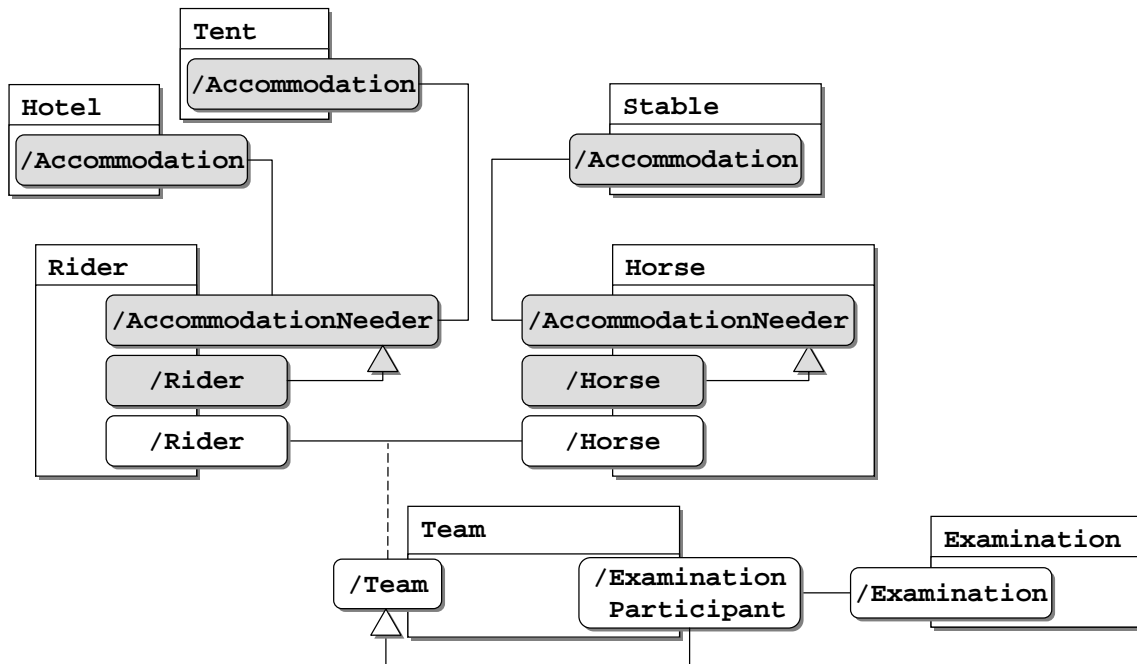
1b) **Task:**

Now map the roles from the previous subtask onto classes. Do you need to create new constraints? Are there alternative ways of mapping?

Solution:

Tent
/Accommodation

Hotel
/Accommodation

Stable
/Accommodation

Rider
/AccommodationNeeder
/Rider
/Rider

Horse
/AccommodationNeeder
/Horse
/Horse

Team
/Team
/Examination
Participant

Examination
/Examination

Task 2: Bridge Templates

We have seen in the lecture, that design pattern structures can be viewed as role models. In this task, we are going to look at some design patterns from this perspective.

2a) **Task:**

Using the role-model notation from the lectures, provide a role model for TEMPLATE CLASS and one for BRIDGE.

Solution:

TEMPLATE CLASS

```
┌──────────────┐       ┌──────────┐          ┌──────────────────┐
│  /Template   │───────│  /Hook   │◁─────────│  /ConcreteHook   │
└──────────────┘       └──────────┘          └──────────────────┘
```

- -

BRIDGE

```
┌──────────────┐   ┌──────────────┐       ┌────────────────────────┐
│ /Abstraction │───│ /Implementor │◁──────│ /ConcreteImplementor   │
└──────────────┘   └──────────────┘       └────────────────────────┘
       △
       │
┌──────────────────────┐
│ /RefinedAbstraction  │
└──────────────────────┘
```

2b) **Task:**

Use the role identification notation to show how BRIDGE can be viewed as a specialisation of TEMPLATE CLASS.

Solution:

```
/Template  ├─────────┤  /Hook  ◁───────  /ConcreteHook

    △                     △                  △

/Abstraction  ├───┤  /Implementor  ◁───  /ConcreteImplementor

    △

/RefinedAbstraction
```