

MODELING - STRUCTURE

SU:E16:L5

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CONTENTS

- **Elevator control system: Event table**
- **Problem domain analysis: Structure**

ELEVATOR – EVENT TABLE

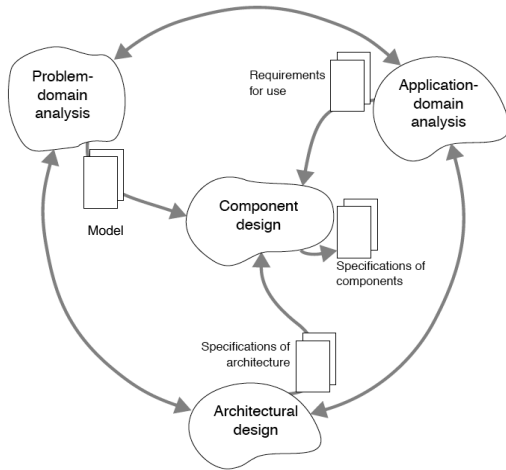
- **Context:**
 - The system is used to decide where an elevator must stop based on the requests of users; e.g. “go to floor 3”. Other systems control the movements of the elevator, its speed, direction and position between floors.

	Elevator	Floor	Choice	Call down	Call up
Left down	X	X		X	
Left up	X	X			X
Arrived	X	X	X		
Called down		X		X	
Called up		X			X
Floor chosen			X		

STRUCTURE

October 3, 2016

ACTIVITIES IN 'ANALYSIS OF PROBLEM DOMAIN'



Classes

- Which objects and events are part of the problem domain?
- Class, object, and event.

Structure

- How are classes and objects conceptually related?
- Generalization, aggregation, association, and cluster.

Behavior

- Which dynamic properties do the objects have?
- Event trace, behavioral pattern, and attribute.

ACTIVITIES IN 'STRUCTURE'



Find candidates for structure

Study abstract, static relations between classes

Study concrete, dynamic relations between objects

Identify generalizations, aggregations, associations, and clusters

Explore patterns

The Role Pattern

The Relation Pattern

The Hierarchy Pattern

The Item-Descriptor Pattern

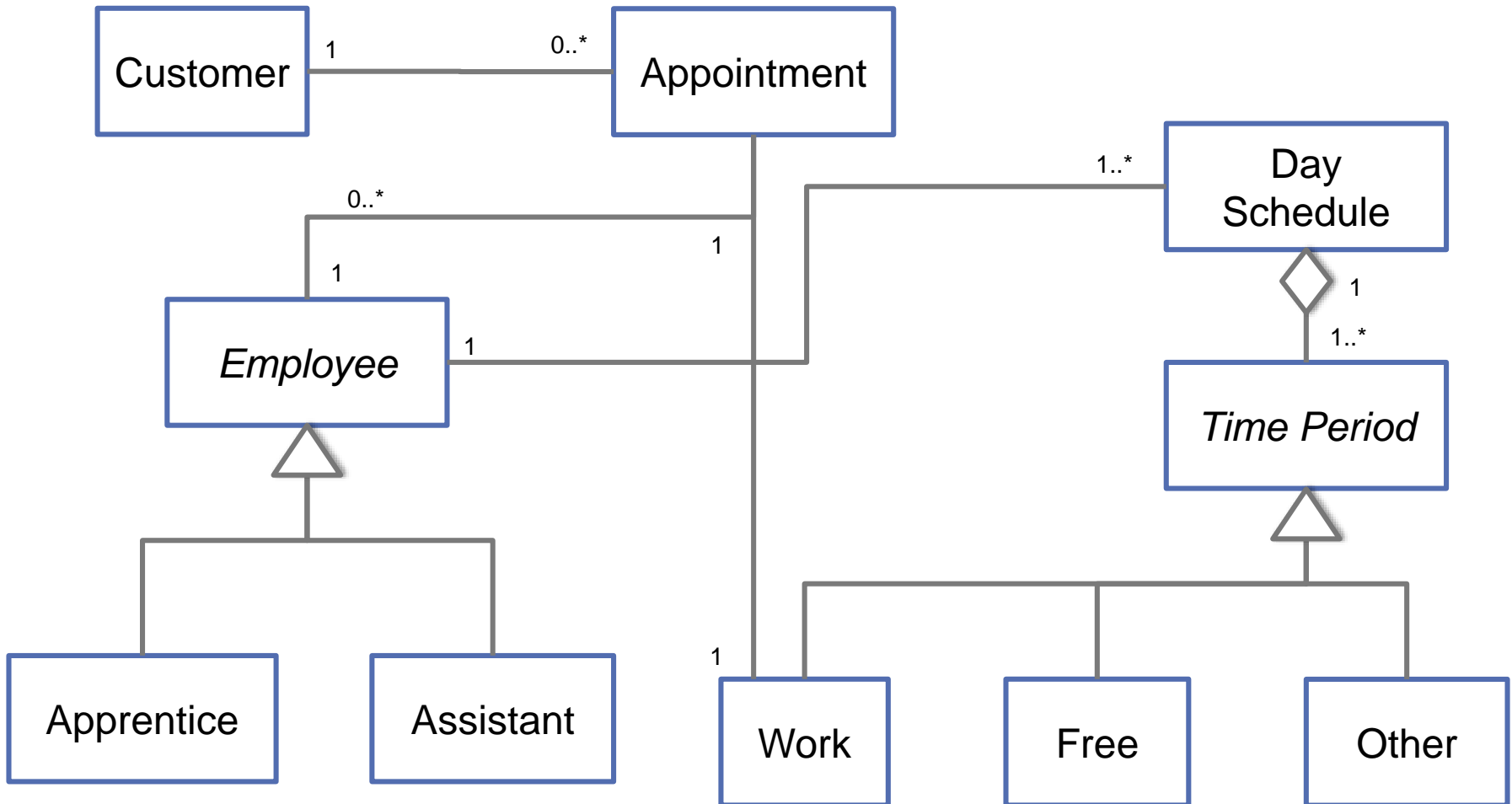
Evaluate systematically

Structures must be used correctly

Structures must be conceptually true

Structures must be simple

RESULT OF 'STRUCTURE'



