

Lecture 5

STRUCTURED SYSTEMS ANALYSIS & DESIGN



Objectives

- Explain SSADM
- Describe tools of SSADM



SSADM

- It is a **data (logical)** oriented approach to system analysis and design that **focuses on nature and flow of data through the system**

APPROACH

- Uses **models (graphics & pictorial)** to show relationships between data & business processes throughout the stages of analysis & design



Advantages

- Gives a **pictorial representation** that can be understood by both users & system developers



Types of modeling

- ∃ 2 types

(a) Logical Data Modeling (LDM)

- Entity relationship Modeling (ERM)
- Entity Behavior Modeling (EBM)

(b) Data Flow (process) Modeling

- Data Flow Diagrams (DFD)
- Logic modeling



(a) Logical (data) modeling

- *It is a technique of identifying & modeling the data requirements of an IS.*
- LDM consists of logical data structures (LDS) which represent entities and their relationships through ERD/ERM diagrams
- LDM is used in creation of databases and is also called database modeling

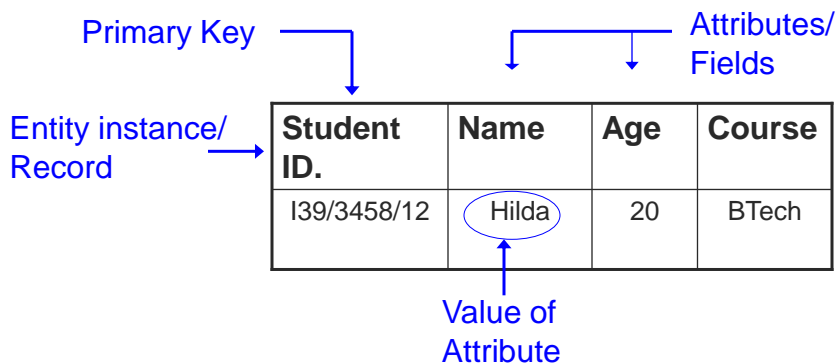


- ERM uses 3 major abstraction to describe “things” to which data is related to: **Entity, attribute, instance & relationship**
- **Entity** = something for which data is recorded about e.g., persons, events etc
- **Attributes**:- characteristic/property of an entity that has a unique value e.g., student (**entity**) is described by attributes such as **ID No., Name, Age** etc. They are stored as fields in a **Table**



- **Table**: = A grouping of records = basic data structure

E.g., Entity = Student



- **Entity Instance (record)** :- A single occurrence of an entity e.g., one instance of entity “student” is “Name” and value is “Hilda”
- **Primary Key**:- Unique identifier for the records e.g., **ID-No**
- **Relationships** = Associations between entities.
- ERM uses these abstractions together with **relationship between entities** to create **Databases**



Creating a LDM

- Collect and divide data about entities into separate subjects (Fields)
- Group related fields into (ONE) table
- Create **Primary Keys** to link data in Tables
- Determine nature of **relationship** between entities
- E.g., Information relating to books in library and users (borrowers) can be grouped as follows:



Table: BOOK

ISBN	Author	Date-Pub	Publisher	Title

Table: BOOKINGS

Date-Out	Due Date	User-Id	Title	Status

Table: USER

User-ID	User_Name	Tel	Address	Occupation

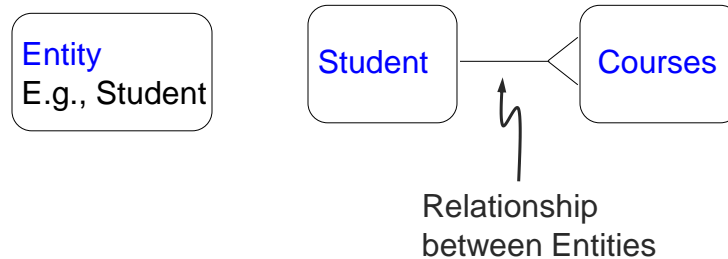
Relationships

- NB Fields in a Table should not be repeated in other tables



Entity Relationship Modeling

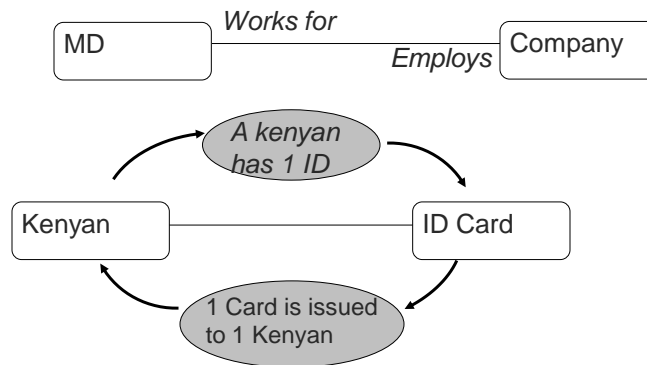
- **ERM** shows the associations between entities.
- **ERM Symbols**



