Software Engineering

Software System Modeling

Learning Outcomes

- Understanding the need of modeling to represent software systems
- Understanding why different types of models are required
- Understanding structured system modeling methods
- Understanding OO oriented concepts and UML software system modeling.

Software System Models

- System modeling is the process of developing abstract models of a system, which each model representing a different view or perspective of that system.

- A model can be used as a tool for communication with clients and also among the development team members.

- Models are used during requirement engineering process to help derive the requirements of the system, during the design process to describe system components and also to document a system.

Software development Methodologies

- Structured Methods(Pascal, C, Cobol, Fotran)
- Object oriented methods(C++, Python, Java)

Structured modeling Diagrams

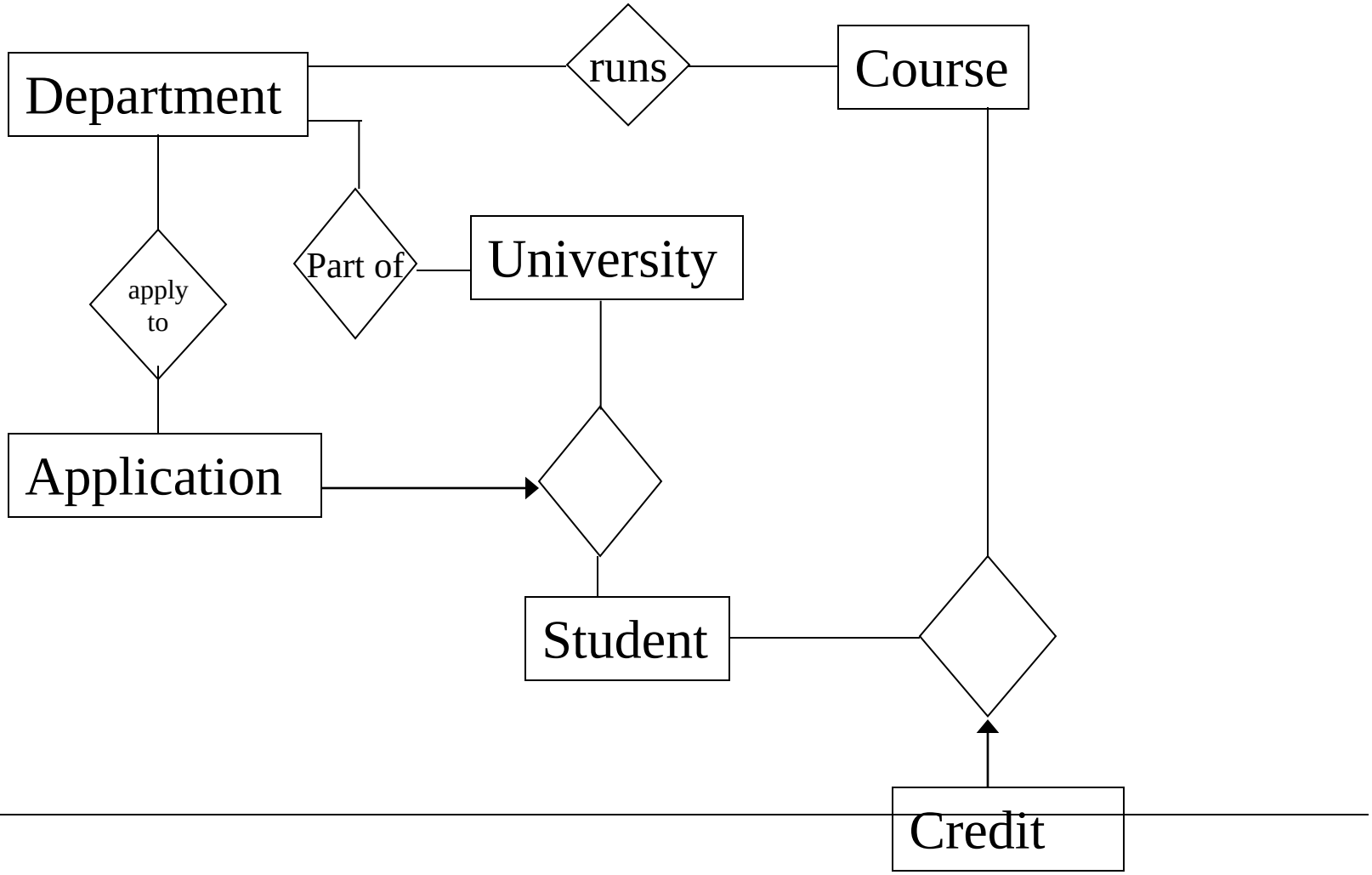
- **Data modeling**