CLASS STRUCTURES AND OBJECT STRUCTURES



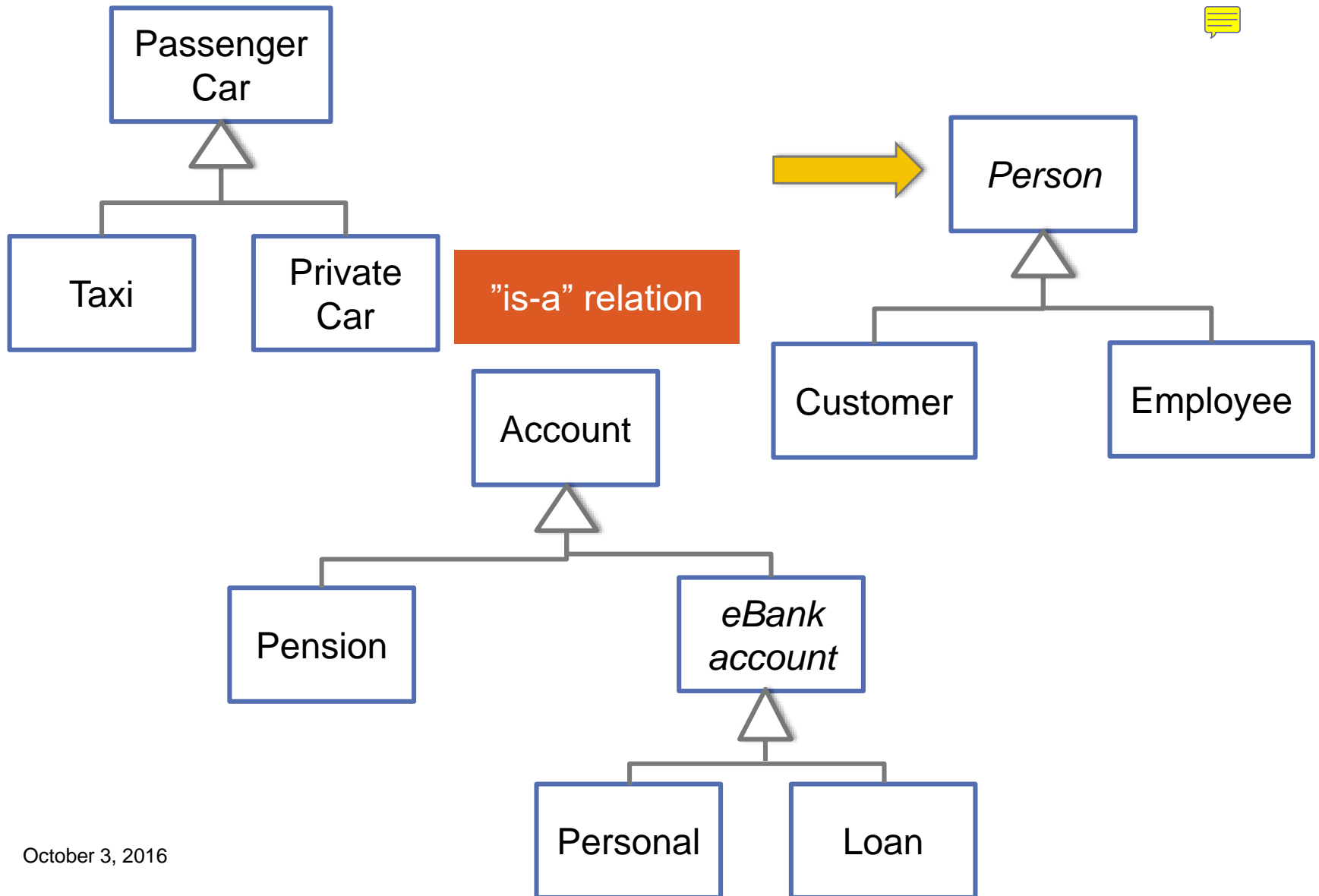
Class structure

- Expresses static, conceptual relations between classes
 - Generalization
 - Cluster

Object structure

- Captures dynamic relations between objects
- Described at the class level
- *Some* objects from the related classes can be connected
 - Aggregation
 - Association

GENERALIZATION



EXAMPLE (1)

Customer

	Customer	Assistant	Apprentice	Appointment	Plan
reserved	X	X		X	X
cancelled	X	X		X	
treated	X			X	
employed		X	X		
resigned		X	X		
graduated			X		
agreed		X	X		X