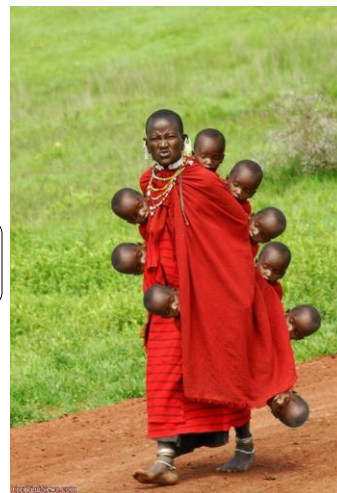
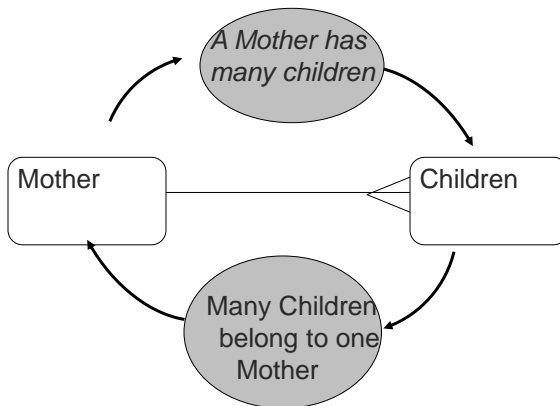
Degree of relationships

(a) One : One

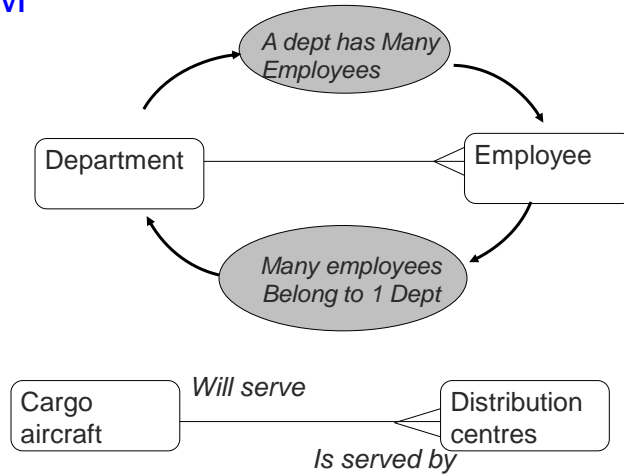
- For any entity A, \exists only one member of entity B associated with it and vice versa. E.g.,



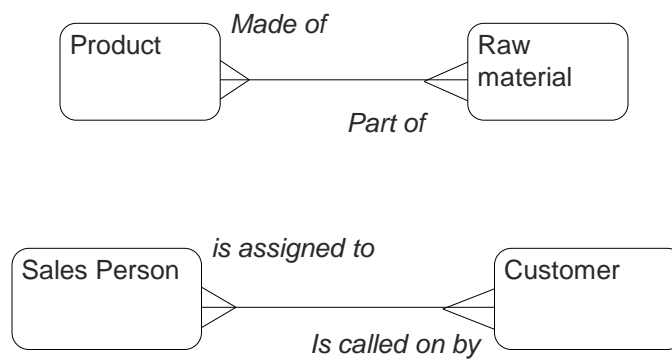
(a) One : Many



■ 1:M



(c) Many : Many



Activity

- A company has one CEO who is not employed by another company. The company has several divisions each of which employs several people, No employee works for more than one division. Each division produces several products. No product is made by more than one division. Each product may be made out of one or more raw materials. Any raw materials may go into one or more products.

