



Chapter 4

STRUCTURED ANALYSIS

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Software Design Methodologies- Structural Analysis

➤ Structural Analysis

- Performed prior to the design stage, and it provides the internal forces and stresses that will be evaluated during the design and code checking
- It uses graphical diagrams to develop and portray system specifications that are easily understood by users.
- It also helps to describe **the steps that need to occur** and the data required **to meet the design function** of a particular software.
- mainly focuses on logical systems and functions, and aims to convert business requirements into computer programs and hardware specifications.
- During structure analysis high-level functions are successfully decomposed into more detailed functions.

...Software Design Methodologies- **Structural Analysis**

There are three **orthogonal views** related to structured analysis:

- **Functional View:** This involves data flow diagrams, which define the work that has been done and the flow of data between things done, thereby providing the primary structure of a solution.
- **Data View:** This comprises the entity relationship diagram and is concerned with what exists outside the system that is being monitored.
- **Dynamic View:** This includes state transition diagrams and defines when things happen and the conditions under which they may happen.

...Software Design Methodologies- **Structural Analysis**

- During Structured Analysis, various techniques and tools are used for system development. These are:
 - Data Dictionary
 - Data Flow Diagrams
 - Decision Tables
 - Structured English
 - Decision Trees
 - Pseudocode, etc.

Data flow Diagram (DFD) or Bubble Chart

- A graphical representation of flow of data in an information system. It is capable of depicting incoming data flow, ongoing data flow and storing data flow.
- There is a prominent difference between DFD and flowchart. The flowchart depicts flow of control in program modules. DFD's depicts flow of data in the system at **various level**.

...Data flow Diagram (DFD) or Bubble Chart

Types of DFD

1. Logical DFD

- This type of DFD concentrates on the system process, and flow of data in the system. For example in a bank software system. How data is moved between different entities?

2. Physical DFD –(Reading Assignment)

....Data flow Diagram (DFD) or Bubble Chart



Entity

- Which are also known as terminators, sources, sinks (destination of data flow), or actors, are a system or process that sends or receives data to and from the diagrammed system.

Process

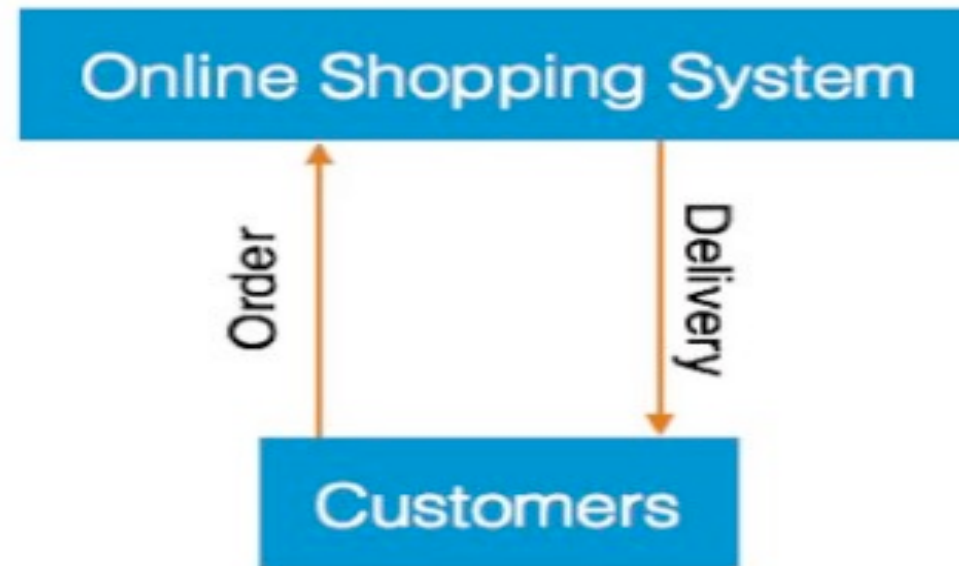
- Process is a procedure that manipulates the data and its flow by taking incoming data, changing it, and producing an output with it. A process can do this by performing computations and using logic to sort the data, or change its flow of direction.