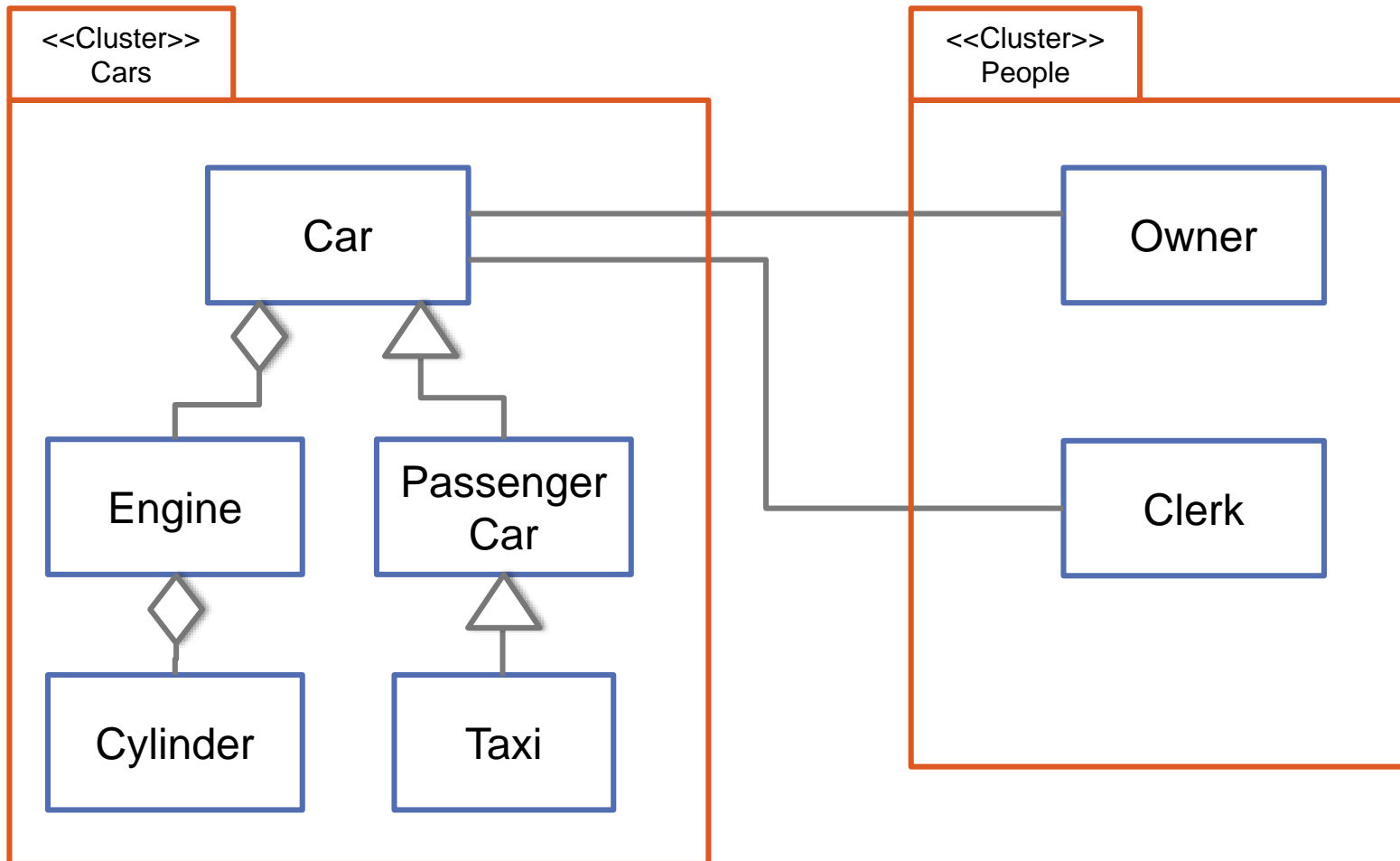
Appointment

Plan

Apprentice

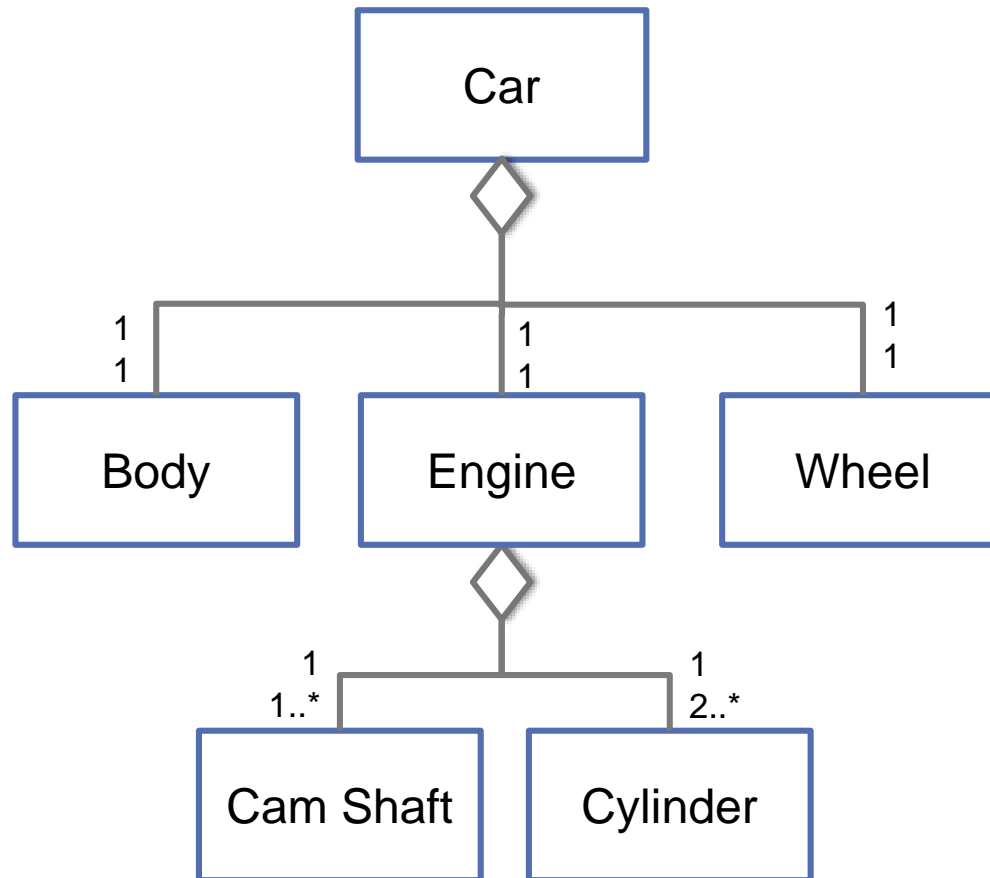
Assistant

CLUSTER



AGGREGATION

- Whole – part
- Container – contents
- Union – member
- “has-a” or “is-part-of” relation



