System Modeling

Lecture # 24

Lecture by Engr. Sidra

Structural models

- Structural models of software display the organization of a system in terms of the components that make up that system and their relationships.
- Structural models may be static models, which show the structure of the system design, or dynamic models, which show the organization of the system when it is executing.
- You create structural models of a system when you are discussing and designing the system architecture

Class diagrams

- Class diagrams are used when developing an object-oriented system model to show the classes in a system and the associations between these classes.
- It is static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.
- A UML class diagram is made up of: A set of classes and A set of relationships between classes
- A class is a description of a group of objects all with similar roles in the system, which consists of:
  - **Structural features** (attributes) define what objects of the class "know"
  - **Behavioral features** (operations) define what objects of the class "can do"

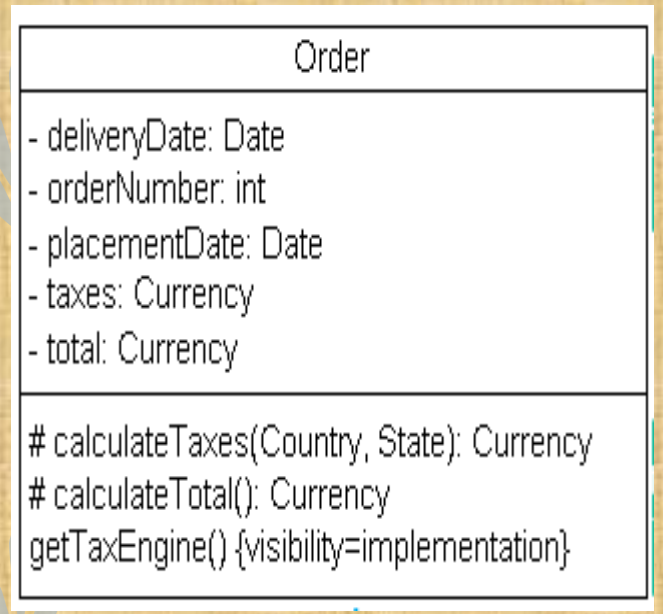
Class Diagram

Class

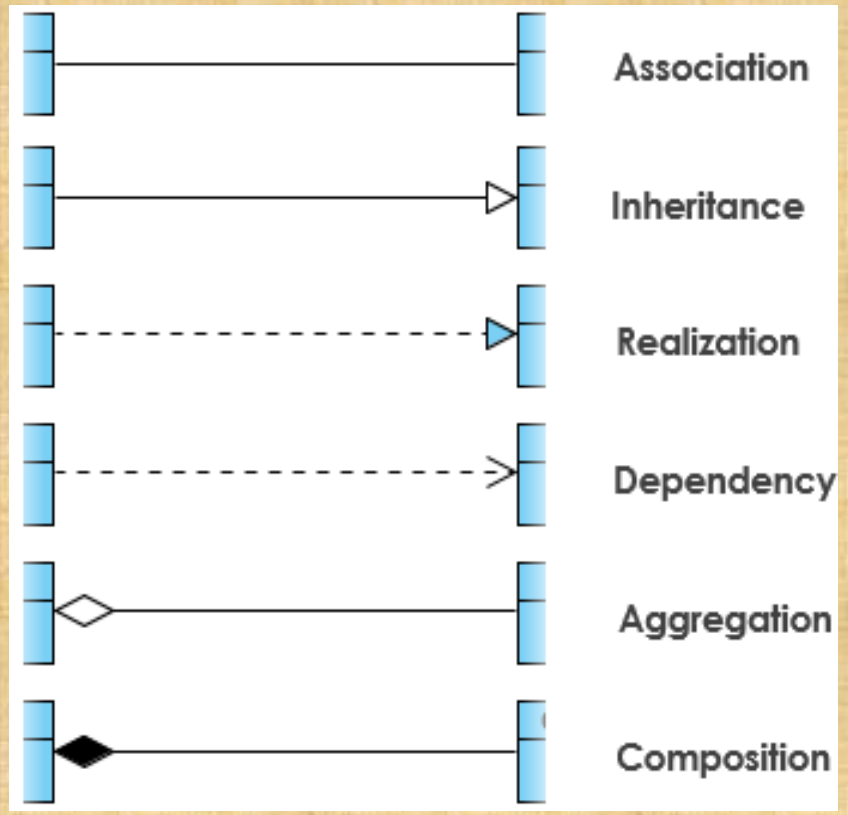
Name

Attributes

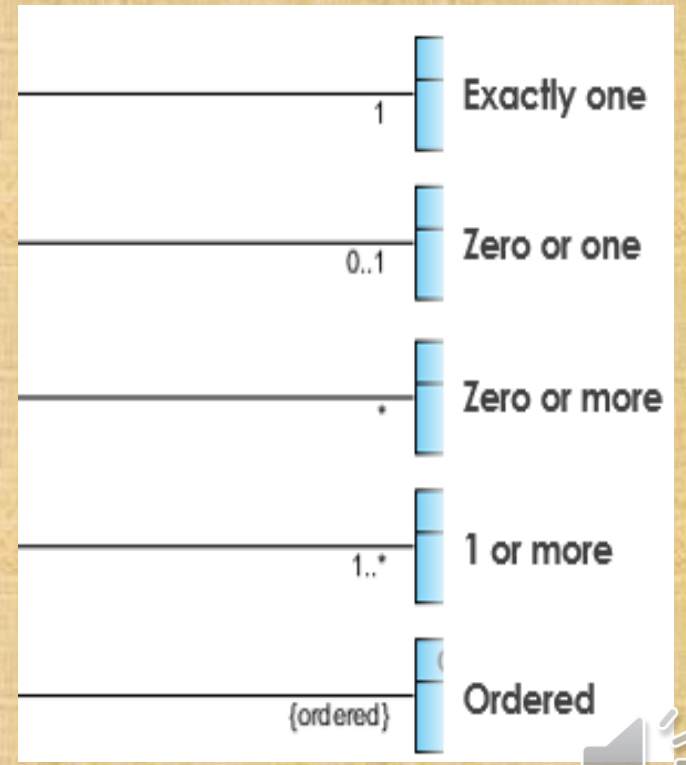
Operations

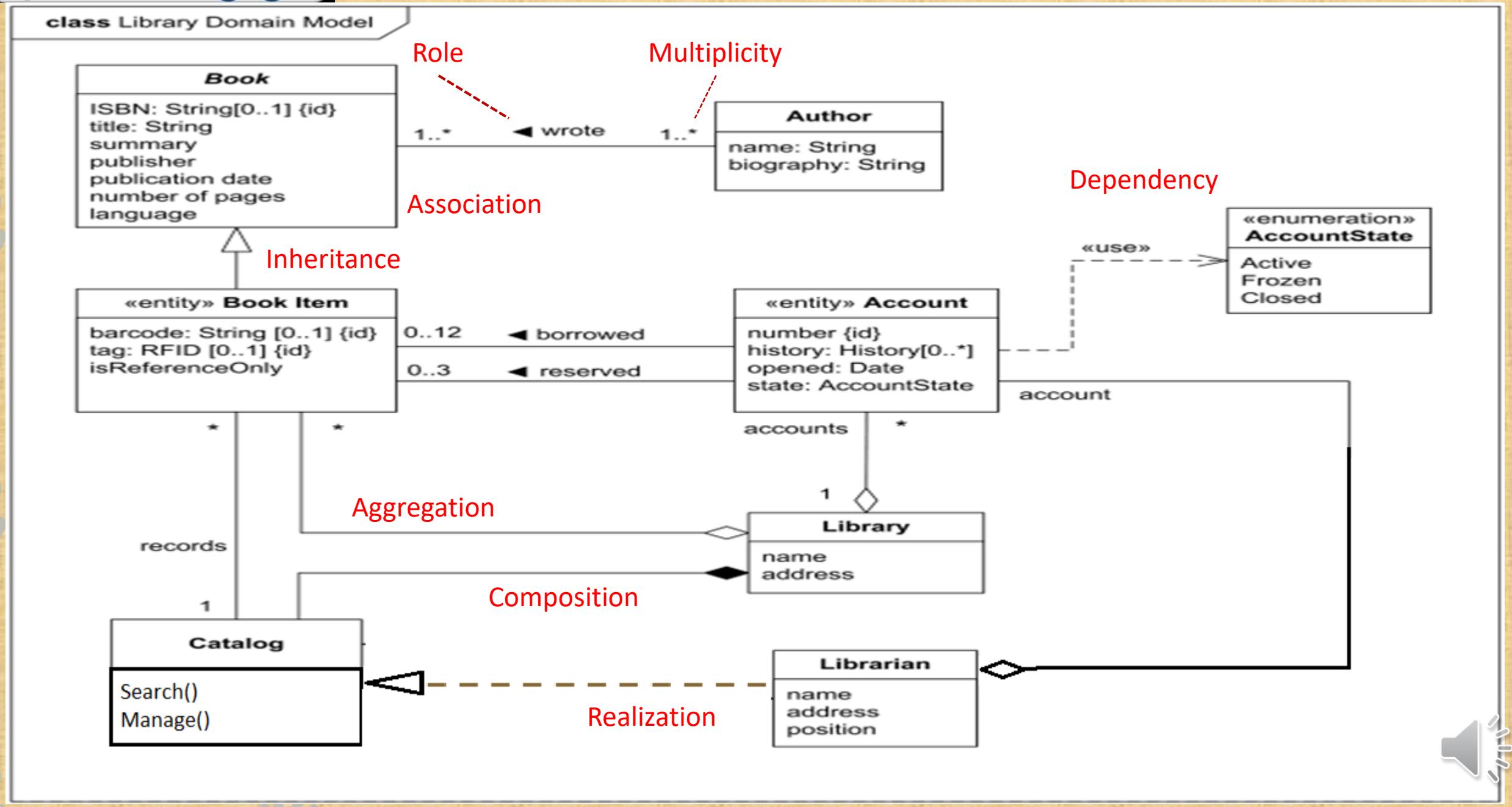


Relationship between Classes



Cardinality




class Library Domain Model
Role
Multiplicity
Book
ISBN: String[0..1] {id}
title: String
summary
publisher
publication date
number of pages
language
1..*
wrote
1..*
Author
name: String
biography: String
Association
Dependency
«enumeration»
AccountState
Active
Frozen
Closed
«use»
Inheritance
«entity» Book Item
barcode: String [0..1] {id}
tag: RFID [0..1] {id}
isReferenceOnly
0..12
borrowed
0..3
reserved
«entity» Account
number {id}
history: History[0..*]
opened: Date
state: AccountState
account
accounts
*
*
*
1
Aggregation
records
Library
name
address
Composition
1
Catalog
Search()
Manage()
Librarian
name
address
position
Realization