....Data flow Diagram (DFD) or Bubble Chart

Levels of DFD

1. Level 0: Context Diagram

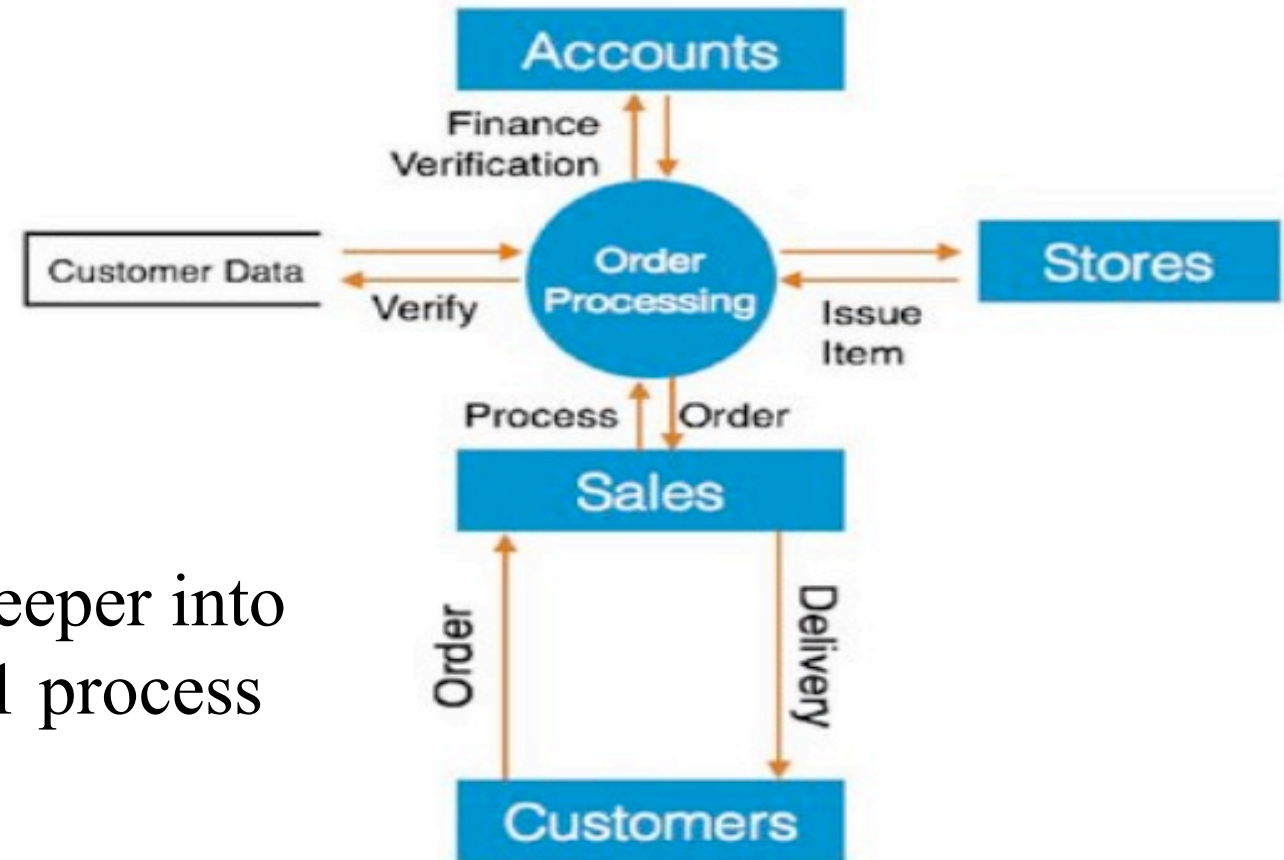
- This DFD level focuses on high-level system processes or functions and the data sources that flow to or from them. Level 0 diagrams are designed to be simple, straightforward overviews of a process or system.



....Data flow Diagram (DFD)

Level 1: Process Decomposition

- While level 1 DFDs are still broad overviews of a system or process, they're also more detailed — they break down the system's single process node into sub processes. Depicts basic modules in the system and flow of data among various modules



Level 2: Deeper Dives

- The next level of DFDs dive even deeper into detail by breaking down each level 1 process into granular sub processes.