  Entity relationship diagrams

- **Process Modeling**

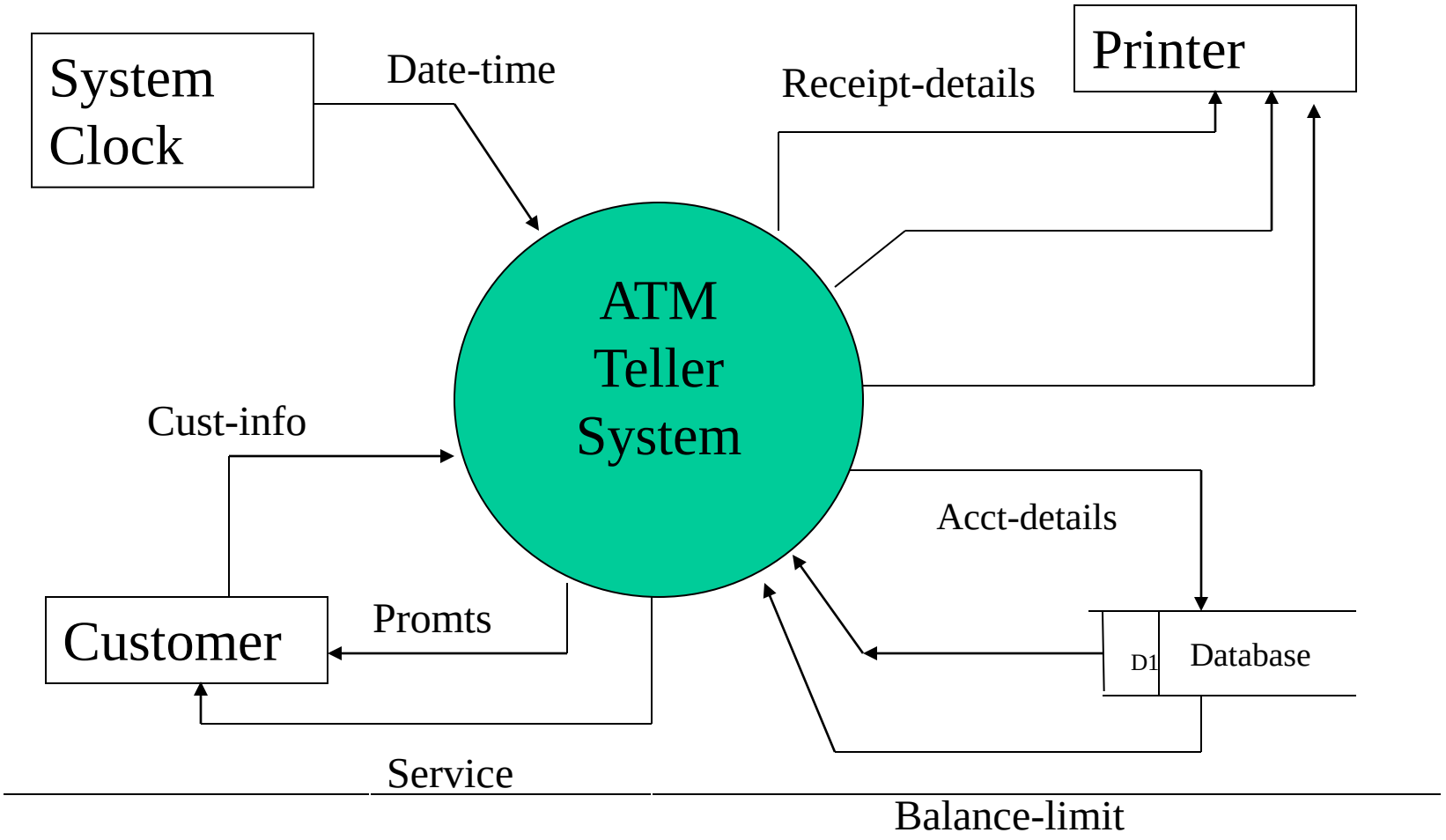
  Dataflow diagrams

Entity Relationship Diagrams

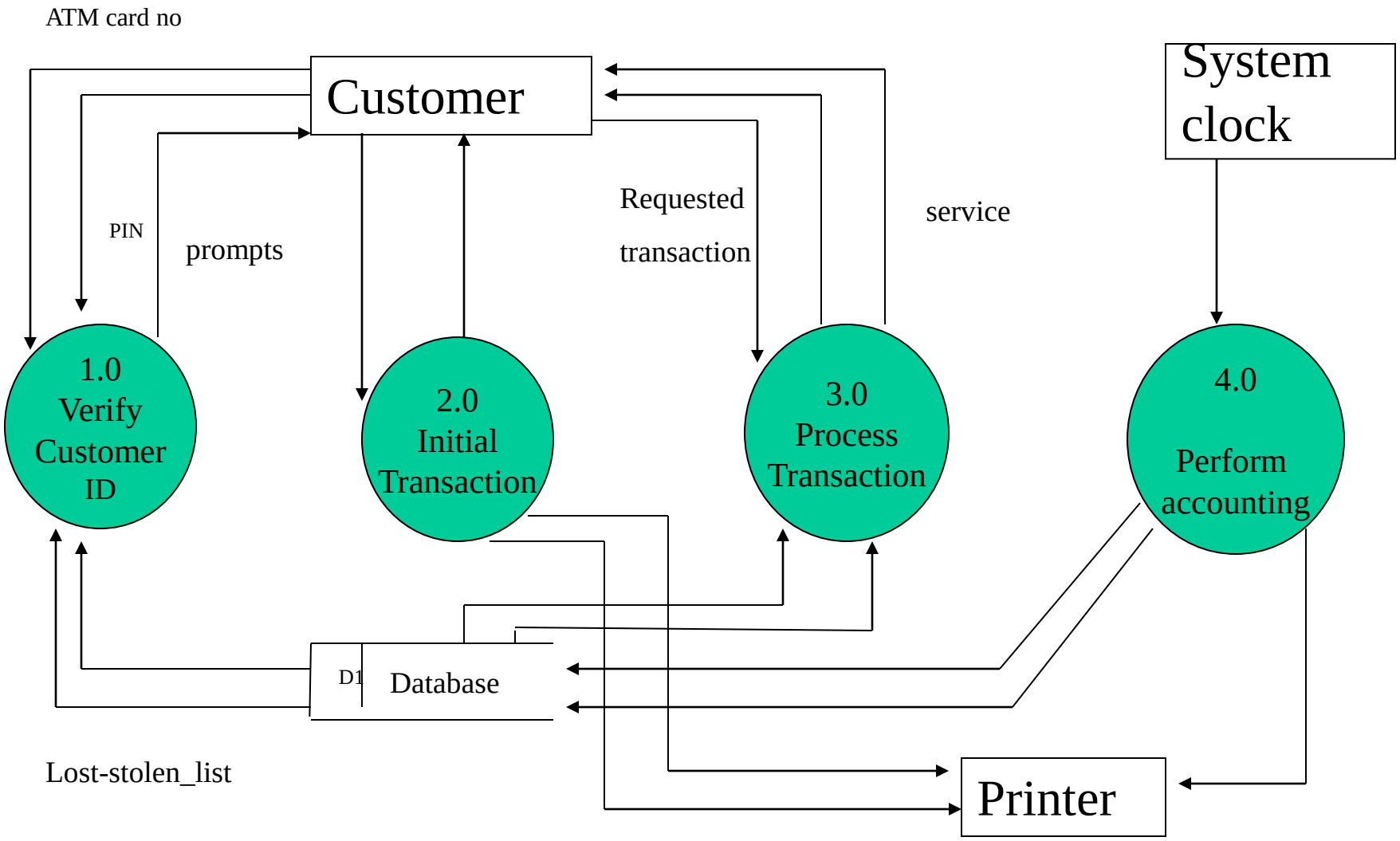


Data Flow Diagrams

Context Diagram



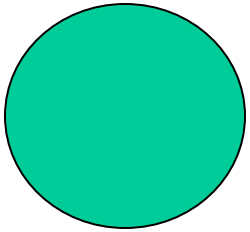
A First Level DFD



DFD Notation

- External Entity

- Process



- Data Store

- Data Flow

Object Oriented Software Systems

- An Object Oriented Software System is a collection of objects which interact with each other to perform system functions.