ASSOCIATION

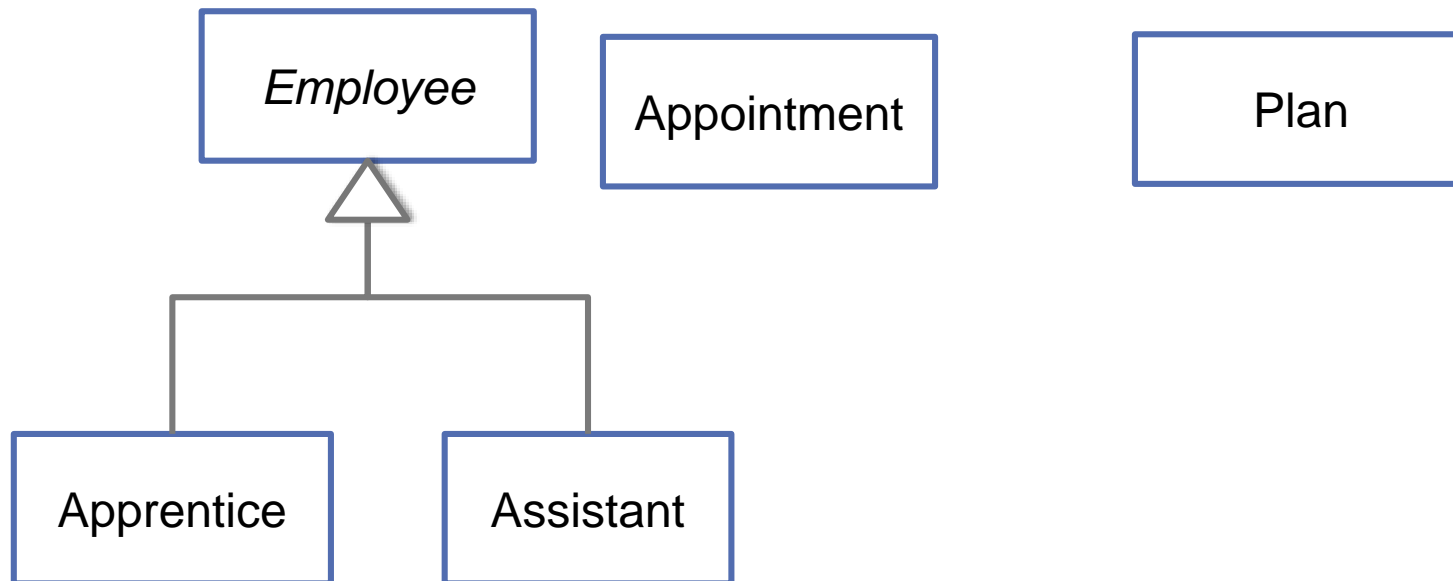
"knows" or
"associated-with"
- relation



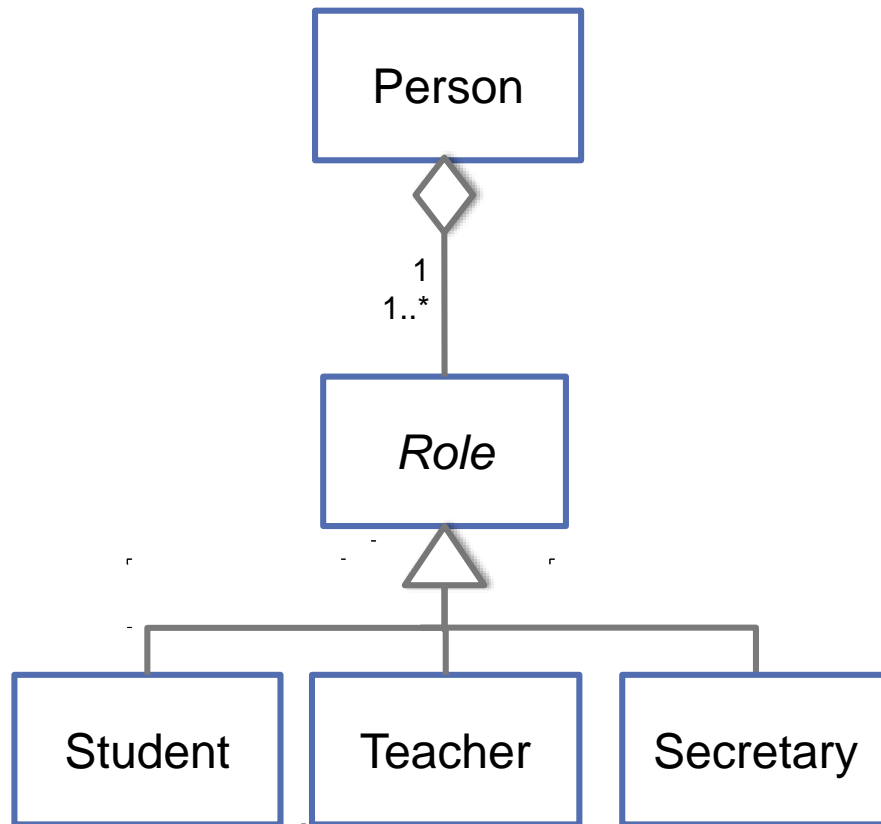
EXAMPLE (2)

Customer

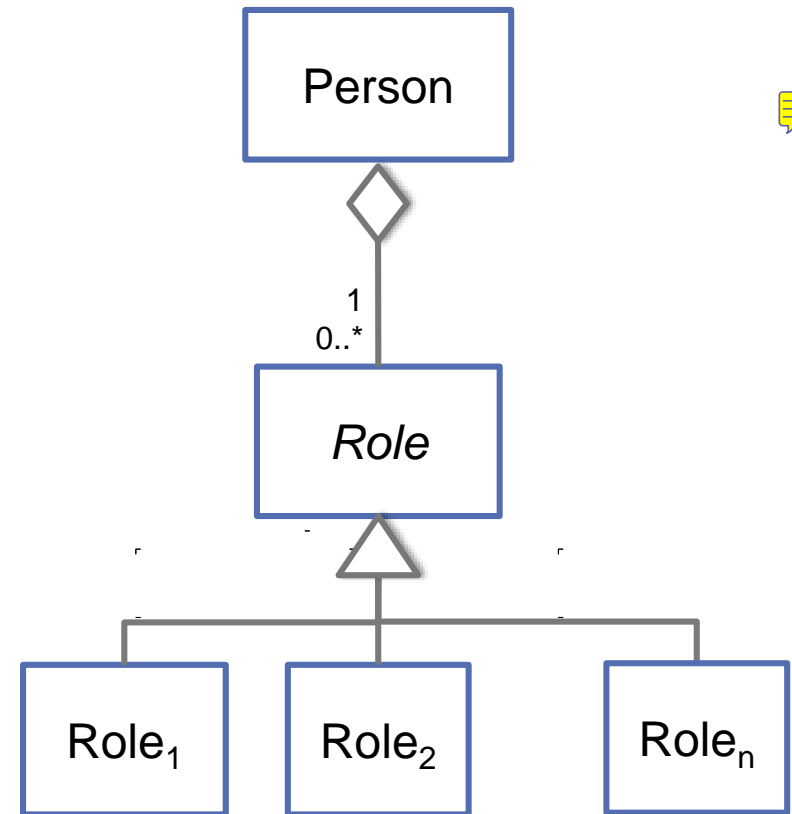
	Customer	Assistant	Apprentice	Appointment	Plan
reserved	X	X		X	X
cancelled	X	X		X	
treated	X			X	
employed		X	X		
resigned		X	X		
graduated			X		
agreed		X	X		X