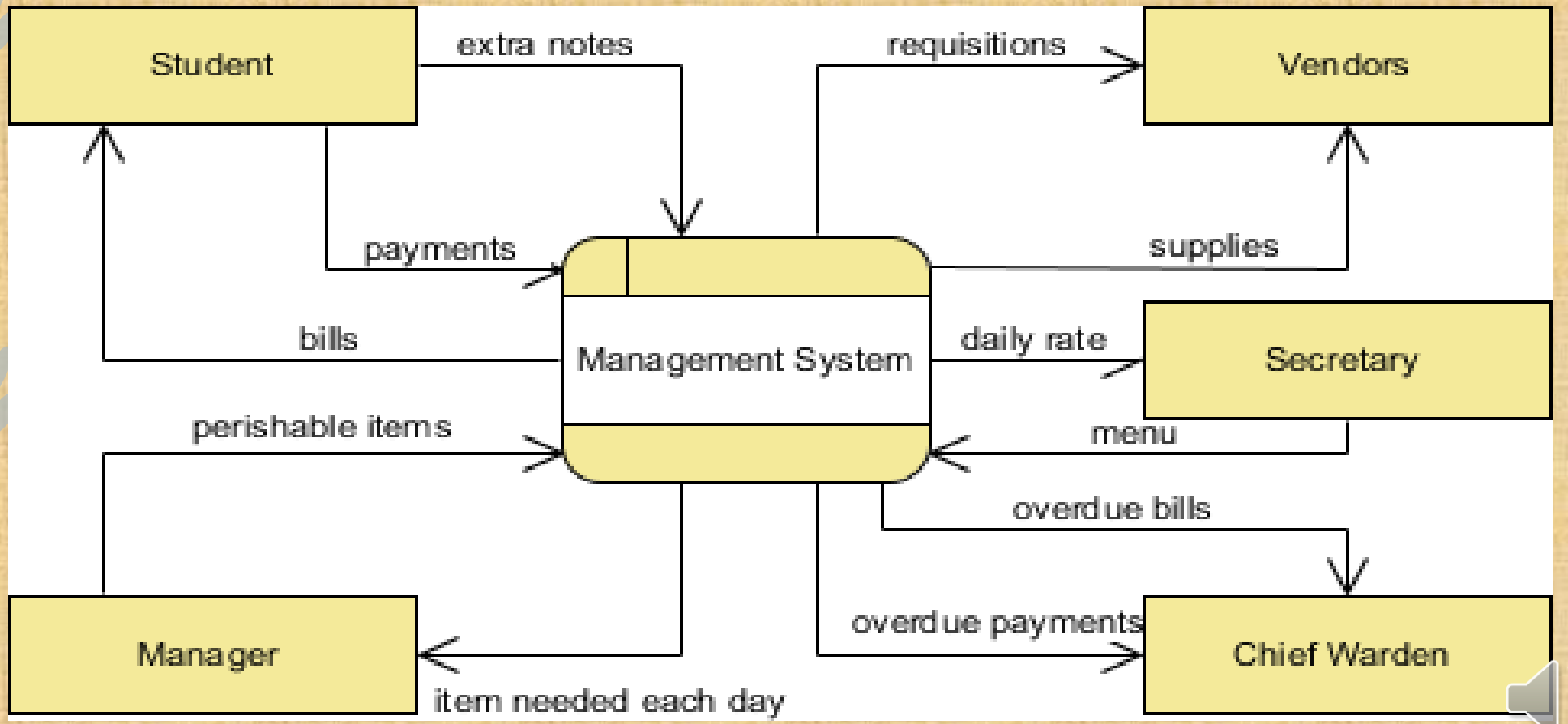
Behavioral Models

- Behavioral models are models of the dynamic behavior of a system as it is executing. They show what happens or what is supposed to happen when a system responds to a stimulus from its environment.
- You can think of these stimuli as being of two types:
  - Data Some data arrives that has to be processed by the system.
  - Events Some event happens that triggers system processing. Events may have associated data, although this is not always the case