Construct ERD from the narrative



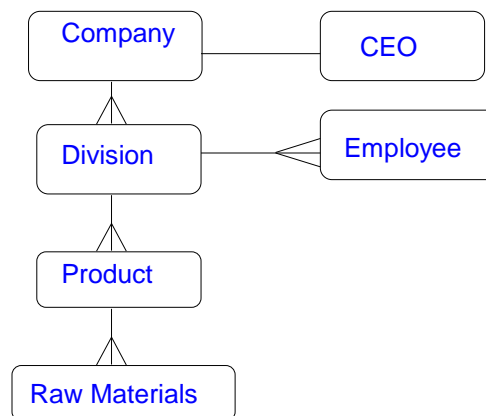
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Soln


- **Entities:** Company, CEO, Division, Employee, pds, raw materials



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- Once the relationships are developed, we then create Databases
 - **Database** = An integrated collection of logical data relating to an entity or collection of related fields

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(b) Process & Logic modeling

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- **Process Modeling** = technique of identifying & modeling how data moves around an IS by examining processes that transform data, data stores and external entities using DFDs.
 - **Logic modeling** shows the logical, policies & procedures to be implemented by a system's process

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(i) DFDs

- DFDs shows **processes** (activities) that transform data from one form to another, **data stores** (holding areas of data), **External entities** (things that sent data into or receive data from a system) and **data flows** (routes by which data flows).



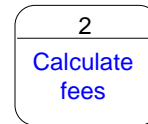
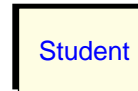
∃ 2 types of DFDs

- *Logical DFD*
- *Physical DFD*
- **Logical DFD**
 - Shows actual data flows and processes that transform data
 - NOT concerned about HOW the system works or will be constructed



DFD symbols

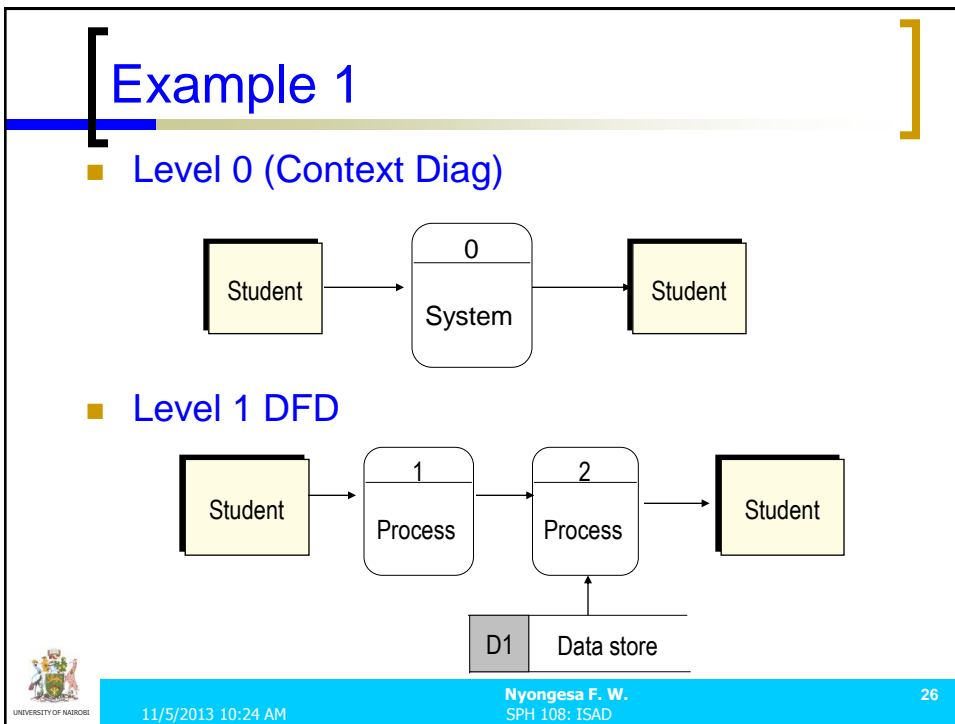
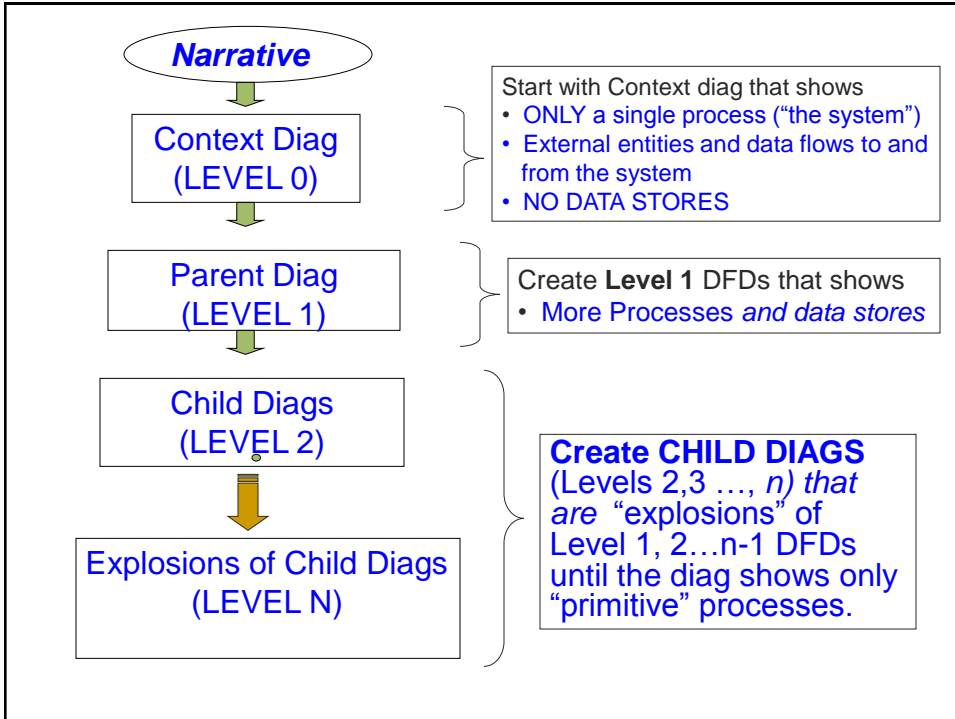
- **External entities** = Source or destination of data e.g., Student, Customer.
- **Processes** = Actions that transform data
- **Data stores** = Temporary or permanent stores of data that are inputs to or outputs of processes
- **Data flows** = transfer of data