EXPLORE PATTERNS: ROLE PATTERN

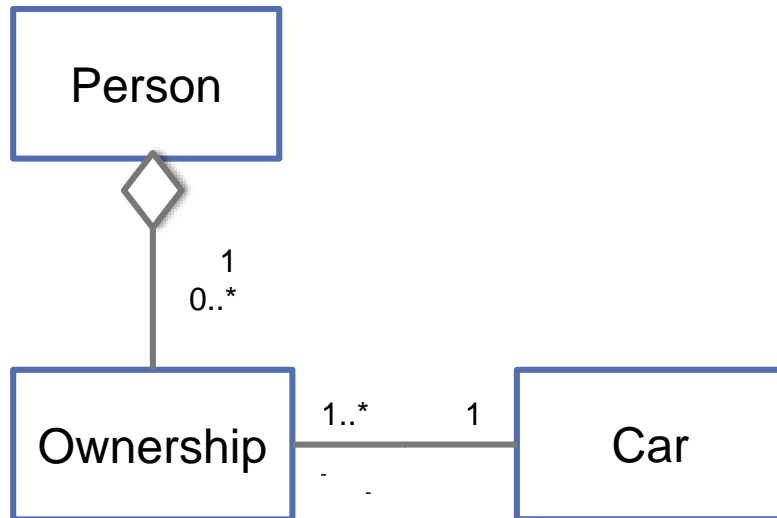


Example

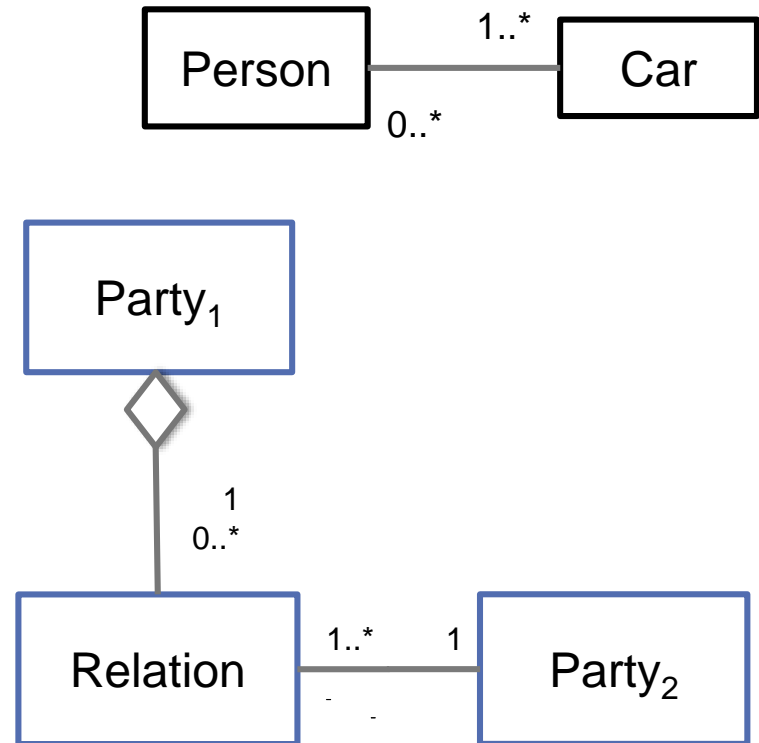


Generic

EXPLORE PATTERNS: THE RELATION PATTERN

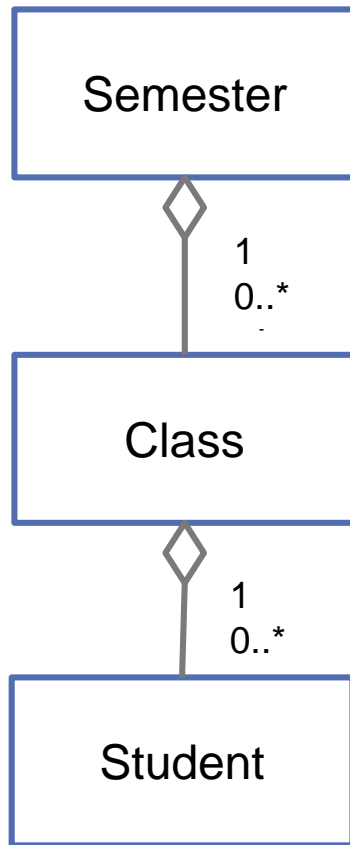


Example

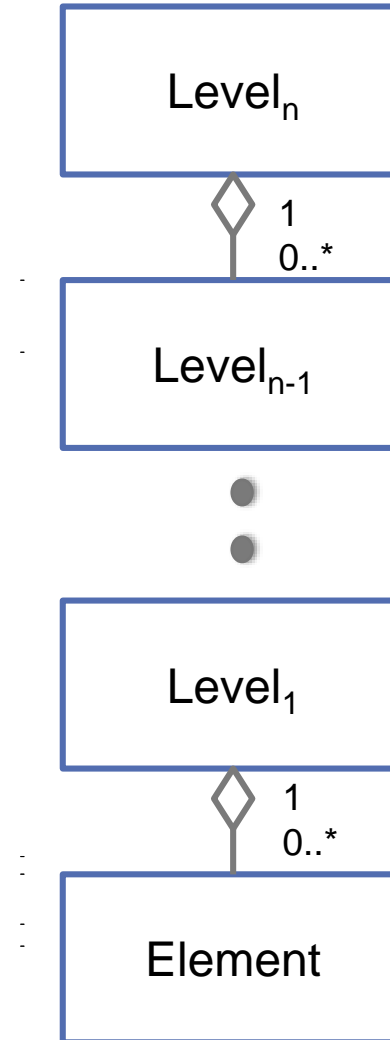


Generic

EXPLORE PATTERNS: THE HIERARCHY PATTERN



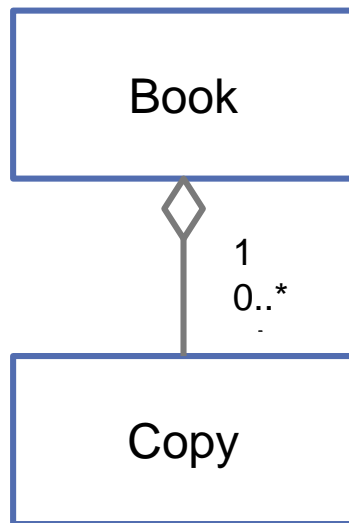
Example



Generic

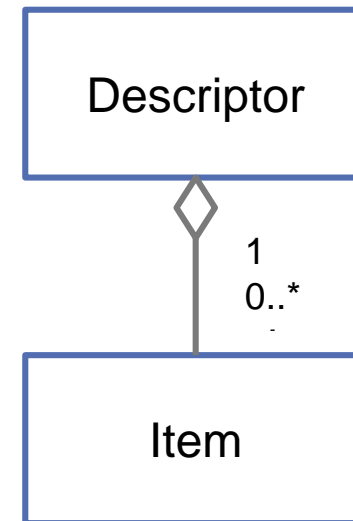
EXPLORE PATTERNS: DESCRIPTOR-ITEM

Example



Descriptor

Generic



GROUP DISCUSSION

- **Suggest class diagrams for these situations:**
 - Patients treated by a physician
 - Planes of different types
 - Cars that drive for Uber
 - Chairs on a plane, which stand in rows and are equipped with video monitors

