

Different models represent system from different perspectives

External perspective

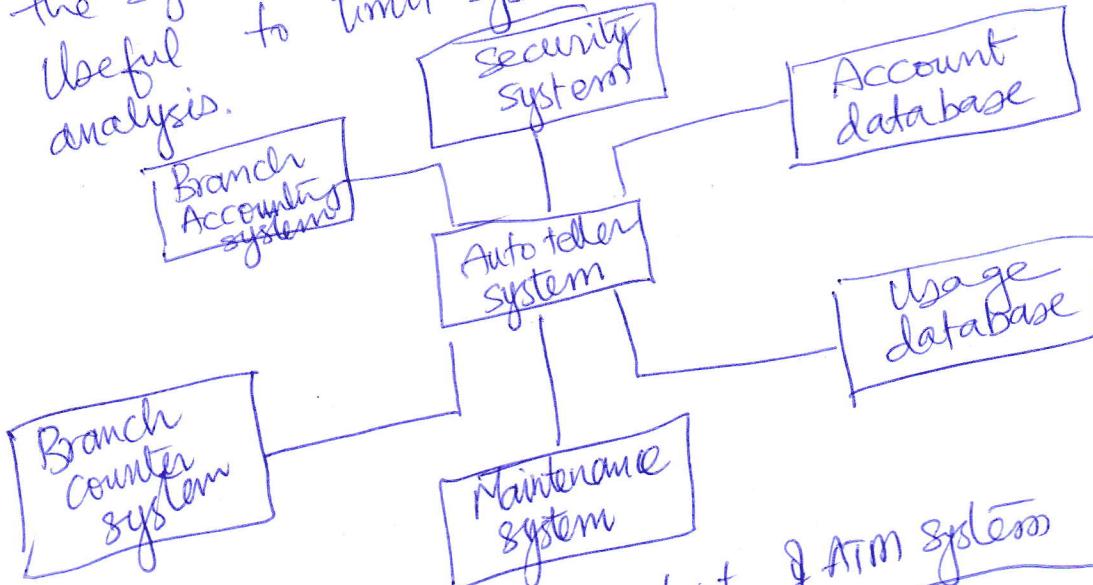
A behavioral perspective

A structural perspective

A context model?

what are context models : Model used to distinguish the system from the environment.

Context Models : Model used to distinguish the system from the environment. Useful to limit system costs and time needed for analysis.