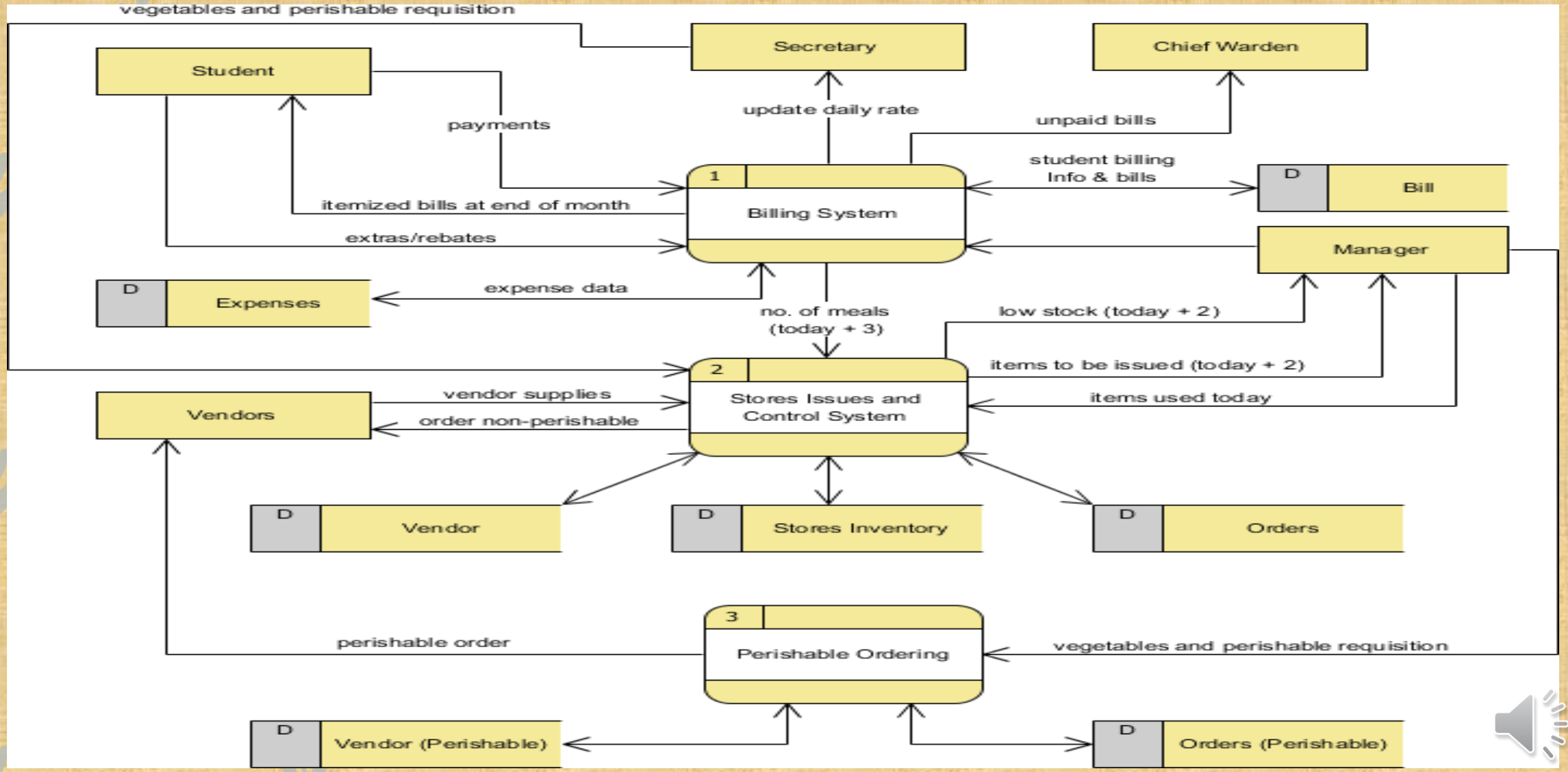
Data-Driven Modeling

- Many business systems are data-processing systems that are primarily driven by data. They are controlled by the data input to the system, with relatively little external event processing.
- Data-driven models show the sequence of actions involved in processing input data and generating an associated output.
- They are particularly useful during the analysis of requirements as they can be used to show end-to-end processing in a system.