....Data Dictionary

- Data dictionary is a graphical tool for outlining a program's **metadata**. The tool assists in establishing items, such as variables, that will be contained within a program.
- Data dictionary contain the heading of Data items, Data Type, Format, Number of bytes for Storage, size for display, Description, Example and validation.
 - **Data Item**: The name of a particular field used in the program (Player ID, First_Name)
 - **Data Type**: The way the field will be recognised by the system (Integer, String, Real or Boolean).
 - **Format**: The way data will be displayed by the system(DD/MM/YY or DD/MM/YYYY)
 - **Number of bytes for storage**: Hard disk space required for saved data.
 - **Size for display**: Amount of RMA required to display the data
 - **Description**: An outline of the type of data expected for the specific item
 - **Example**: A sample of expected data for the item
 - **Validation** : Rules applied to data items to ensure correct data is entered

....Data Dictionary

Why Data dictionary is essential ?

- There are less information and details provided by DFD models. So, a data dictionary is very essential and needed to have proper knowledge and usage of contents.
- The details of data items are documented separately in data dictionary.
- Provides all information about names that are used in system models.
- It also provides information about entities and attributes that are present in system model.

....Data Dictionary

- Most DBMSs have a data dictionary as a standard feature.

Example, refer the following table –

Sr.No.	Data Name	Description	No. of Characters
1	ISBN	ISBN Number	10
2	TITLE	title	60
3	SUB	Book Subjects	80
4	ANAME	Author Name	15

Types of Data Dictionary

1. Active Data dictionary

- A huge responsibility of the database management system is to make sure that the change in the structure of the database should immediately be reflected in the data dictionary. It is known as an active data dictionary as they are **self-updating**.

