Lecture Notes
On
Structure Analysis and Design

UNIT-III

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What is Structured Analysis?

Structured Analysis is a development method that allows the analyst to understand the system and its activities in a logical way.

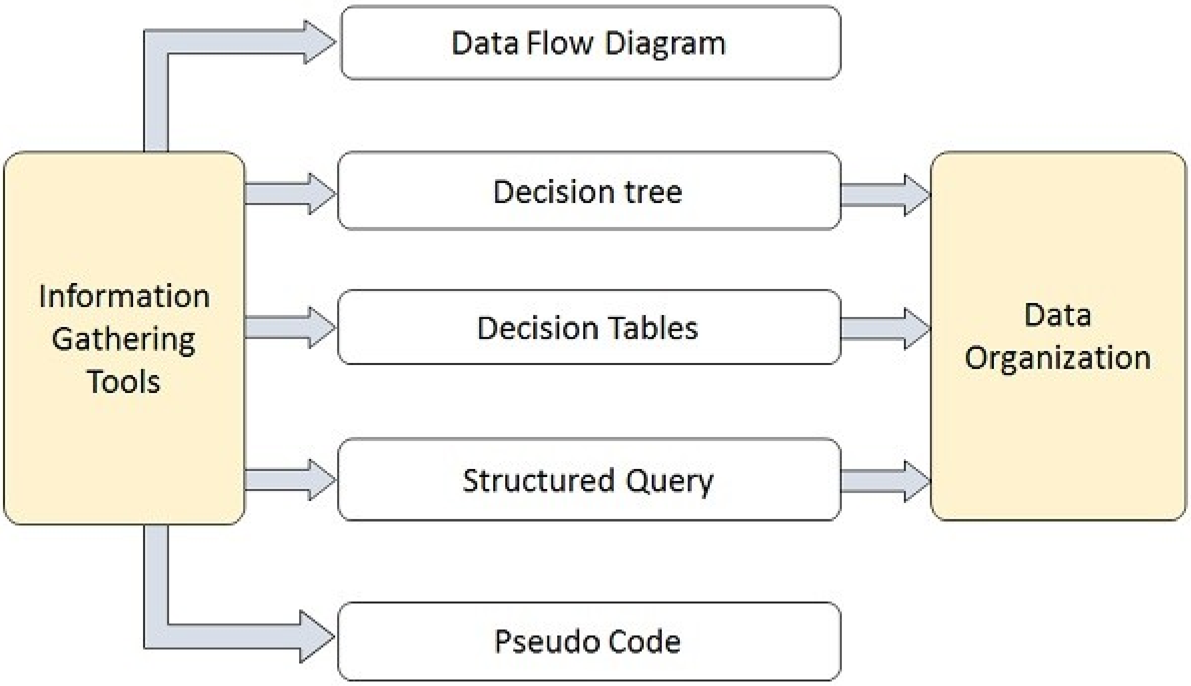
It has following attributes −

- It is graphic which specifies the presentation of application.
- It divides the processes so that it gives a clear picture of system flow.
- It is logical rather than physical i.e., the elements of system do not depend on vendor or hardware.
- It is an approach that works from high-level overviews to lower-level details.

Structured Analysis Tools

During Structured Analysis, various tools and techniques are used for system development. They are −