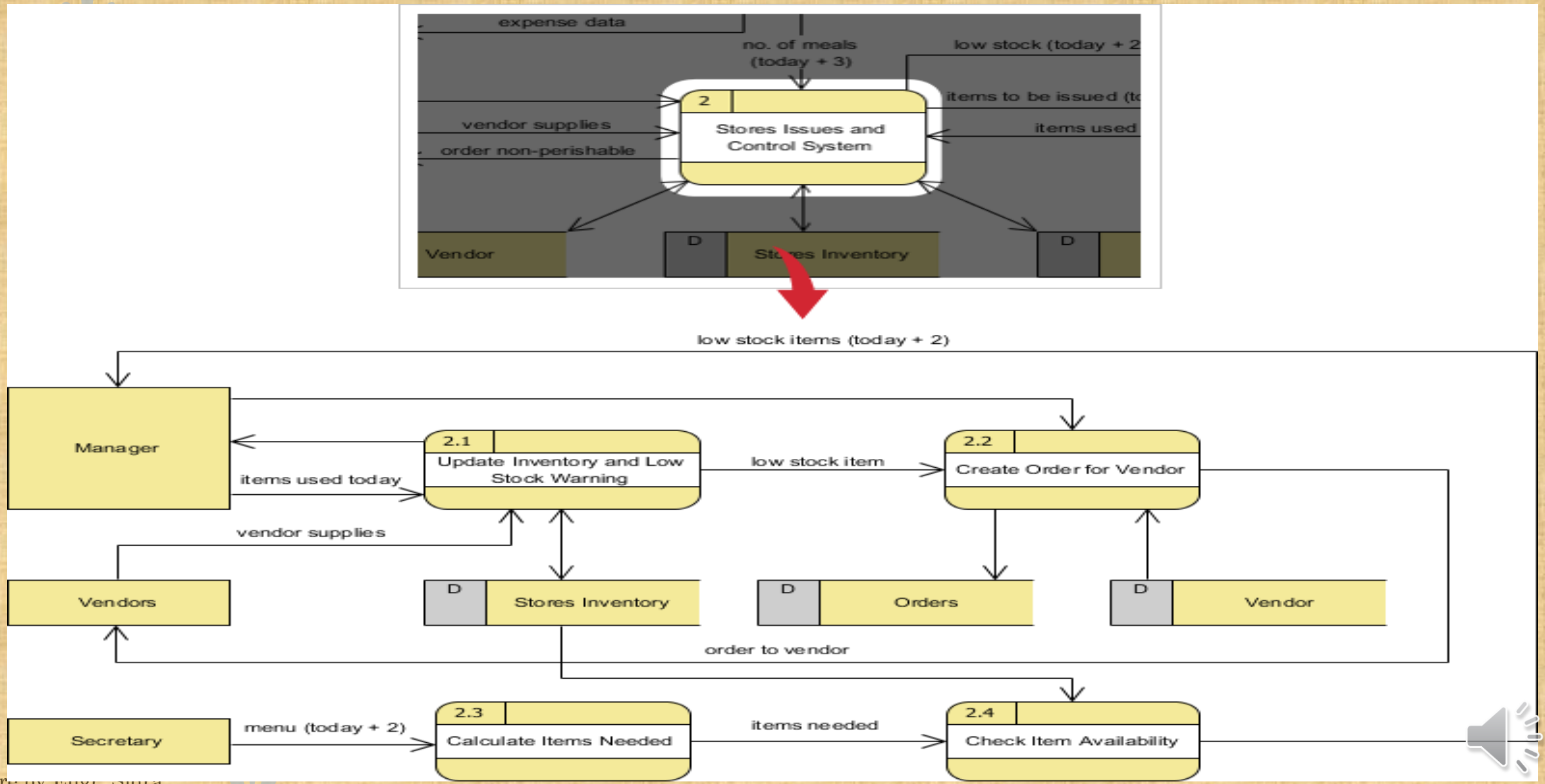
Data Flow Diagram (Level 0 or Context Level)