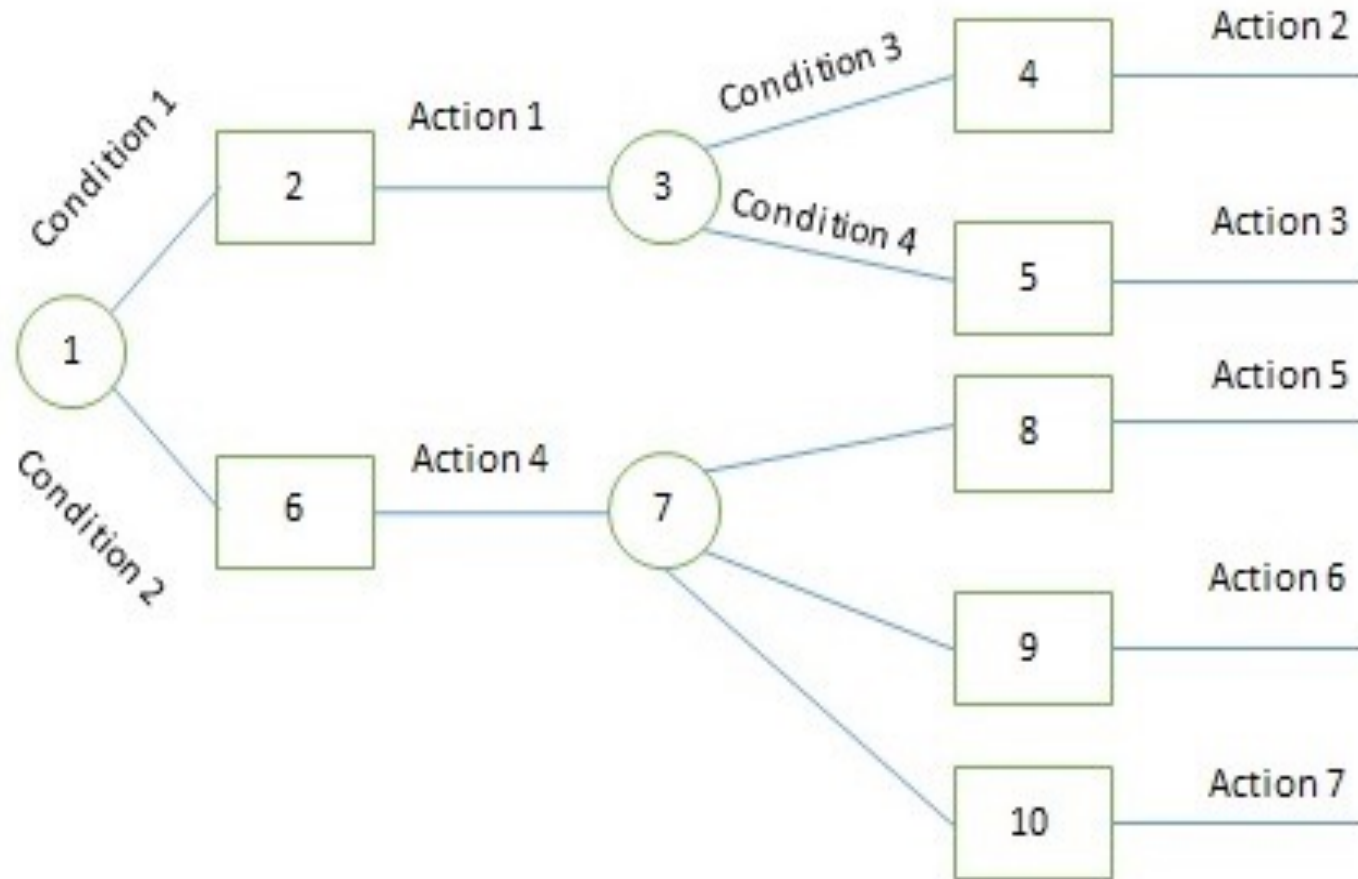
2. Passive data dictionary

- These types of dictionaries are not that useful or easy to handle like an active data dictionary. Every time a database is modified, one has to manually update the data dictionary to match the database. This dictionary is maintained separately from the database.
- We may made a passive data dictionary of the database into the MS Word, MS Excel or in any other word processing tool of your choice and manage it manually

Decision Tree

- A Decision Tree is a graph that uses a branching method to display all the possible outcomes of any decision.
- It helps in processing logic involved in decision-making, and corresponding actions are taken. **It is a diagram that shows conditions and their alternative actions within a horizontal tree framework.**
- It helps the analyst consider the sequence of decisions and identifies the accurate decision that must be made.
- We use a decision tree as a visual representation of a **set of business rules** that will show the **path to each possible decision** when a predefined set of factors is evaluated.