Developing DFDs

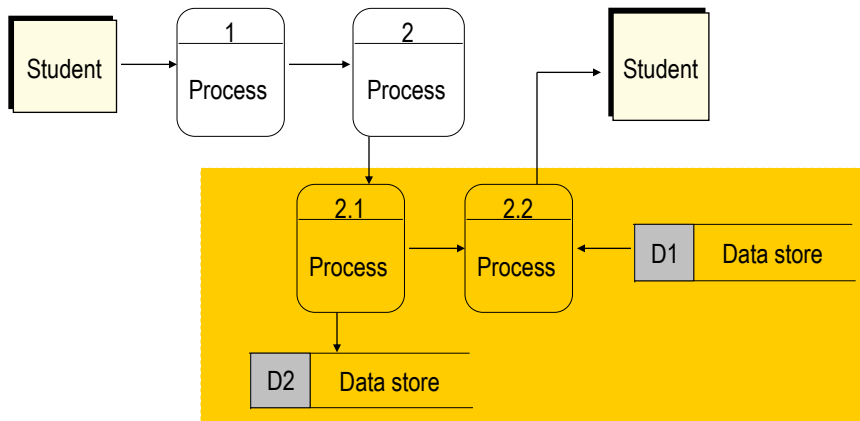
- DFDs are developed using top-down approach (a process called “Leveling”)
- **PROCEDURE**
 1. Define entities, data flows, processes & data stores
 2. Draw content diag (level 0)
 3. Draw Parent diag (Level 1)
 4. Processes on level 1 may in turn be exploded to create more detailed **child diags** (levels 2 ...n)





Level 2 DFD

- Shows child processes



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Rules on creating Child diagrams

1. A Child diag is created from a process of the previous level diag
2. 1ST sub-Level (Child diags) are numbered to correspond to the respective parent e.g., 2.1, 2.2 etc
3. Each Child diag should have the same number of input and output data flow as the parent process i.e., data flow from parent process to child diag must match
4. Child diags may include additional data stores not shown in the parent process e.g., D2



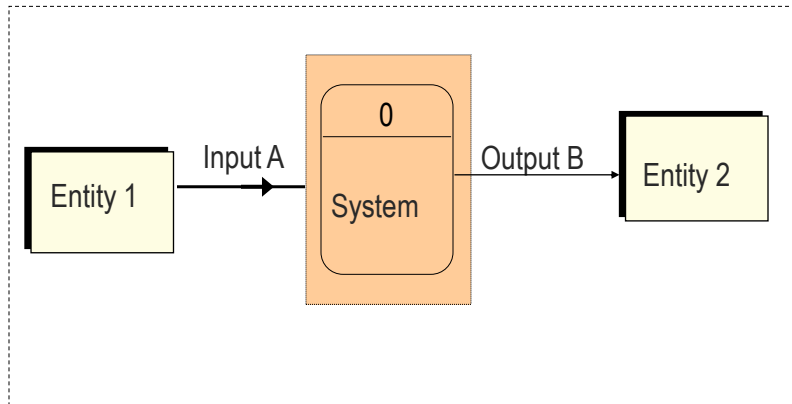
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Example 2 Level 0 (Context Diag)