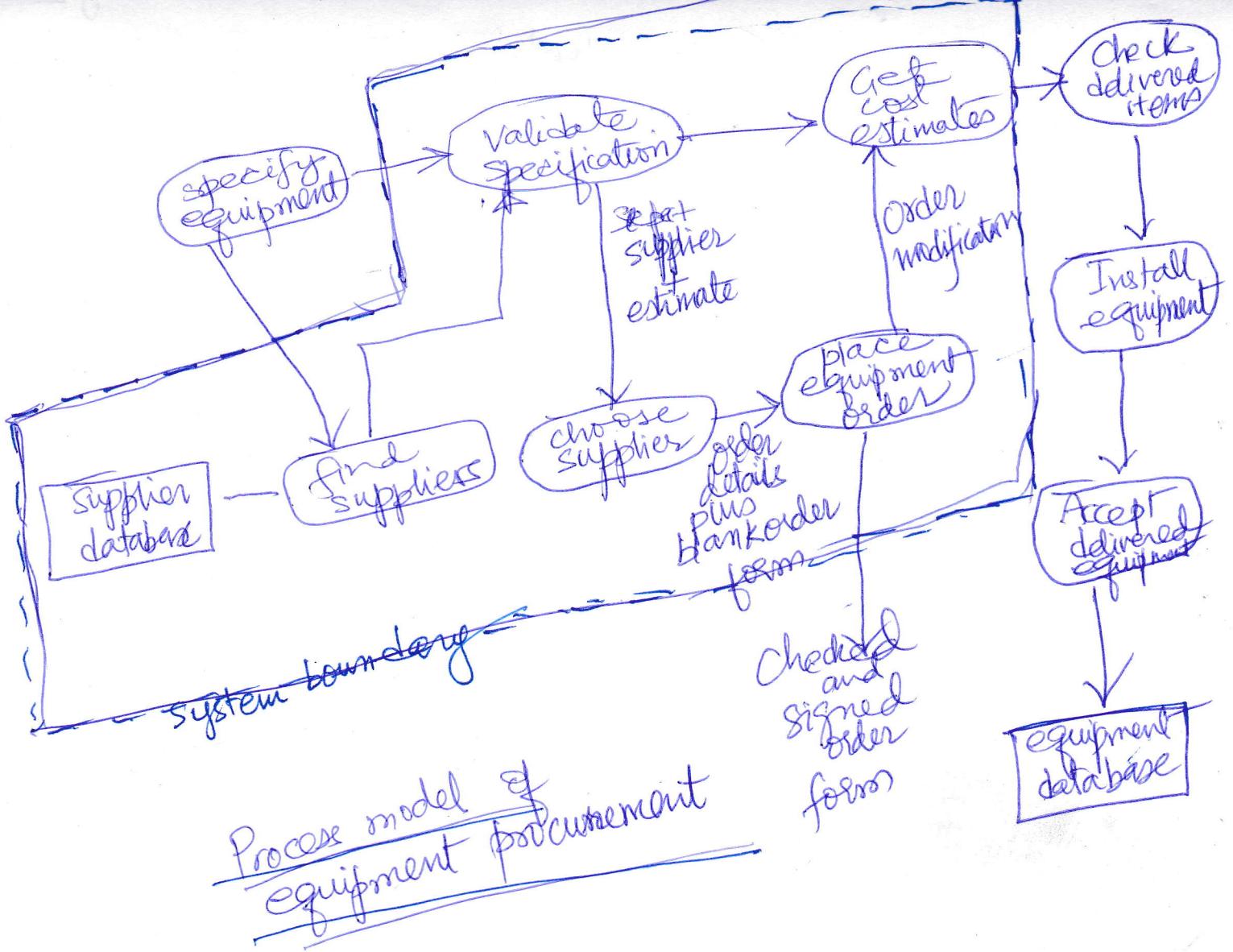
The context of ATM system

What is the difference between ~~system models~~ representation and abstraction?

Representation should maintain complete information of the entity (being represented).

Abstraction simplifies an entity and represents only the most salient (important) characteristics of an entity.

A system model is an abstraction of a system. It deliberately picks only some salient features. Thus there are many types of system models. e.g.: dataflow, stimulus-response models etc.



Behavioral Models :

What are behavioral models ?  
They are used to describe overall behavior of the system  
(Abstraction)

behavioral models are two types

① dataflow models      ② state-machine models

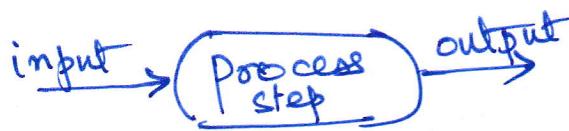
What's the purpose of these models ?  
Most business systems are primarily data driven. These systems can be modeled using data-flow models.

Real-time systems are primarily event-driven. These systems can be modeled using state-machine models