OO Software System Modeling

- **Interaction Modeling**

  Use Case Diagrams

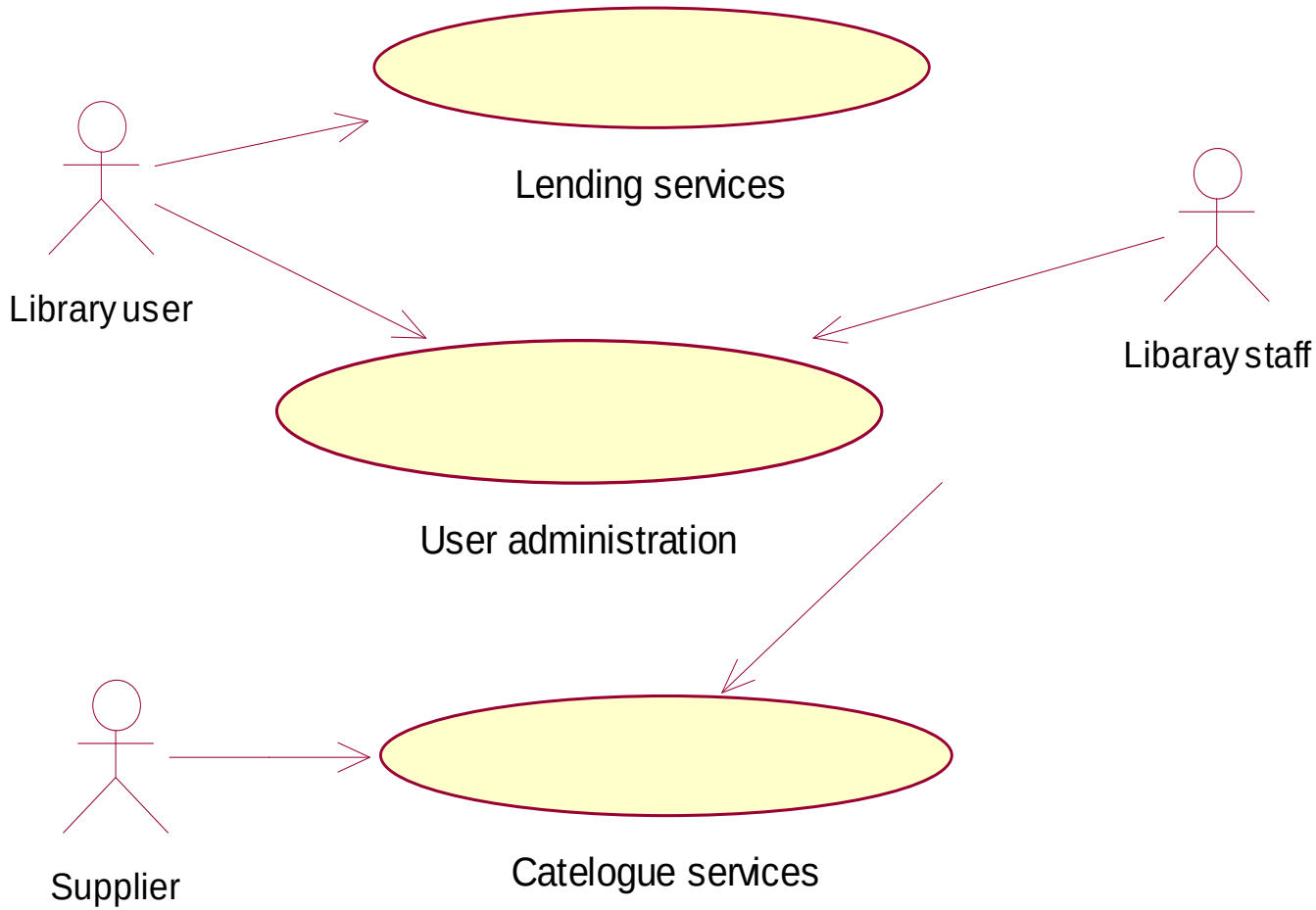
- **Structural Modeling**

  Class Diagrams

- **Behavioral Modeling**

  Sequence Diagrams

A Use-case Diagram

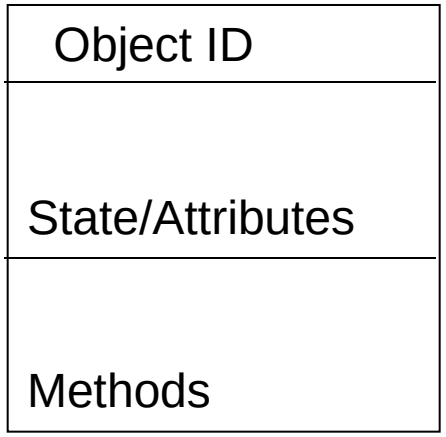


Use-cases are a scenario-based technique for requirements elicitation which were first introduced in the Objectory methods (Jacobson et at 1993).