- Only 1 process (numbered 0) & NO Data stores



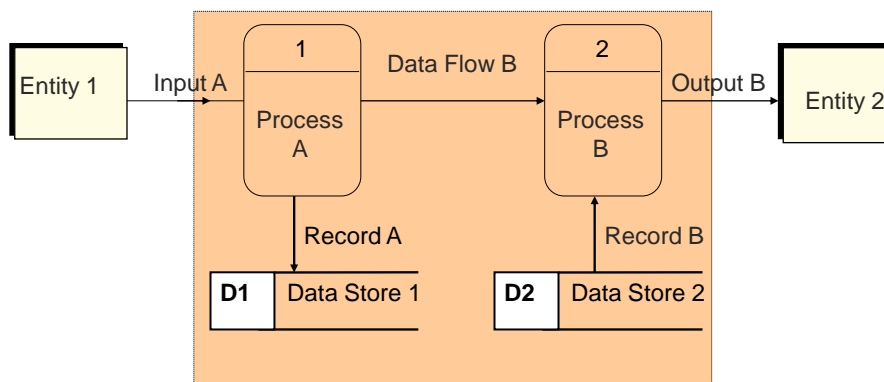
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Level 1 DFD (Parent Diag)

- Shows more (unexploded) processes & data-stores



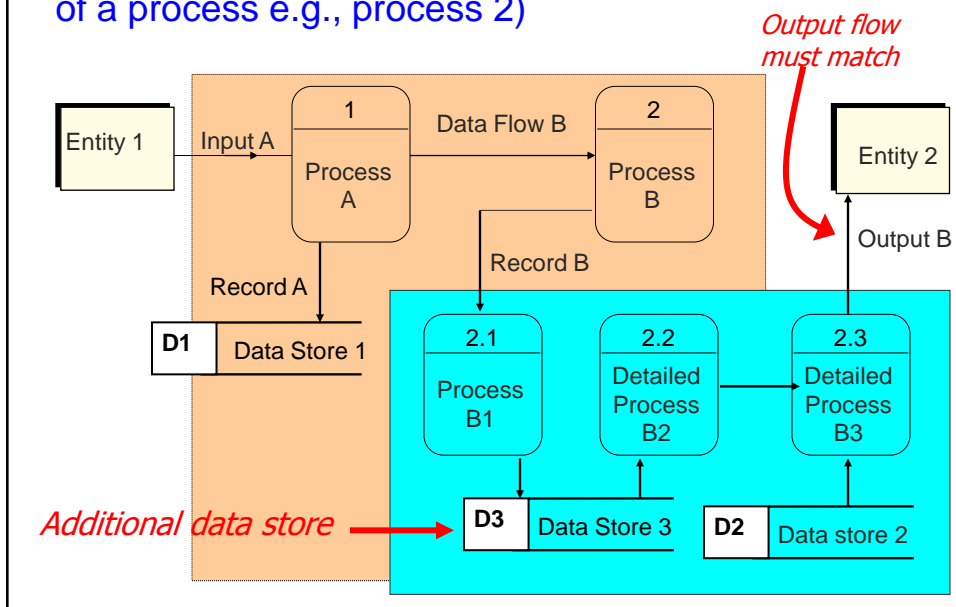
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Level 2 DFD (Child Diags)

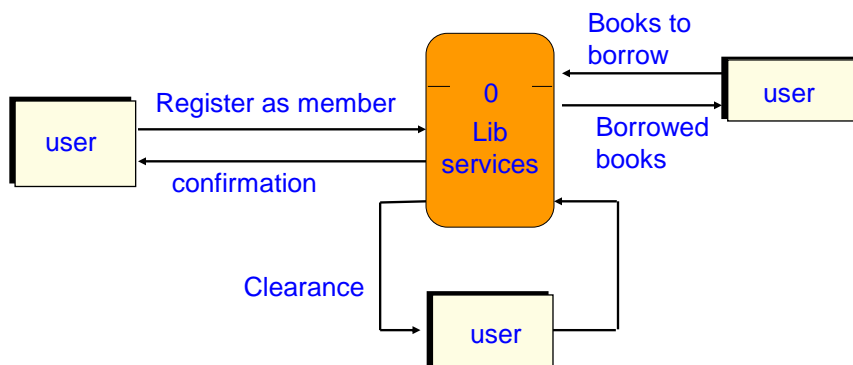
- Shows 1ST sub-levels of a process (i.e., explosion of a process e.g., process 2)