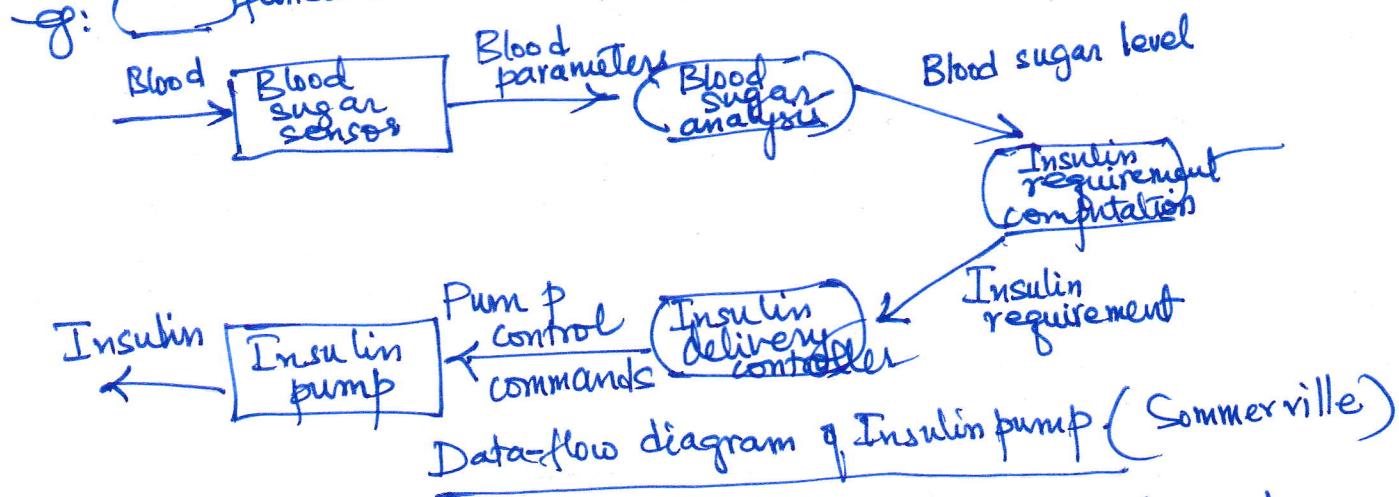
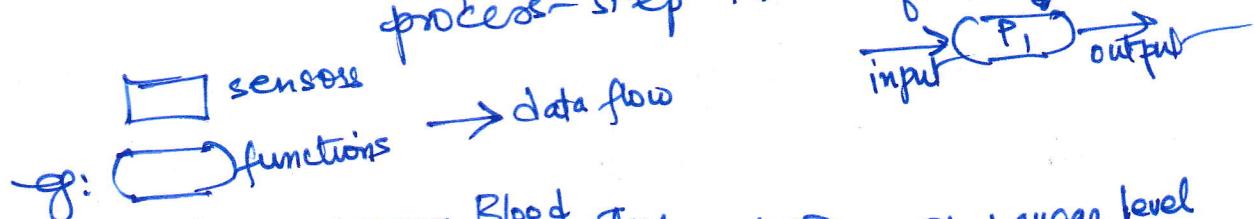
Data-flow model (abstracts) focuses on flow of data in a system  
State-machine model focuses on how system reacts to events .

Data-flow models: They show how data flows through a sequence of processing steps

They show functional-perspective, where input data is processed (transformed) into output data for each process step (function).



- Steps:
1. ~~First~~ Identify the process-steps (functions) to create data-flow model
  2. Identify the sequence of flow of for process steps
  3. Identify the input and output for each process step(function). The output of one process-step becomes input to next process-step in sequence (flow).



These models are simple and can be validated by customers/end-users.

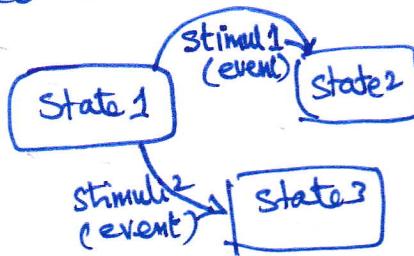
State machine models: It models how system responds to internal and external events.

It consists of

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graph LR
    A[states] --> B[events]
    B --> C[transitions]
  
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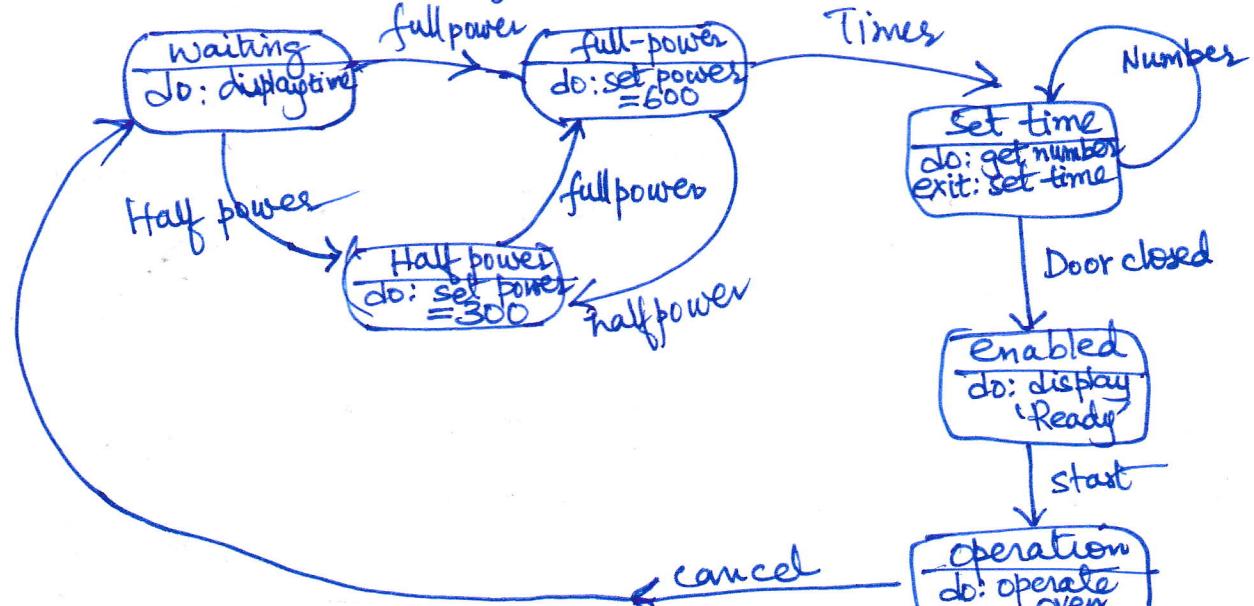
It assumes that a system at any time is in one of the multiple states. The system transitions to a different state based on the event (stimuli) it receives