EVALUATE SYSTEMATICALLY

Structures must be used correctly

- Generalization vs. aggregation
- Aggregation vs. association



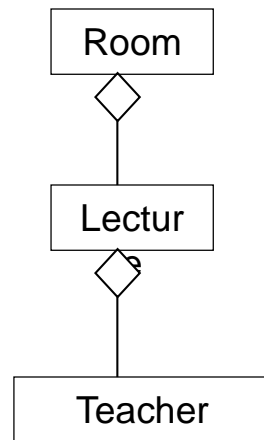
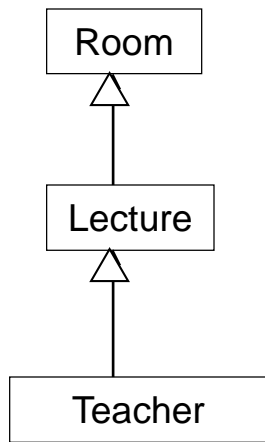
Structures must be conceptually right

- Names, concepts and structures should correspond to the users' understanding
- The future users

Structures must be simple

- Avoid unnecessary generalizations and aggregations
- Check against the systems definition

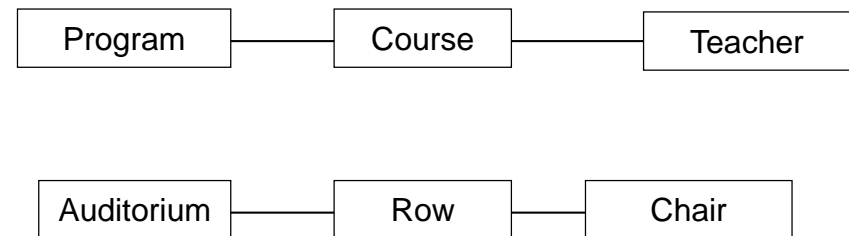
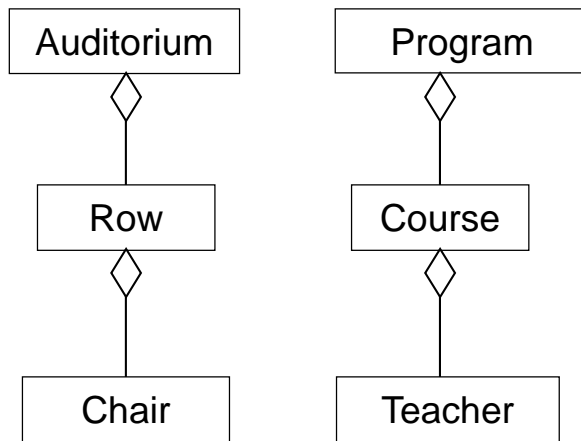
GENERALIZATION, AGGREGATION OR ASSOCIATION?



Which structure is most appropriate?

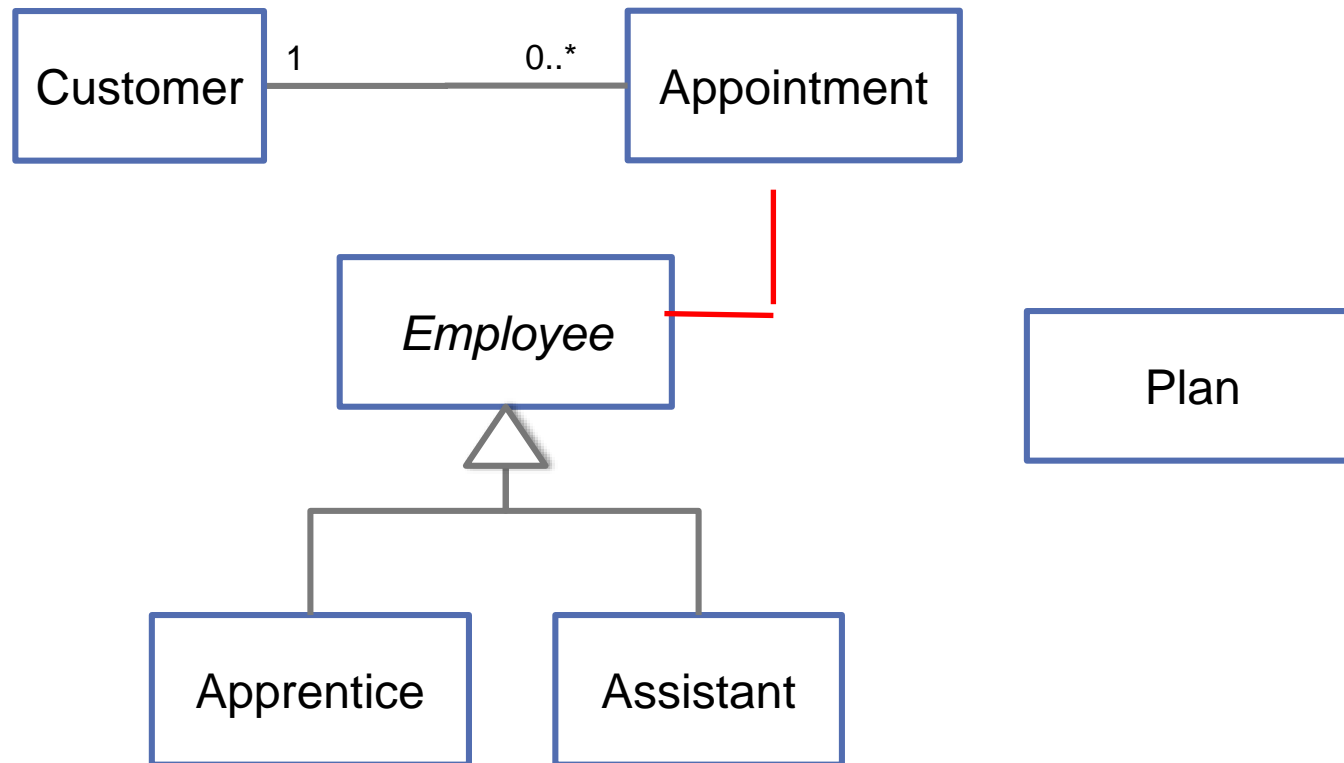
AGGREGATION OR ASSOCIATION?