.....Decision trees



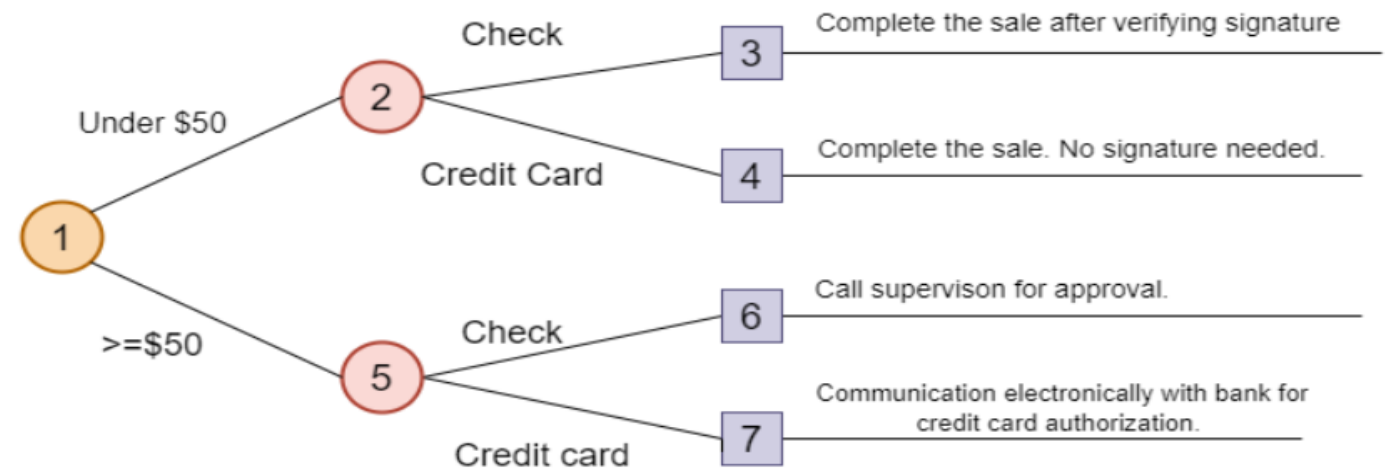
....Decision Tree

- A business analyst need to discover and confirm the following points :
 - What factors are essential to making a decision (conditions)
 - What are possible values of each decision factor (alternatives)
 - What are possible outcomes (decisions)
 - How each factor influences the outcome

....Decision Tree

Example:

- Conditions included the sale amount (under \$50) and whether the customer paid by check or credit card. The four steps possible were to:
- Complete the sale after verifying the signature.
- Complete the sale with no signature needed.
- Communicate electronically with the bank for credit card authorization.
- Call the supervisor for approval.



1. Identify all conditions and actions and their order and timing (if they are critical).

2. Begin building the tree from left to right, making sure you list all possible alternatives before moving to the right.

Drawing a decision tree to show the noncash purchase approval actions for a department store.

....Decision Tree

Advantages of decision trees

- Decision trees represent the logic of **If-Else** in a pictorial form.
- helps to identify the actual decision to be made.
- useful for expressing the logic when the value is variable or action depending on a nested decision.
- used to verify the problems that involve a limited number of actions.

Decision Tables

Decision Tables

- Decision tables are a method of describing the complex logical relationship in a precise manner which is easily understandable.
- It is useful in situations where the resulting actions depend on the occurrence of one or several combinations of independent conditions.
- It is a matrix containing row or columns for defining a problem and the actions.

...Decision Tables

Components of a Decision Table

- **Condition Stub** – It is in the upper left quadrant which lists all the condition to be checked.
- **Action Stub** – It is in the lower left quadrant which outlines all the action to be carried out to meet such condition.
- **Condition Entry** – It is in upper right quadrant which provides answers to questions asked in condition stub quadrant.
- **Action Entry** – It is in lower right quadrant which indicates the appropriate action resulting from the answers to the conditions in the condition entry quadrant.

Example : Decision table/ decision Tree

Example : $n^{\text{number of conditions}}$, 2^2 (to get all possible outcomes)

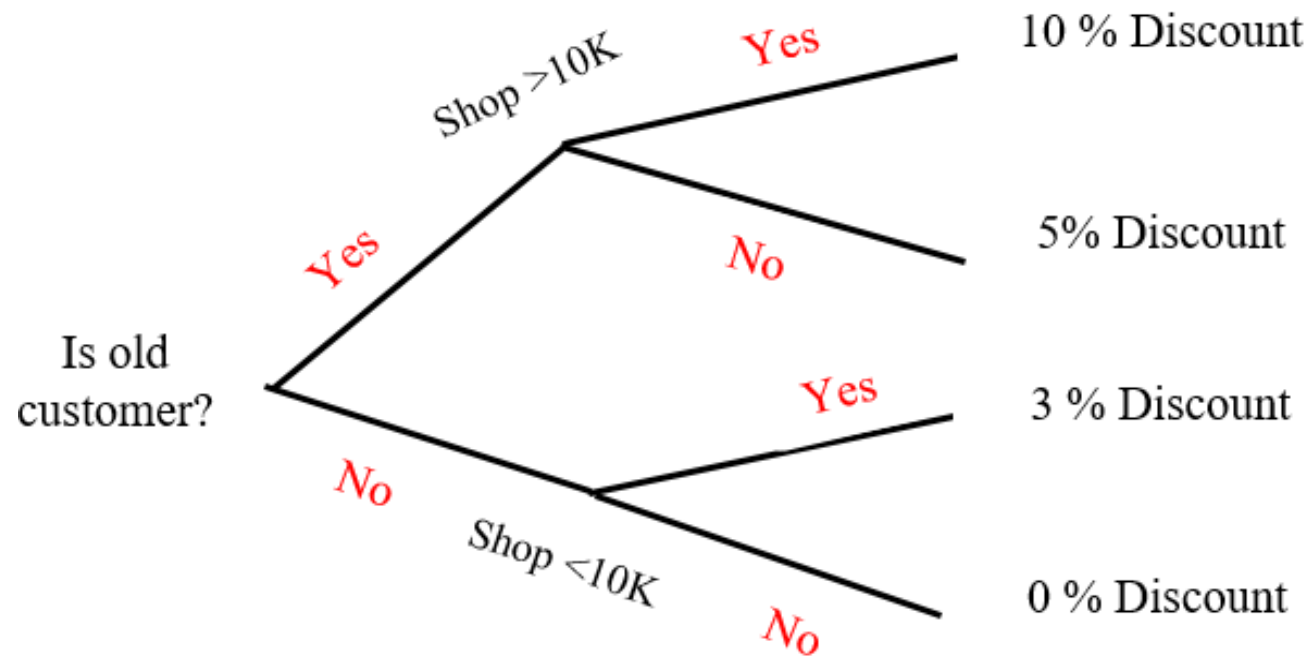
If a customer is old and shop more than 10,000, then 10% discount