Example 3

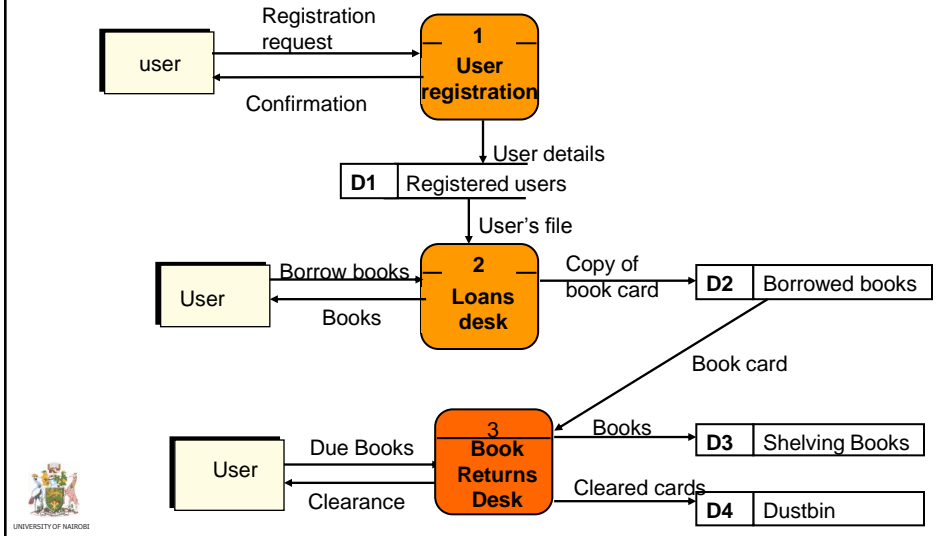
Content diag of Library System

- NB ∃ 3 outputs to user & 3 inputs from user



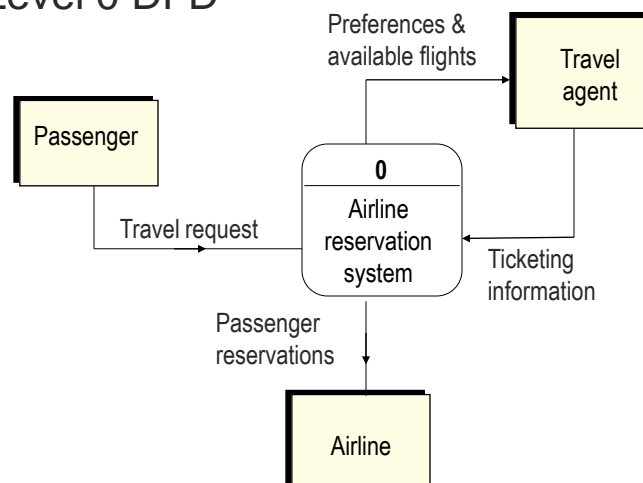
Level 1 DFD of Lib system

- NB ∃ 3 outputs to user & 3 inputs from user



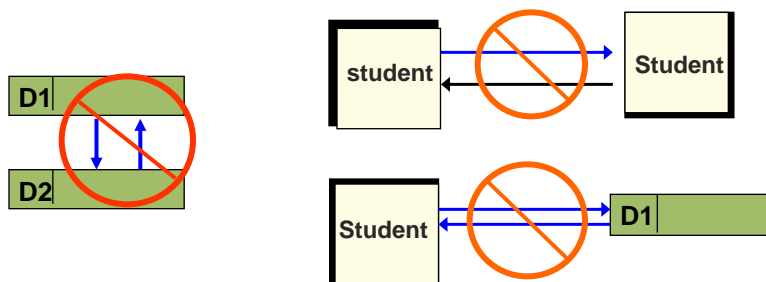
Example 4 Airline Reservation system

- Level 0 DFD



Rules in Constructing DFDs

- No data flow is permitted between
 - Two Data Sources/External Entity
 - Two Data Stores
 - Data Stores and data source.



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Worked Example

- ABC is a book publishing company in Westlands. It is organized in sections e.g., accounting and sales

When the clerk receives book orders from bookstores, he verifies the orders. He then checks the book information as well as the customer credit from the customer file and authorizes shipment through the warehouse. The shipment is verified before shipping and it is accompanied by an invoice. The clerk keeps a copy of the details of the order in a file called "bookstore orders".

Accounts receivable are processed through the accounts department from forms filled out by an accounting clerk.