- Can objects exist independently of each other?
- Are objects equally ranked?
- Can the connection be changed from one pair of objects to another?
- The more 'yes' the more it is an association



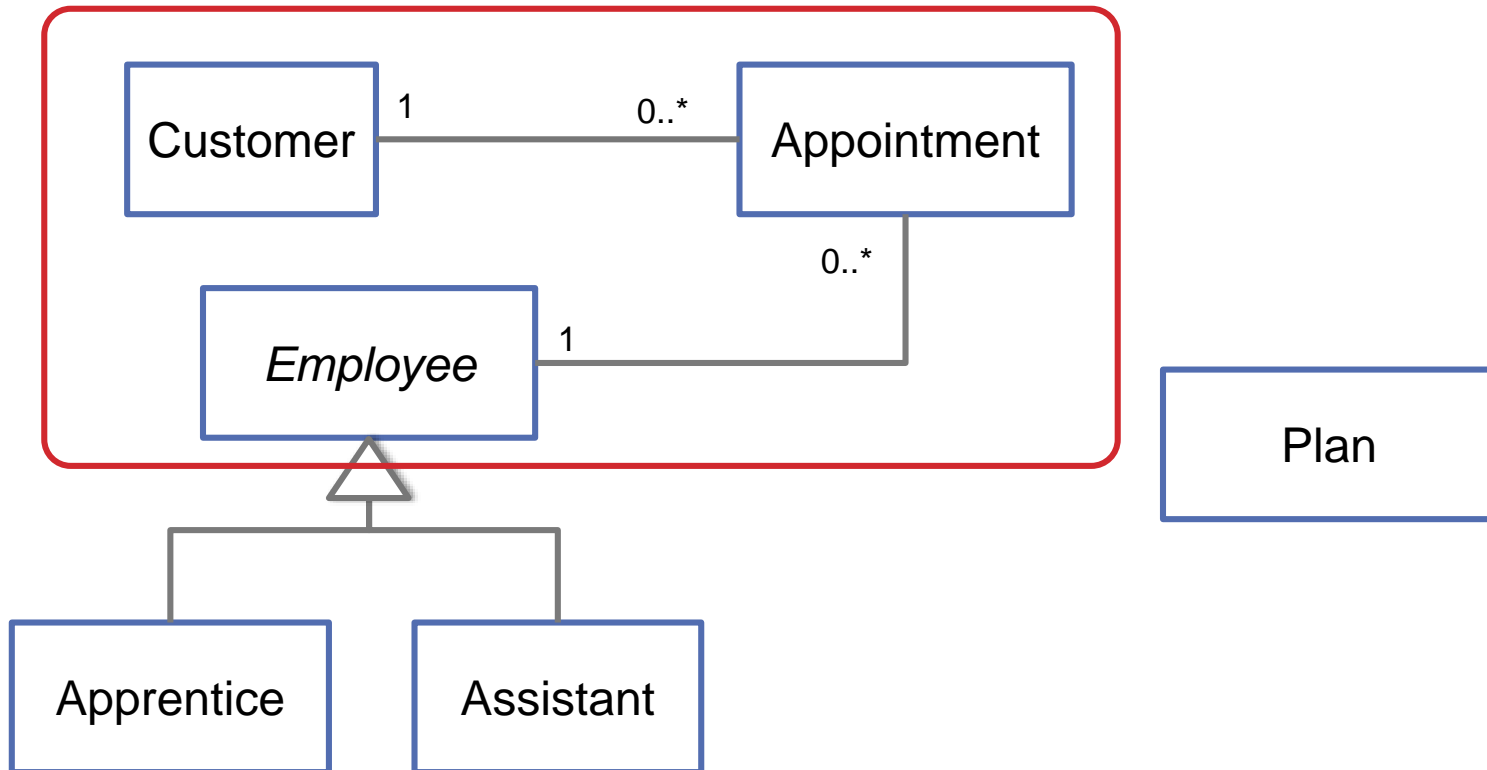
EXAMPLE (3)

	Customer	Assistant	Apprentice	Appointment	Plan
reserved	X	X		X	X
cancelled	X	X		X	
treated	X			X	
employed		X	X		
resigned		X	X		
graduated			X		
agreed		X	X		X



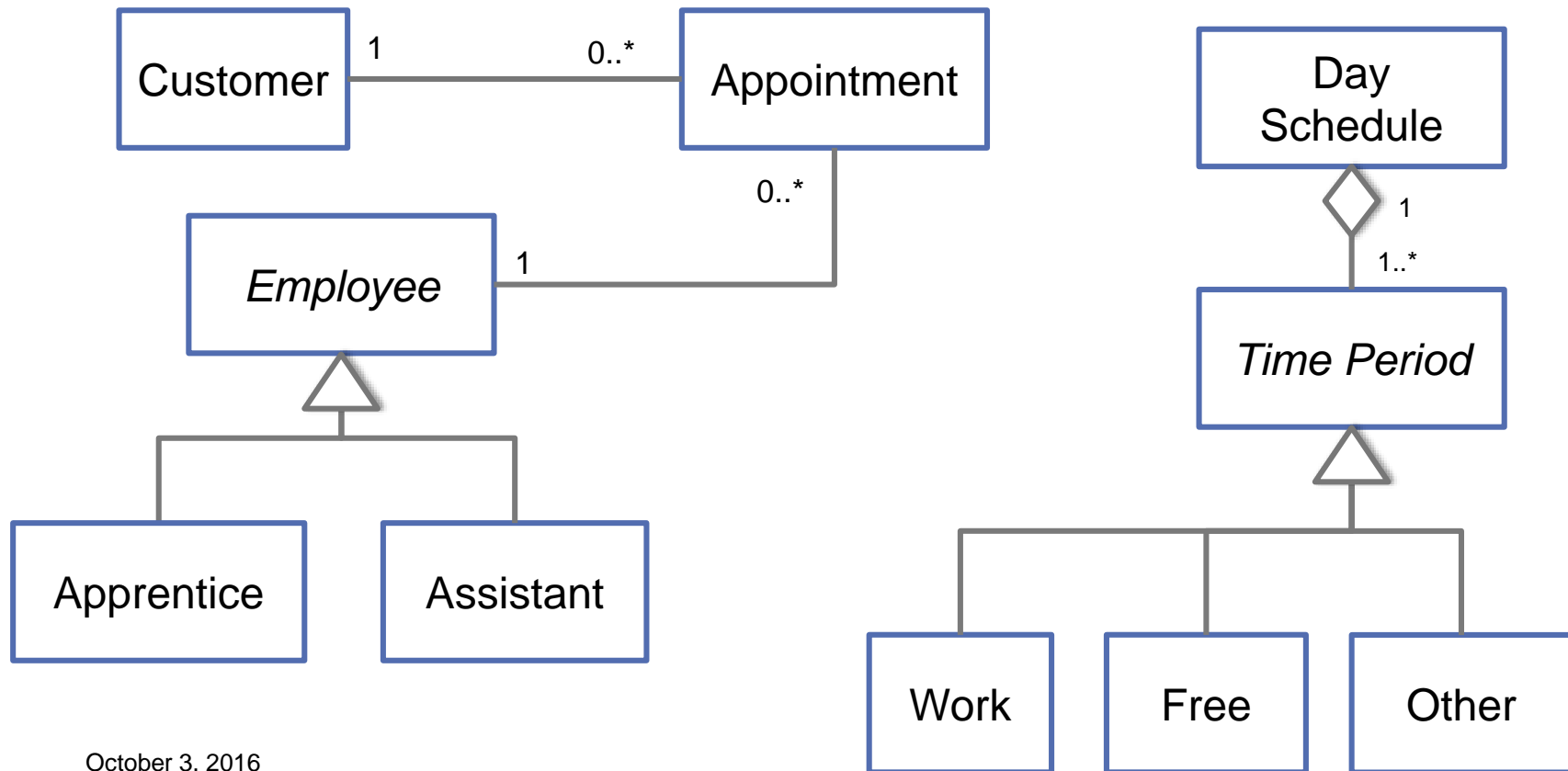
EXAMPLE (4)