If a customer is old and shop less than 10,000, then 5% discount

If a customer is new and shop more than 10,000, then 3% discount

If a customer is new and shop less than 10,000, then 0% discount

Decision Tree



Decision Table

Is Customer Old	T	T	F	F
Shop > 10k	T	F	T	F
10%	✓			
5%		✓		
3%			✓	
0%				✓

....Decision table

- A way to document complicated logic ->(We don't want to miss any combination of the different input conditions)
- This helps test all combinations of functions.

Example 1 :-

No. of combinations = No. condition 1 values *
No. condition 2 values

No. Combinations = $2^{\text{No. of True/False(conditions)}}$

Email	SoftwareAndTestingTraining			
Password	*****			
Email	F	T	F	T
Password	F	F	T	T
Expected result	Error: Please enter email.	Error: Please enter password.	Error: Please enter email.	Login processed.

....Decision table.

Example 2:-

Conditions	Email	Blank	Blank	Blank	Invalid	Invalid	Invalid	Valid	Valid	Valid
	Passw ord	Blank	Invalid	Valid	Blank	Invalid	Valid	Blank	Invalid	Valid
Actions	Expec ted result	Error: Please enter email.	Error: Please enter email.	Error: Please enter email.	Error: Please enter a valid email.	Error: Login failed.	Error: Please enter a valid email.	Error: Please enter passwo rd.	Error: Login failed.	-
	Show Page	Login page	Login page	Login page	Login page	Login page	Login page	Login page	Login page	Home page

No. of combinations = No. of condition1 values * No. of condition2 values

E.g. No. of combinations = 3 * 3 = 9

....Decision table.

Example 3:- Library system scenario

Conditions	User registered?	F	F	F	F	T	T	T	T
	No outstanding fees?	F	F	T	T	F	F	T	T
	Under borrow limit?	F	T	F	T	F	T	F	T
Actions	Borrow book?	No	No	No	No	No	No	No	Yes

No. of combinations = No. of condition1 values * No. of condition2 values *

No. of condition3 values

E.g. No. of combinations = $2 * 2 * 2 = 8$

....Decision table.

- Simplified decision Table for **Example 3**

Conditions	User registered?	F	T	T	T
	No outstanding fees?	-	F	T	T
	Under borrow limit?	-	-	F	T
Actions	Borrow book?	No ↖	No	No	Yes

....Decision table.

Advantages of a Decision Table

- Decision tables are very much helpful in requirement design technique.
- It helps the analyst to search the effects of combinations of different inputs and other software states that implement business rules.
- It provides a regular way of stating complex business rules.
- It the most preferable choice for requirements management.
- It is a structured exercise to prepare requirements when dealing with complex business rules.
- It is also used in model complicated logic.

End of Ch.4