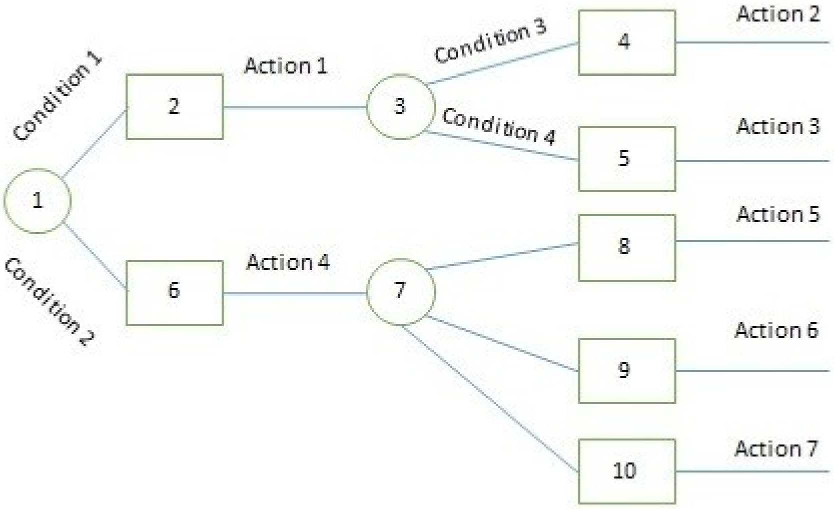
- Data Flow Diagrams
- Data Dictionary
- Decision Trees
- Decision Tables
- Structured English
- Pseudocode



Decision Trees

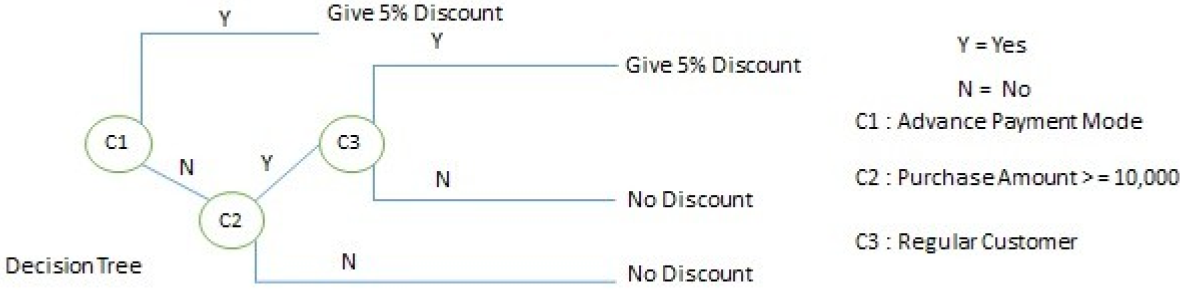
Decision trees are a method for defining complex relationships by describing decisions and avoiding the problems in communication. A decision tree is a diagram that shows alternative actions and conditions within horizontal tree framework. Thus, it depicts which conditions to consider first, second, and so on.

Decision trees depict the relationship of each condition and their permissible actions. A square node indicates an action and a circle indicates a condition. It forces analysts to consider the sequence of decisions and identifies the actual decision that must be made.



The **major limitation** of a decision tree is that it lacks information in its format to describe what other combinations of conditions for testing. It is a single representation of the relationships between conditions and actions.

For example, refer the following decision tree −



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.

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.

The entries in decision table are given by Decision Rules which define the relationships between combinations of conditions and courses of action. In rules section,

- Y shows the existence of a condition.
- N represents the condition, which is not satisfied.
- A blank - against action states it is to be ignored.
- X (or a check mark will do) against action states it is to be carried out.

For example, refer the following table −

CONDITIONS	**Rule 1**	**Rule 2**	**Rule 3**	**Rule 4**
Advance payment made	Y	N	N	N
Purchase amount = Rs 10,000/-	-	Y	Y	N
Regular Customer	-	Y	N	-
ACTIONS				
Give 5% discount	X	X	-	-
Give no discount	-	-	X	X

Structured English

Structure English is derived from structured programming language which gives more understandable and precise description of process.

It is based on procedural logic that uses construction and imperative sentences designed to perform operation for action.

- It is best used when sequences and loops in a program must be considered and the problem needs sequences of actions with decisions.
- It does not have strict syntax rule. It expresses all logic in terms of sequential decision structures and iterations.