Use Case Diagrams Exercise

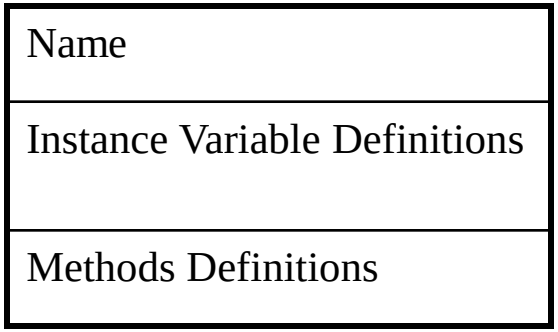
Adwel is an small advertising company. Customers can place their advertising campaigns on line. An advertising campaign consists of many advertisements. An advertisement can be a new paper ad, TV ad or a website ad. The staff of the company are administrative staff and technical staff. Administrative staff perform the administrative management of advertisement campaigns. The technical staff perform technical management of advertisements.

Object



- Represents an entity.
- Has an identity.
- Encapsulates data (attributes) as its state.
- Performs operations when requested.
- Has a public interface.
- Has a private internal representation.

Class



- Defines the structure and the behavior of the particular variety of object.
- Acts as a template or blueprint
- An object must be an *instance* of one(and only one) class.
- A class may have many instance objects.

Instantiation

- The activity of creating an object given its class
- The object's data structure(state) must be initialized.

Structure and Relationships

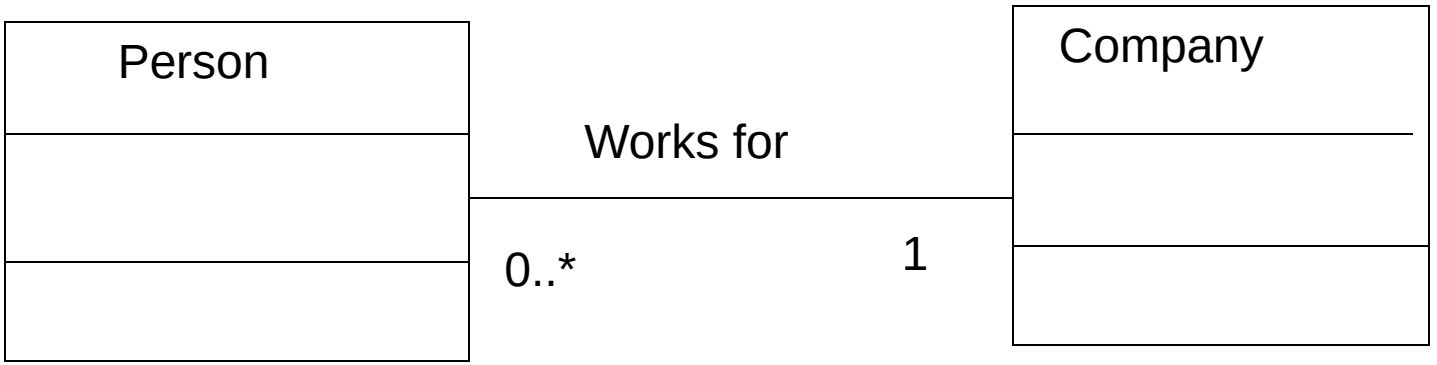
- Classes are used to describe the structure of a system.
- To do this classes must be related or connected with one another.
- There are three key relationships:
  - Association
  - Aggregation(composition)
  - Inheritance

Association

- Models a relationship between two classes.

  For example, the association *works-for* between a person class and a company class.