Arrow represents transition  
Label of arrow represents event/stimuli

All the states represent the states of the same system.

e.g.: State-machine model of simple microwave (UML notation)



Here labels on transitions (arrows) represent buttons or selection on microwave OVEN.

States of system may increase rapidly for large systems. In such cases, a superstate can encapsulate a number of substates to simplify the diagram. The expanded version of the superstate can be represented elsewhere without causing too much clutter.

## Data Models

Structural perspective (modeling types)

1. Data models      2. Object models (types)

1. inheritance models      2. Object aggregation models

What are data models?

Data Models: For data-oriented systems, like systems

that use large databases, system models are used  
to represent the logic form of data being processed.  
Such models are called semantic data models.

A widely used data modeling technique is Entity-Relationship

- Attribute (ERA) models.

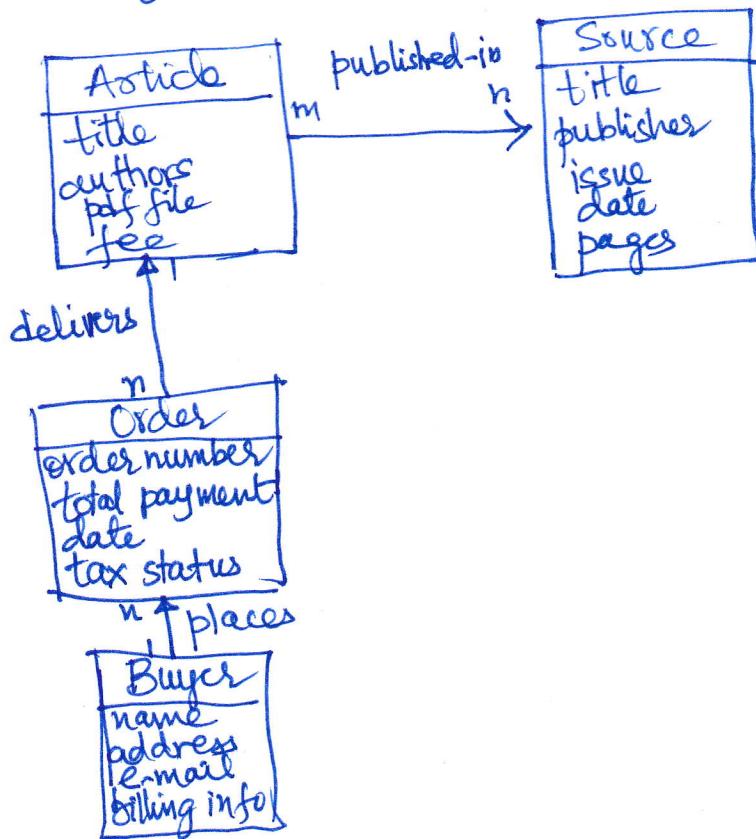
These models show the entities their attributes and the  
relationships between these entities.

Relational database schemes are derived from  
these models

It is simple to implement these models using  
Object-oriented

database.