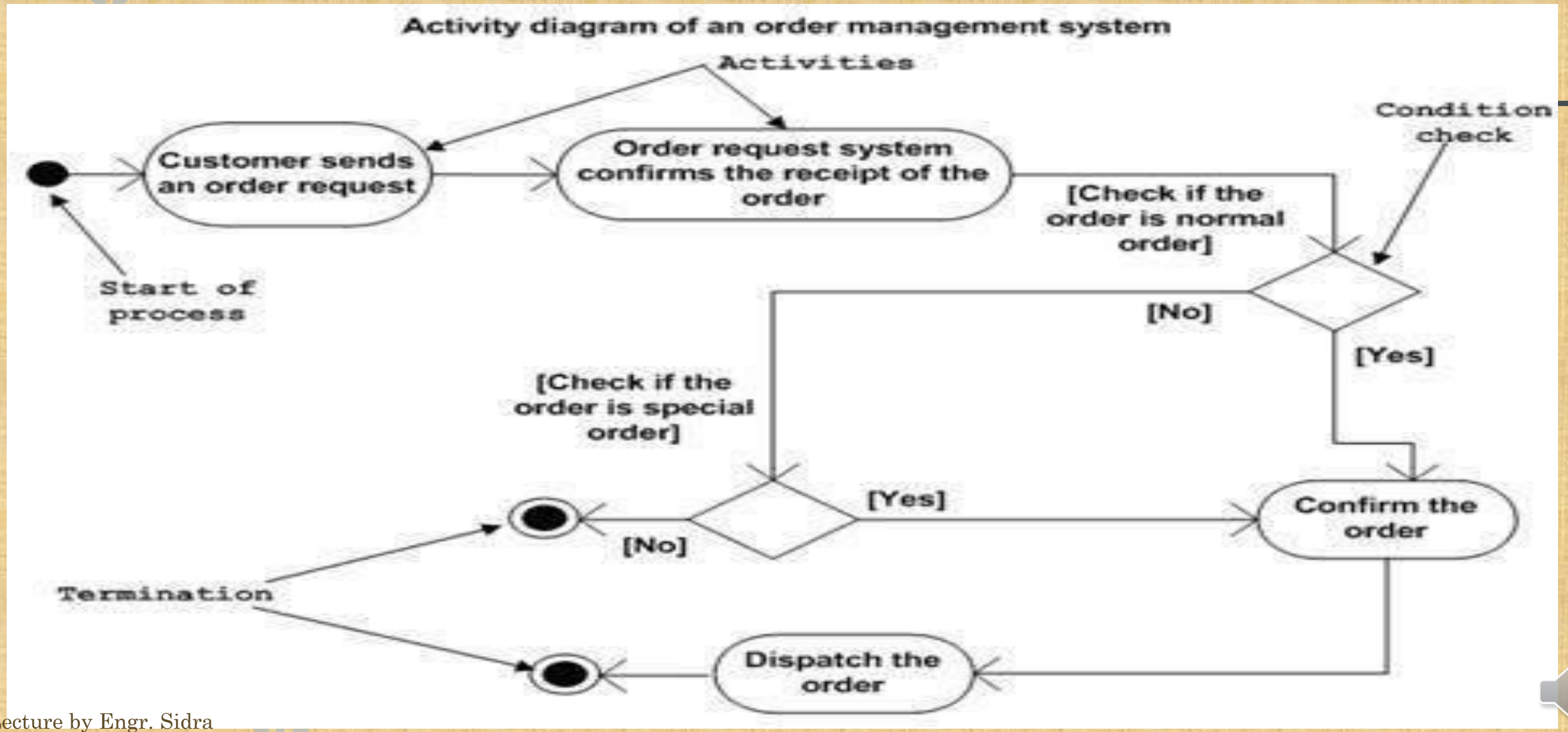
Data Flow Diagram (Level 1)



Data Flow Diagram (Level 2)