Association

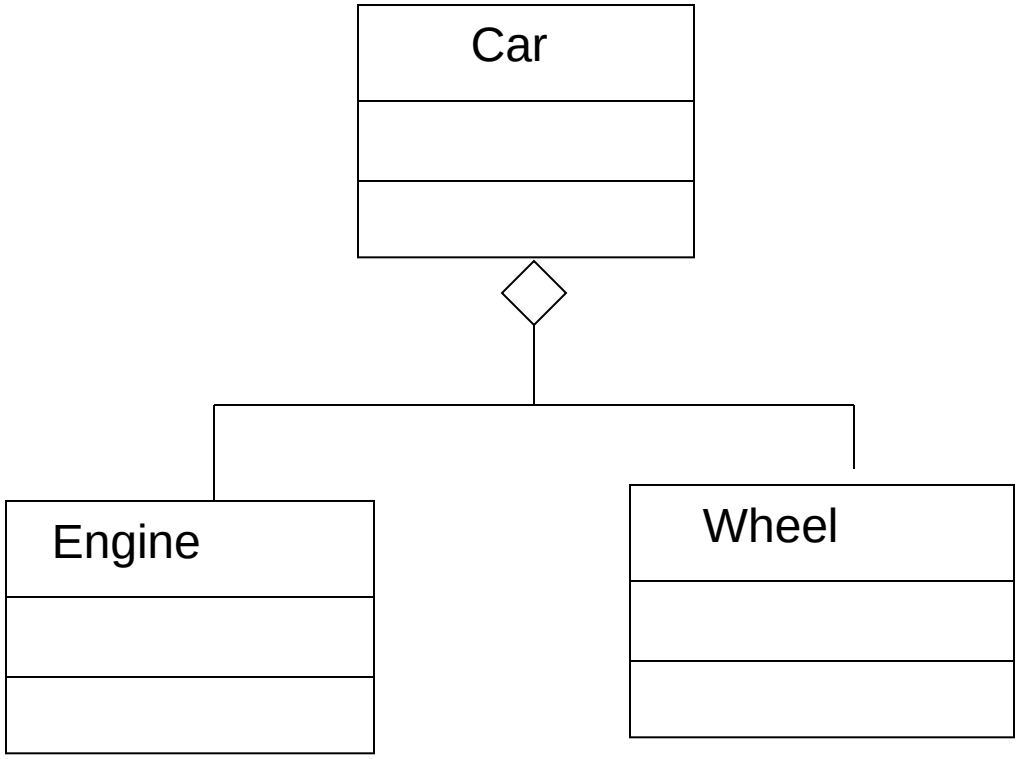


Aggregation(Composition)

- Represents a *part-whole* relationship.
- A stronger form of association.
- The life-time of the whole dictates the life-time of the parts.

For example, an engine is a *part-of* a car.

Aggregation

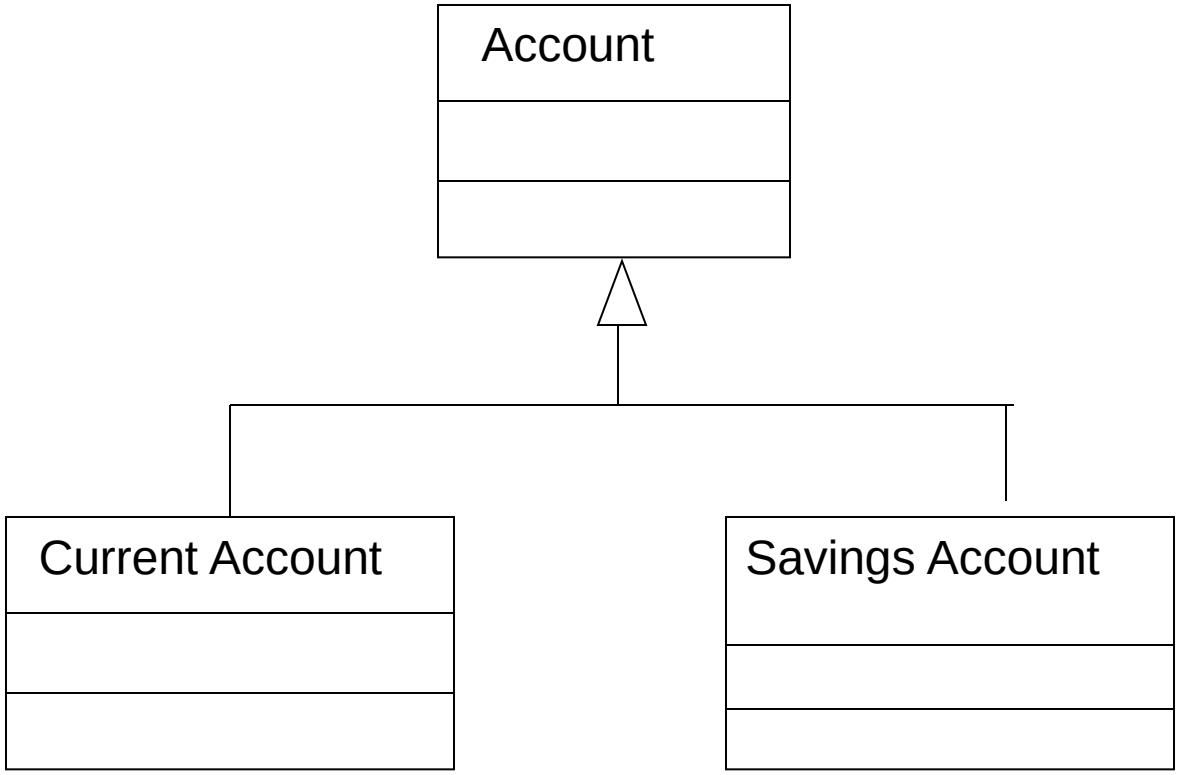


Inheritance

- Models the “ kind-of ” relationship between classes.
- Specifies that one class is an extension of another class.