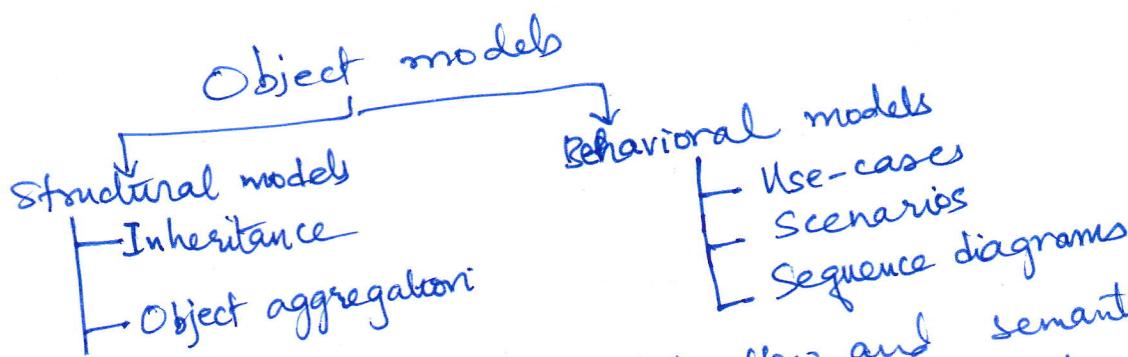
UML ~~may be~~ notation may be used to represent database  
modeling.



What is a Data dictionary?

It is a list of all names included in system modeling with description of named entities, composition of objects if any. Other details could include date of creation, creator's name and other information.

- Advantages:
1. It is a single repository for entities, attributes and relationships so that developers and other use the names consistently with no duplication
  2. Single repository for information about a system for entire organization. This information can include links between analysis, design, implementation & evolution phases



Object model combine both data-flow and semantic data models. They additionally classify the entities and represent their composition. Object-models represent real-world entities especially at lower-level of abstraction like cars, aircrafts, books etc.

What is object-oriented analysis?  
An object class abstracts set of objects that have common attributes and services provided by that each object.

Objects are instantiations of class.  
(Object-oriented)  
Requirements analysis mostly focus on just identify object classes, their relationships and how they are aggregated to form other objects.

The Unified Modeling Language (UML) is now a standard way to represent these models.

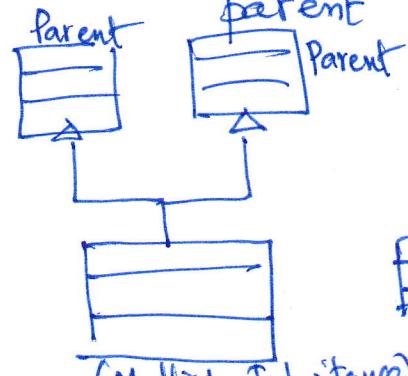
What are Inheritance models?

Once the domain ~~object~~ class objects are identified, they are organized into a taxonomy.

Taxonomy shows classification scheme about how a class ~~is~~ related to other classes through attributes & services.

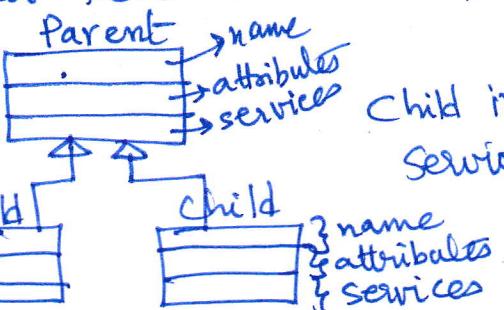
Inheritance models classify classes based on inheritance of attributes and services of a class by other classes (parent) (children)

In UML notation an arrow points 'upwards' to the parent rather than 'downwards', towards the child