For example, see the following sequence of actions −

```
if customer pays advance
   then
      Give 5% Discount
   else
      if purchase amount >=10,000
         then
            if  the customer is a regular customer
               then Give 5% Discount
            else  No Discount
         end if
      else No Discount
   end if
end if
```

Pseudocode

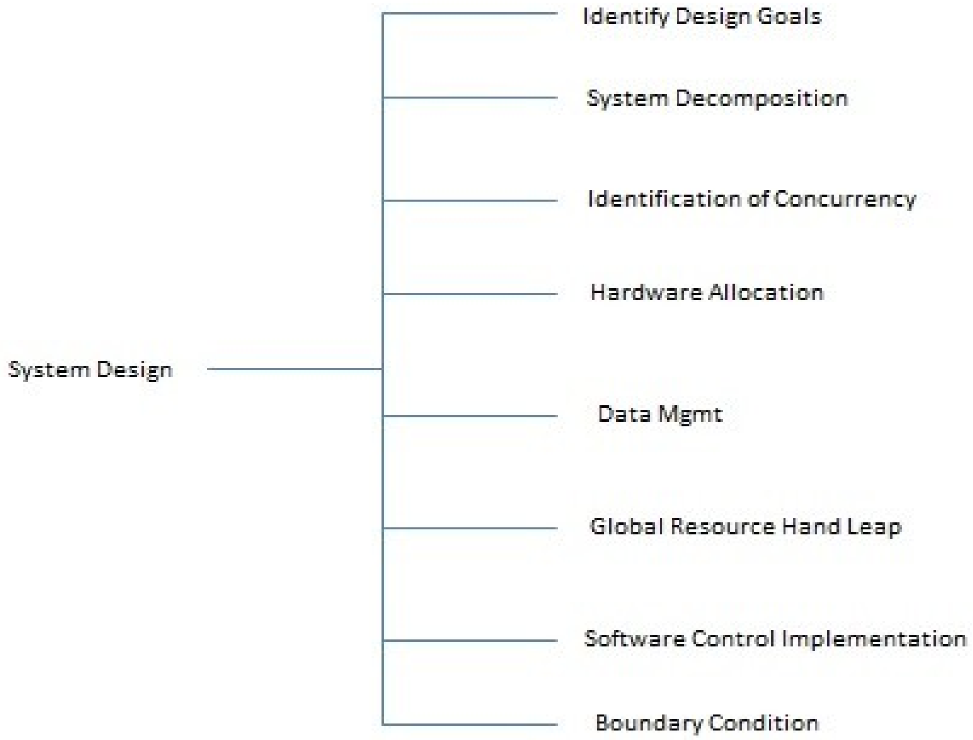
A pseudocode does not conform to any programming language and expresses logic in plain English.

- It may specify the physical programming logic without actual coding during and after the physical design.
- It is used in conjunction with structured programming.
- It replaces the flowcharts of a program.

System design is the phase that bridges the gap between problem domain and the existing system.

It is the phase where the **SRS document** is converted into a format that can be implemented and decides how the system will operate.

In this phase, the complex activity of system development is divided into several smaller sub-activities, which coordinate with each other to achieve the main objective of system development.


System Design
Identify Design Goals
System Decomposition
Identification of Concurrency
Hardware Allocation
Data Mgmt
Global Resource Hand Leap
Software Control Implementation
Boundary Condition

Inputs to System Design

System design takes the following inputs −

- Statement of work
- Requirement determination plan
- Current situation analysis
- Proposed system requirements including a conceptual data model, modified DFDs, and Metadata (data about data).

Outputs for System Design

System design gives the following outputs −

- Infrastructure and organizational changes for the proposed system.
- A data schema, often a relational schema.
- Metadata to define the tables/files and columns/data-items.
- A function hierarchy diagram or web page map that graphically describes the program structure.
- Actual or pseudocode for each module in the program.
- A prototype for the proposed system.

Types of System Design

Logical Design

Logical design pertains to an abstract representation of the data flow, inputs, and outputs of the system. It describes the inputs (sources), outputs (destinations), databases (data stores), procedures (data flows) all in a format that meets the user requirements.

While preparing the logical design of a system, the system analyst specifies the user needs at level of detail that virtually determines the information flow into and out of the system and the required data sources. Data flow diagram, E-R diagram modeling are used.