For example, a dog is a *kind-of* animal.

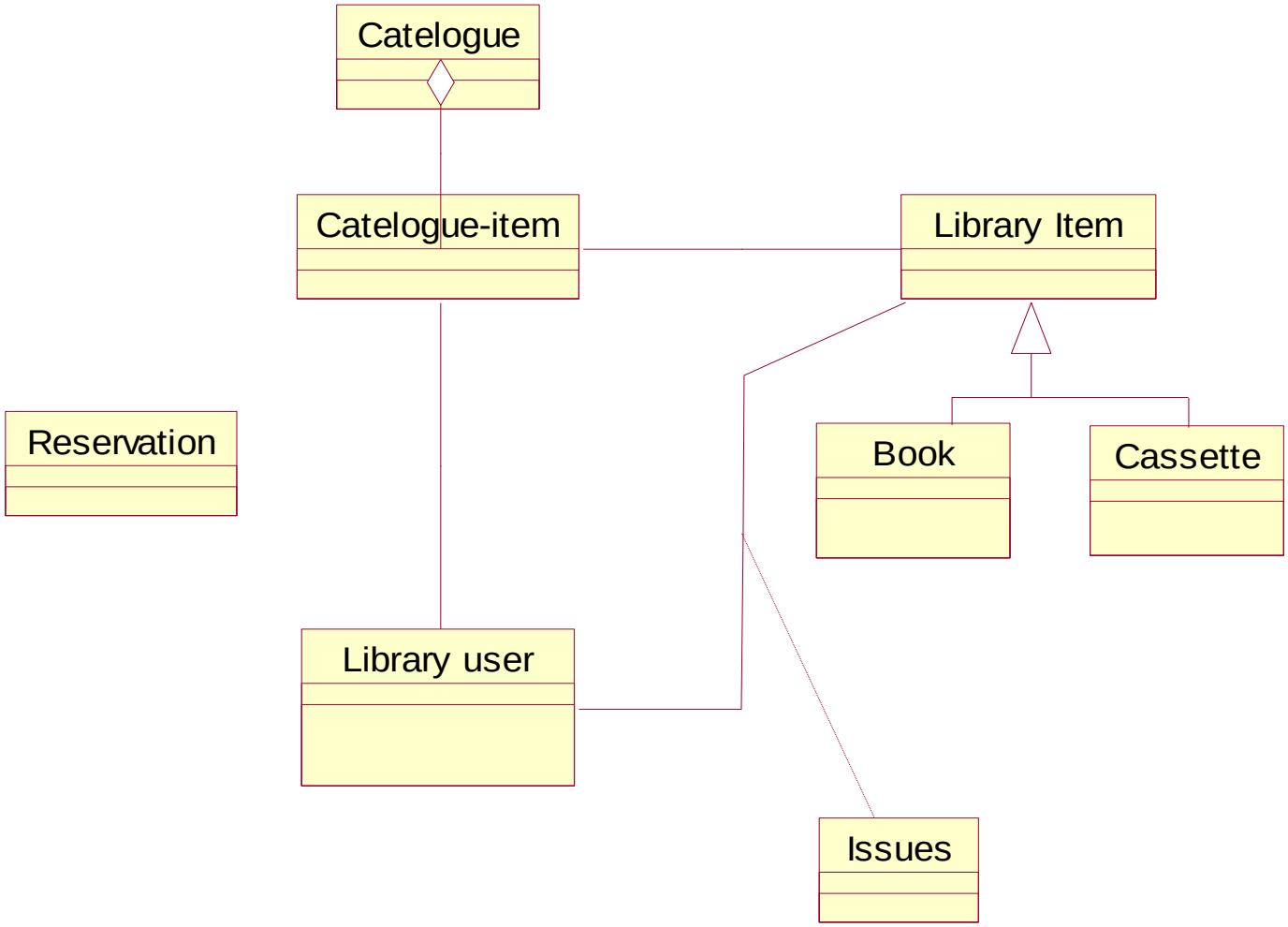
Inheritance



Class Diagrams

A class diagram represents the main classes in a system and their relationships in one diagram. Class diagrams are used for structural modeling of a system and use as a major tool for design of a system.