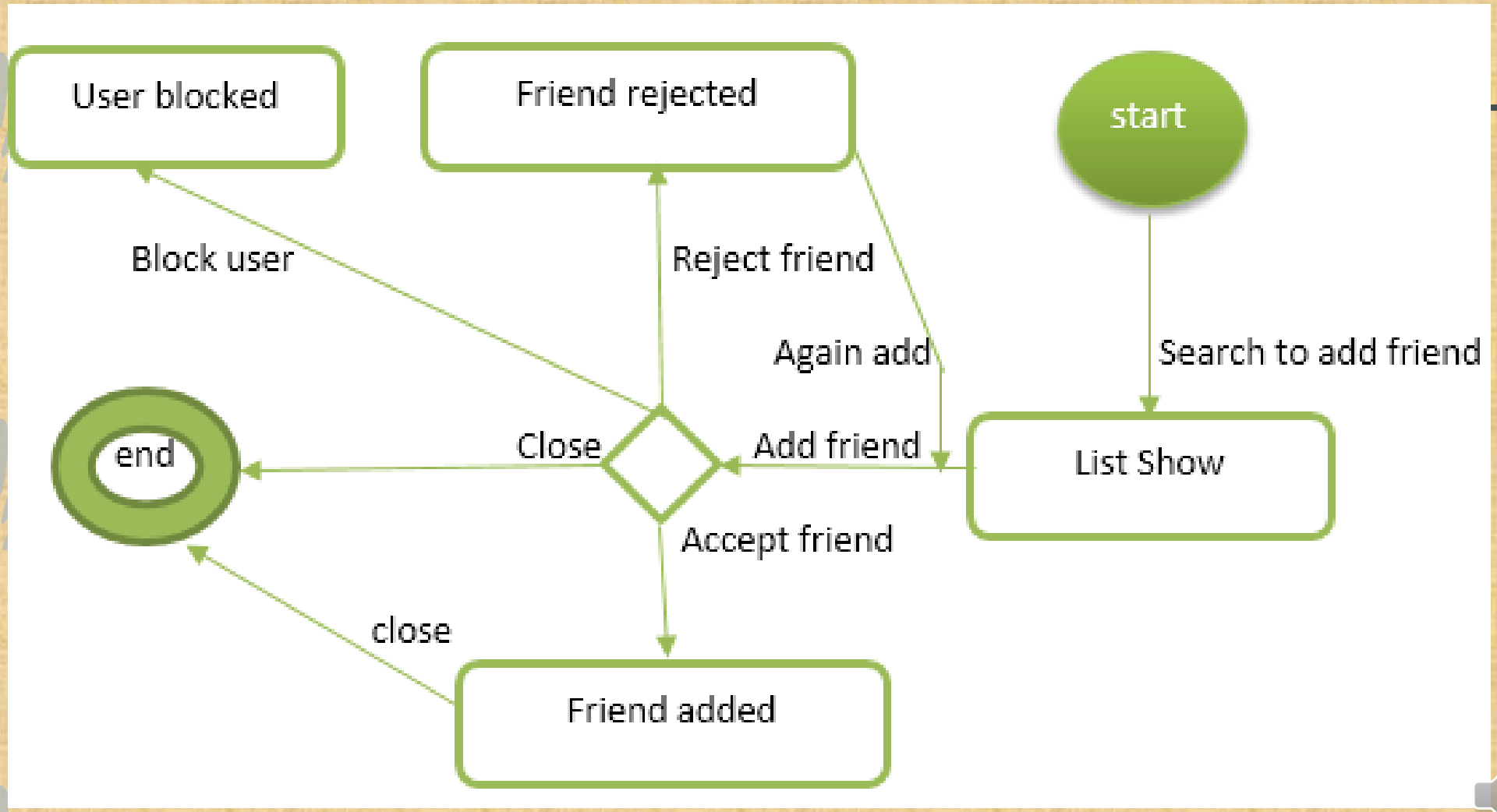
Activity Diagram



Event-Driven Modeling

- Real-time systems are often event-driven, with minimal data processing. For example, a landline phone switching system responds to events such as ‘receiver off hook’ by generating a dial tone.
- Event-driven modeling shows how a system responds to external and internal events.
- It is based on the assumption that a system has a finite number of states and that events (stimuli) may cause a transition from one state to another.

State Transition Diagram



State Machine Models

- These model the behavior of the system in response to external and internal events.
- They show the system's responses to stimuli so are often used for modelling real-time systems.
- State machine models show system states as nodes and events as arcs between these nodes. When an event occurs, the system moves from one state to another.
- Statecharts are an integral part of the UML and are used to represent state machine models

State Machine Models