Draw a logical model for the system



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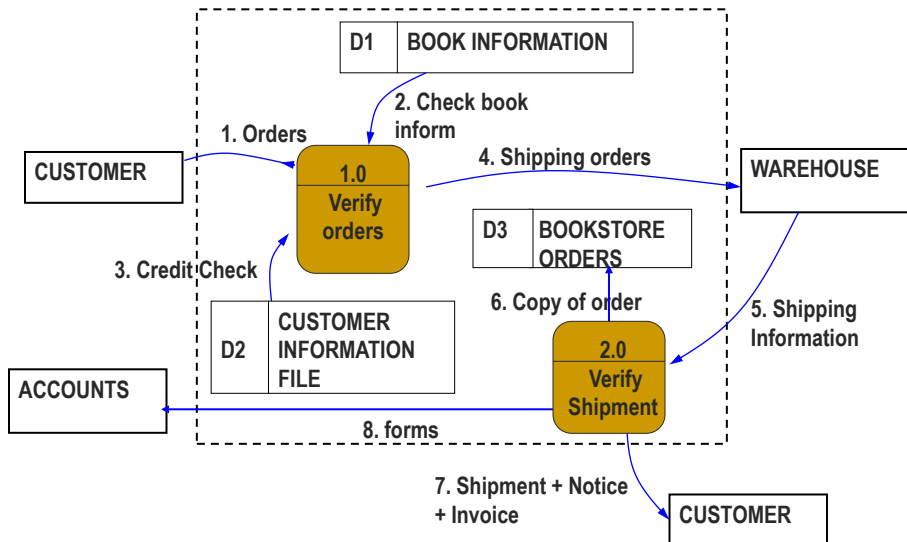
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Soln

- Entities:
- Data Stores:
- Processes
- Data Flows



■ Soln



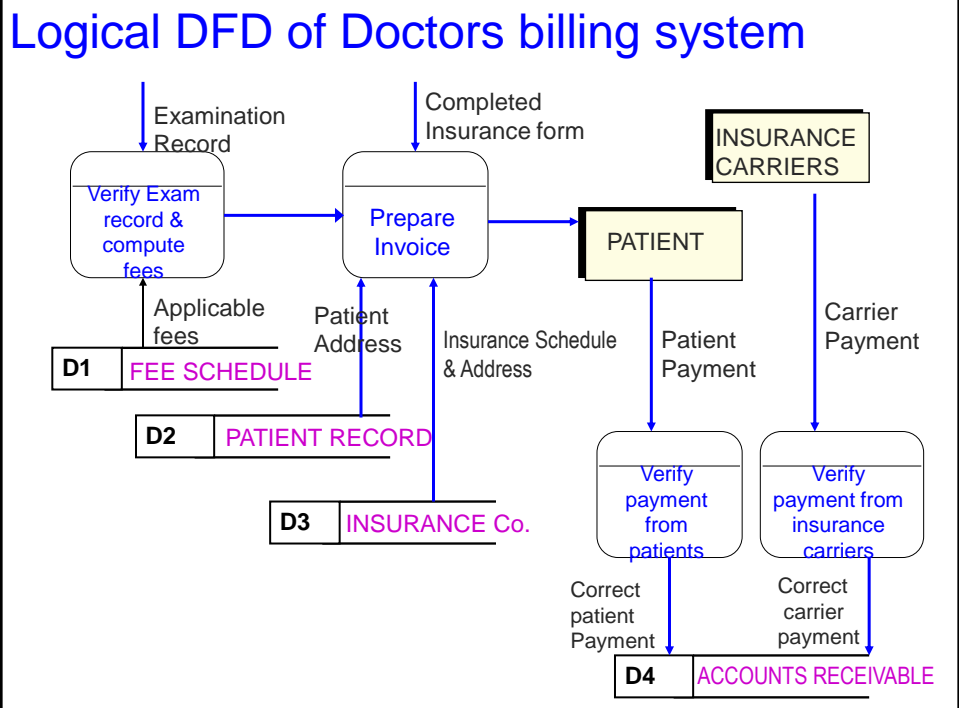
Physical DFDs

- Are created from Logical DFDs
- It depicts the system i.e., it **shows HOW the system is physically implemented** (designed or works) including personnel, hardware, software, databases, etc
- Shows certain details not shown in logical DFD **such as type of activities that take place in a process**



Example of physical DFD





Advantages of DFDs

- Provides better understanding of the business to the analyst
- Provides better communication with users compared to narrative text
- Identification of error and redundancies is easy (in structured walkthroughs)
- Physical DFDs Show sequence of process, order and in detail how the system works from top to minute details using the levelling technique