Class Diagram for a library system



Class diagram for Adwel Advertising system

- Ex . Draw a class diagram for the Adwel advertising system.

Class diagram for a diagram editing tool

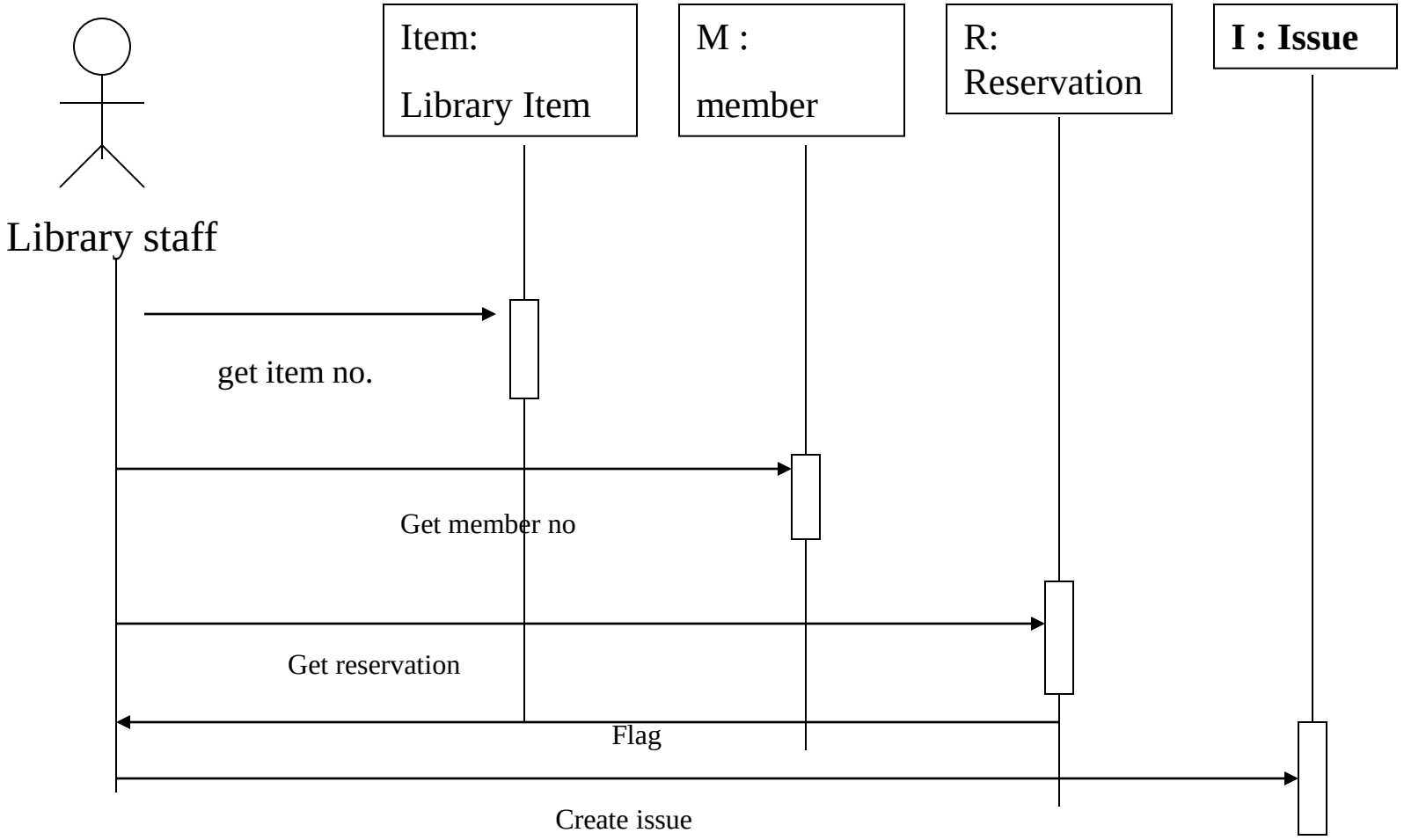
A diagram editing tool need to be developed. The tool operate on documents which contain pages. A page consists of drawing objects. A drawing object can be a text, geometric object or a group. A group is a collection of drawing objects. A geometric object can be a line, a circle or a rectangle.

Draw a class diagram for this system.

Sequence Diagrams

Sequence diagrams model the interaction between objects and also actors to perform a system operation (a use case)

Sequence Diagrams for an issue of a library item



Exercise

Draw sequence diagrams for

- search for a library item
- reservation