	Customer	Assistant	Apprentice	Appointment	Plan
reserved	X	X		X	X
cancelled	X	X		X	
treated	X			X	
employed		X	X		
resigned		X	X		
graduated			X		
agreed		X	X		X



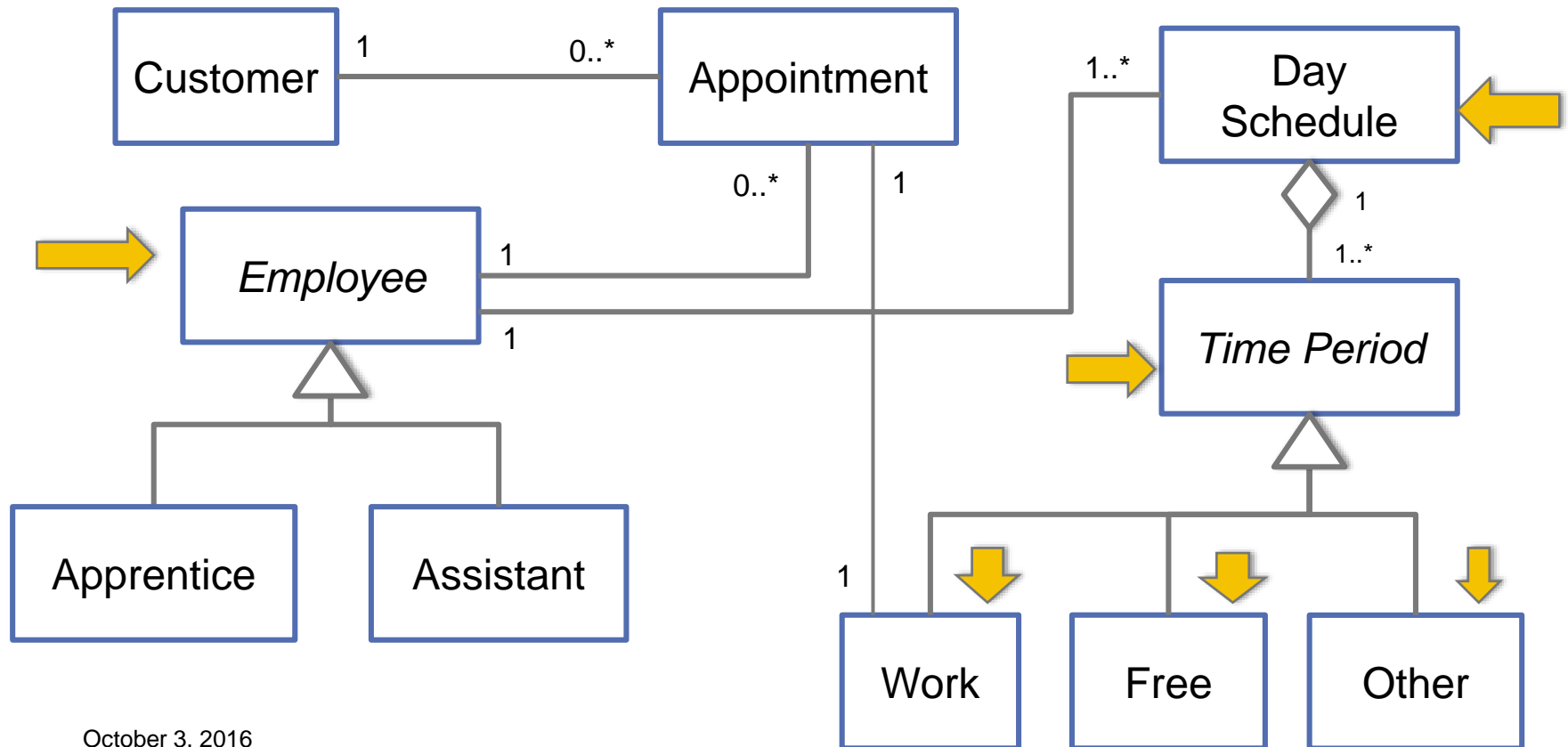
EXAMPLE (5)

	Customer	Assistant	Apprentice	Appointment	Plan
reserved	X	X		X	X
cancelled	X	X		X	
treated	X			X	
employed		X	X		
resigned		X	X		
graduated			X		
agreed		X	X		X



EVALUATE THE EVENT TABLE

	Customer	Assistant	Apprentice	Appointment	Plan
reserved	X	X		X	X
cancelled	X	X		X	
treated	X			X	
employed		X	X		
resigned		X	X		
graduated			X		
agreed		X	X		X



GROUP ASSIGNMENT

System for rating movie shows in a cinema. Registered customers can rate movies after viewing them in a theater.

	Movie	Customer	Show	Cinema
Movie opened	X			
Movie closed	X			
Movie played	X		X	X
Show planned	X		X	X
Customer closed		X		
Customer opened		X		
Movie viewed	X	X	X	
Movie rated	X	X		
Cinema opened				X
Cinema closed				X

OVERVIEW OF 'STRUCTURE'

Purpose

- To describe structural relations between classes and objects in a problem domain

Concepts

- **Class structures:**
 - Generalization: A general class (the super class) describes properties common to a group of specialized classes (the subclass)
 - Cluster: A collection of related classes.
- **Object structures:**
 - Aggregation: A superior object (the whole) consists of a number of objects (the parts).
 - Association: A meaningful relation between a number of objects.

Principles

- Study abstract, static relations between classes.
- Study concrete, dynamic relations between objects.
- Model only the necessary structural relations.

Result

- A class diagram with classes and structures