Activity

- Distinguish between logical and physical DFD
- List advantages of physical DFD over logical DFD



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Structured logic & Decisions

- **Logic modeling** shows the logical, policies & procedures to be implemented by a system's process
- **Tools of Logic modeling:**
 - **Decision tables** :- Used to make a decision between two or more choices depending on the value of the condition
 - **Decision Trees** :- Useful for sketching logical decisions where complex branching routines are involved e.g, calculating discounts or sales commissions etc.
 - **Structured English**:- suited to model logical processes where sequences of actions and decisions are required



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(a) Decision Tables

- It's a 2-D matrix that shows the decision rules that apply when certain **CONDITIONS** occur and **ACTIONS** to be taken

CONDITIONS (IF)	Condition Entry Y/N)
ACTIONS (THEN)	Action Entry (X)

- No of columns required in the condition entry = 2^N where N =Number of conditions



Example

- The delivery charge to be added to customer's invoices is determined as follows:

If the order value is at least 100,000/= and the delivery distance is within 1 Km, the delivery charge is 1,000/=. If the distance > 1 Km, the delivery charge is 1,500/=. If the order value < 100,000/= and the delivery distance is within 1 Km, the delivery charge is 2,000/=, else 3,000/=. Draw a decision table from the above.



Soln

- ∃ 2 conditions: Order value \Rightarrow 1000,000
Delivery dist within 1 Km
- And 4 Actions (Charge 1,000, 1,500, 2,000 & 3,000)
- \Rightarrow Entries = $2^2 = 4$

Order Value \geq 100,000?	Y	Y	N	Y
Delivery Distance within 1 Km?	Y	N	Y	N
Charge 1,000	X			
Charge 1,500		X		
Charge 2,000			X	
Charge 3,000				X



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Activity

- ABC bookshop gives customers discount based on the following policy:
 - Bookstores get 25% discount on orders of 6 or more copies per book title and Nil for orders less than 6 copies. For orders from libraries and individuals, a 5% discount is allowed on orders of 6-19 copies per book title; 10% on orders for 20-49% copies per book tittle; 15% for 50 or more copies. Document this policy using
 - Decision Tables
 - Decision Trees
 - Structured English



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Soln

- \exists 3 conditions: Bookstore; Lib & Order size
- \exists 5 Actions (25, 15, 5 & 0%)
- \Rightarrow Entries = $2^3 = 6$



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Soln

RULES		1	2	3	4	5	6
IF	Customer is bookstore	Y	Y				
	Library or Individual			Y	Y	Y	Y
	Order size \Rightarrow 6 copies	Y	N				N
	Order size 6 - 19 copies					Y	
	Order size 20 - 49 copies				Y		
	Order size \Rightarrow 50			Y			
THEN	Allow 25% discount	X					
	Allow 15% discount			X			
	Allow 10% discount				X		
	Allow 5% discount					X	
	Allow Nil discount		X				X



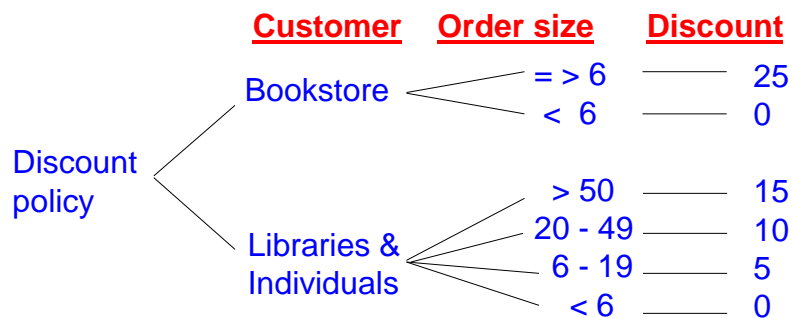
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(b) Decision Trees

- Useful for sketching logical decisions where complex branching routines are involved in the decision process e.g.,



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(c) Structure English

- suited to model logical processes where sequences of actions and decisions are required
- borrowed heavily from control structures in programming especially

...If..Then...Else..



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Soln

```
IF (order is from bookstore & = > 6 copies) THEN
    Discount = 25%
ELSE: Nil
END IF

ELSE
IF (Order from lib & Order > 50 copies) THEN
    Discount = 15%
ELSE IF Order = 20-49 copies
    Discount is 10%

ELSE IF Order = 16-19 copies
    Discount is 5%
END IF
```



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END



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