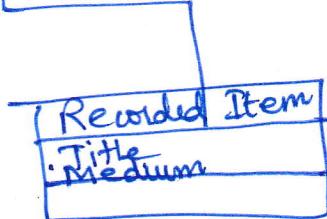
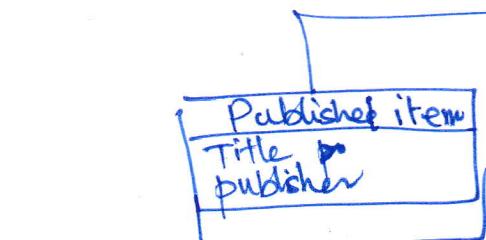
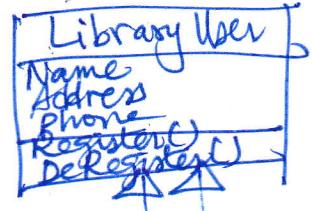
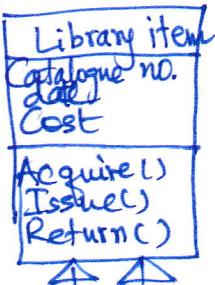
(Multiple Inheritance)

Child inherits from more than one parent.  
attribute & services



(single inheritance)  
Child inherits attributes and services from parent.

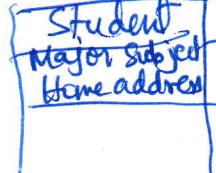
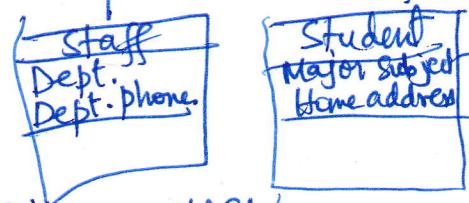
e.g.:



Class hierarchy of library (items)

(Sommerville)

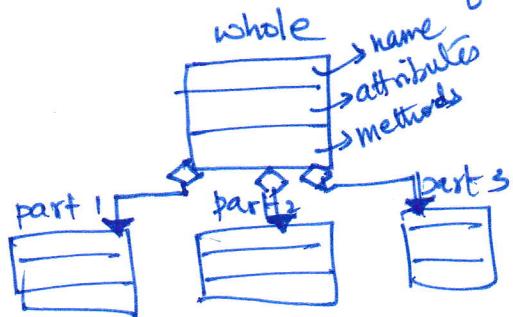
Library User hierarchy  
(Sommerville)



What are aggregation models?

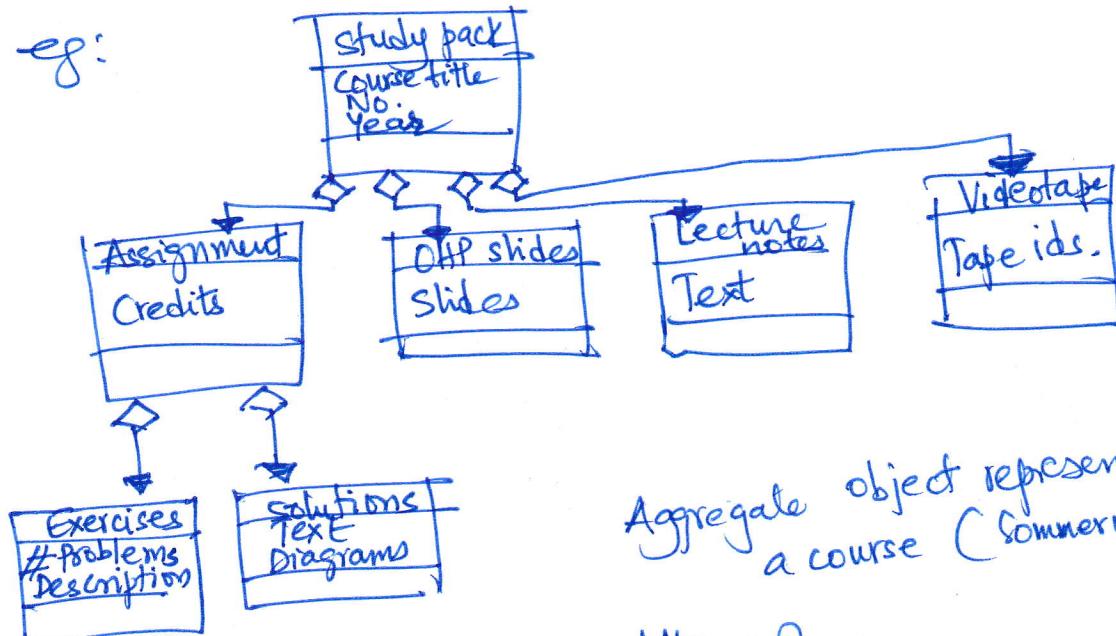
Class may also be classified using aggregation i.e., an class is an aggregate of a set of other classes (object)

UML represents aggregation using a diamond shape symbol on the source of the link (whole)



Here whole object is composed on ~~on~~ three part objects i.e., part1, part2 & part3.

