Lecture 9: System Modeling (2) — Activity Diagram & Class Diagram
Activity Diagram

- Supplements the use case
- Provides a graphical representation of the flow of activities within a specific scenario
Activity Diagram

- The core symbol is the activity box
- Depending on the perspective, the activity is interpreted differently
  - Conceptual perspective:
    - An activity is some task that needs to be done whether by a human or a computer
  - Specification perspective:
    - An activity is a method on a class
- The links between the activities are the triggers
Activity Diagram

• Guards
  • Determine which trigger is used
  • At a single point in time, only one trigger can occur
  • Guards essentially need to be exclusive
To describe nested decisions, UML activity diagrams offer the decision diamond activity symbol.
Concurrent Activities

- Synchronization bars

- Synchronization bars initiate concurrent sections in an activity diagram
Concurrent Activities

- Synchronization bars synchronize concurrent activities

[Diagram showing the process of making coffee, with synchronization bars indicated at various points.]

The outbound trigger occurs only when all inbound triggers have occurred.
Multiple Triggers

- The second source of parallelism in activity diagram
Activity diagrams tell you what happens, but they do not tell you who does what.
Swimlanes

- Swimlanes are indicated by vertical dashed lines which separate the diagram into zones.
- Each zone represents a particular class, person, or department, etc.
Activity Diagram

- Revisit MHC-PMS

Involuntary Detention
When to Use Activity Diagrams

* Activity diagrams show behavior that spans over multiple use cases to describe the workflow of the overall process

* For multiple objects and their high-level interaction, activity diagrams are particularly helpful for representing an overview of concurrent processes

* Do not use activity diagrams to see how objects collaborate

* Activity diagrams are not accurate for describing how an object behaves over its lifetime
Structural Models

- Structural models display the organization of a system
- You create structural models when you are discussing and designing the system architecture
Class Diagrams

- Class diagrams are used to show the classes in a system and the associations between these classes.

- When you are developing models during the early stages of the software engineering process, objects represent something in the real world.
Classes & Associations

- **Condition**
  - 1..* with **Patient**
    - 1..* diagnosed-with
  - 1..* with **Consultation**
    - 1..* runs
      - 1..4 with **Hospital Doctor**
  - 1..* with **Consultant**
    - 1..* referred-to
  - 1..* with **General practitioner**
    - 1..* referred-by

- **Patient**
  - 1..* attends
  - 1..* with **Consultation**
    - 1..* runs
      - 1..4 with **Hospital Doctor**
  - 1..* with **Consultant**
    - 1..* referred-to
  - 1..* with **General practitioner**
    - 1..* referred-by

- **Consultation**
  - 1..* with **Consultant**
    - 1..* referred-to
  - 1..* with **General practitioner**
    - 1..* referred-by

- **Consultant**
  - 1..* referred-to
  - 1..* with **General practitioner**
    - 1..* referred-by

- **General practitioner**
  - 1..* referred-by
  - 1..* with **Consultant**
    - 1..* referred-to

- **Patient**
  - 1..* attends
  - 1..* with **Consultation**
    - 1..* runs
      - 1..4 with **Hospital Doctor**
  - 1..* with **Consultant**
    - 1..* referred-to
  - 1..* with **General practitioner**
    - 1..* referred-by

- **Consultation**
  - 1..* with **Consultant**
    - 1..* referred-to
  - 1..* with **General practitioner**
    - 1..* referred-by

- **Consultant**
  - 1..* referred-to
  - 1..* with **General practitioner**
    - 1..* referred-by

- **General practitioner**
  - 1..* referred-by
  - 1..* with **Consultant**
    - 1..* referred-to
Single Class

* The consultation class

<table>
<thead>
<tr>
<th>Consultation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors</td>
</tr>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Time</td>
</tr>
<tr>
<td>Clinic</td>
</tr>
<tr>
<td>Reason</td>
</tr>
<tr>
<td>Medication prescribed</td>
</tr>
<tr>
<td>Treatment prescribed</td>
</tr>
<tr>
<td>Voice notes</td>
</tr>
<tr>
<td>Transcript</td>
</tr>
<tr>
<td>...</td>
</tr>
</tbody>
</table>

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New ()</td>
</tr>
<tr>
<td>Prescribe ()</td>
</tr>
<tr>
<td>RecordNotes ()</td>
</tr>
<tr>
<td>Transcribe ()</td>
</tr>
<tr>
<td>...</td>
</tr>
</tbody>
</table>
A Generalization Hierarchy
The Aggregation Association

![Diagram of the aggregation association between Patient record, Patient, and Consultation]
Example: From Use Cases to Class Diagrams

- The requirements list of a company includes the following textual description of the use case “order”:

```
Order:
We have customers who order our products.
We distinguish corporate customers from personal customers, since corporate customers are billed monthly whereas personal customers need to prepay their orders.

We want our orders to be lined up product by product. Each line should contain the amount and the price of each product.
```
We have customers who may order several products.

We distinguish corporate customers from personal customers, since corporate customers are billed monthly whereas personal customers need to prepay their orders with a credit card.

We want our orders to be lined up product by product. Each line should contain the amount and the price of each product.
Generalization

We have customers who order our products. *We distinguish corporate customers from personal customers, since corporate customers are billed monthly whereas personal customers need to prepay their orders with a credit card.*

We want our orders to be lined up product by product. Each line should contain the amount and the price of each product.
More Associations

Order:

We have customers who order our products. We distinguish corporate customers from personal customers, since corporate customers are billed monthly whereas personal customers need to prepay their orders with a credit card.

We want our orders to be lined up product by product. Each line should contain the amount and the price of each product.
Attributes and Operations

Order:
We have customers who order our products. We distinguish corporate customers from personal customers, since corporate customers are billed monthly whereas personal customers need to prepay their orders with a credit card.

We want our orders to be lined up product by product. Each line should contain the amount and the price of each product.
Order - Full Class Diagram