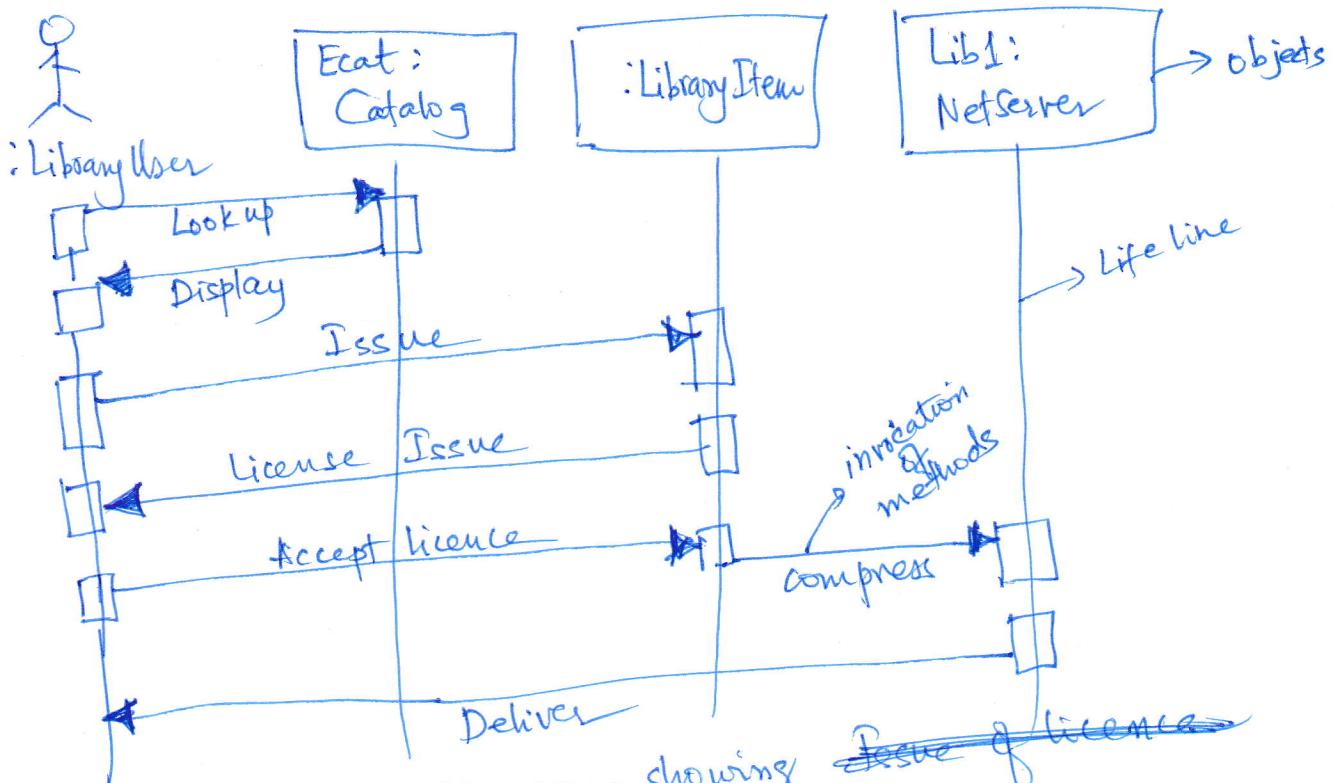
e.g.:



Aggregate object representing a course (Sommerville)

What is object behavior modeling?

This model shows how operations provided by objects are used. Use-case diagrams, collaboration diagrams (communication), sequence diagrams etc. are used for modeling behavior.



Sequence diagram showing ~~Issue of licence~~  
issue of electronic items

### Structured methods

Structured methods provide a systematic way of producing system models during requirements elicitation & analysis. CASE tools support structured methods for projects.

~~CASE~~ CASE tool support ~~include~~ for Structured methods include:

- Diagram editors
- Design & Analysis & checking tools
- Repository query language
- Data dictionary
- Code generators
- Import/Export facilities

etc...