Physical Design

Physical design relates to the actual input and output processes of the system. It focuses on how data is entered into a system, verified, processed, and displayed as output.

It produces the working system by defining the design specification that specifies exactly what the candidate system does. It is concerned with user interface design, process design, and data design.

It consists of the following steps −

- Specifying the input/output media, designing the database, and specifying backup procedures.
- Planning system implementation.
- Devising a test and implementation plan, and specifying any new hardware and software.

- Updating costs, benefits, conversion dates, and system constraints.

Architectural Design

It is also known as high level design that focuses on the design of system architecture. It describes the structure and behavior of the system. It defines the structure and relationship between various modules of system development process.

Detailed Design

It follows Architectural design and focuses on development of each module.

Conceptual Data Modeling

It is representation of organizational data which includes all the major entities and relationship. System analysts develop a conceptual data model for the current system that supports the scope and requirement for the proposed system.

The main aim of conceptual data modeling is to capture as much meaning of data as possible. Most organization today use conceptual data modeling using E-R model which uses special notation to represent as much meaning about data as possible.

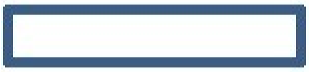
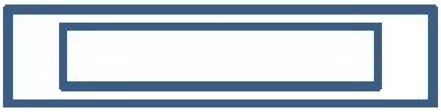
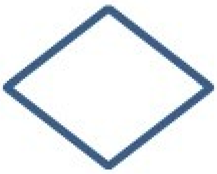
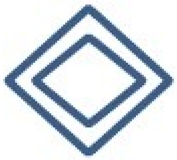
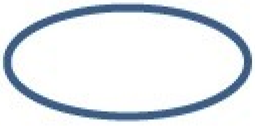
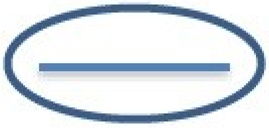
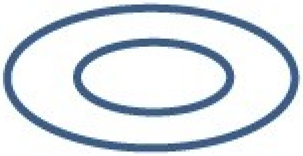
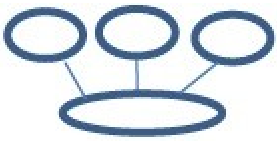
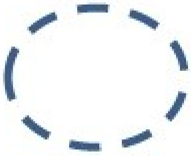
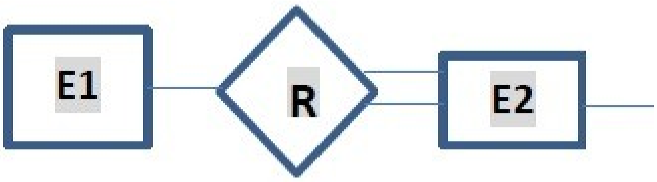
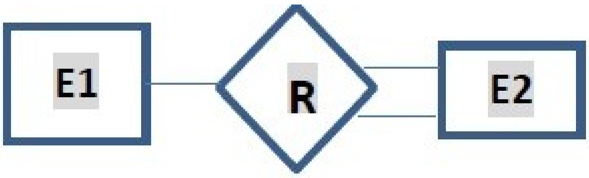
Entity Relationship Model

It is a technique used in database design that helps describe the relationship between various entities of an organization.

Terms used in E-R model

- **ENTITY** − It specifies distinct real world items in an application. For example: vendor, item, student, course, teachers, etc.
- **RELATIONSHIP** − They are the meaningful dependencies between entities. For example, vendor supplies items, teacher teaches courses, then supplies and course are relationship.
- **ATTRIBUTES** − It specifies the properties of relationships. For example, vendor code, student name. Symbols used in E-R model and their respective meanings −

The following table shows the symbols used in E-R model and their significance −

Symbol	Meaning
	Entity
	Weak Entity
	Relationship
	Identity Relationship
	Attributes
	Key Attributes
	Multivalued
	Composite Attribute
	Derived Attributes
	Total Participation of E2 in R
	Cardinality Ratio 1:N for E1:E2 in R

Three types of relationships can exist between two sets of data: one-to-one, one-to-many, and many-to-many.

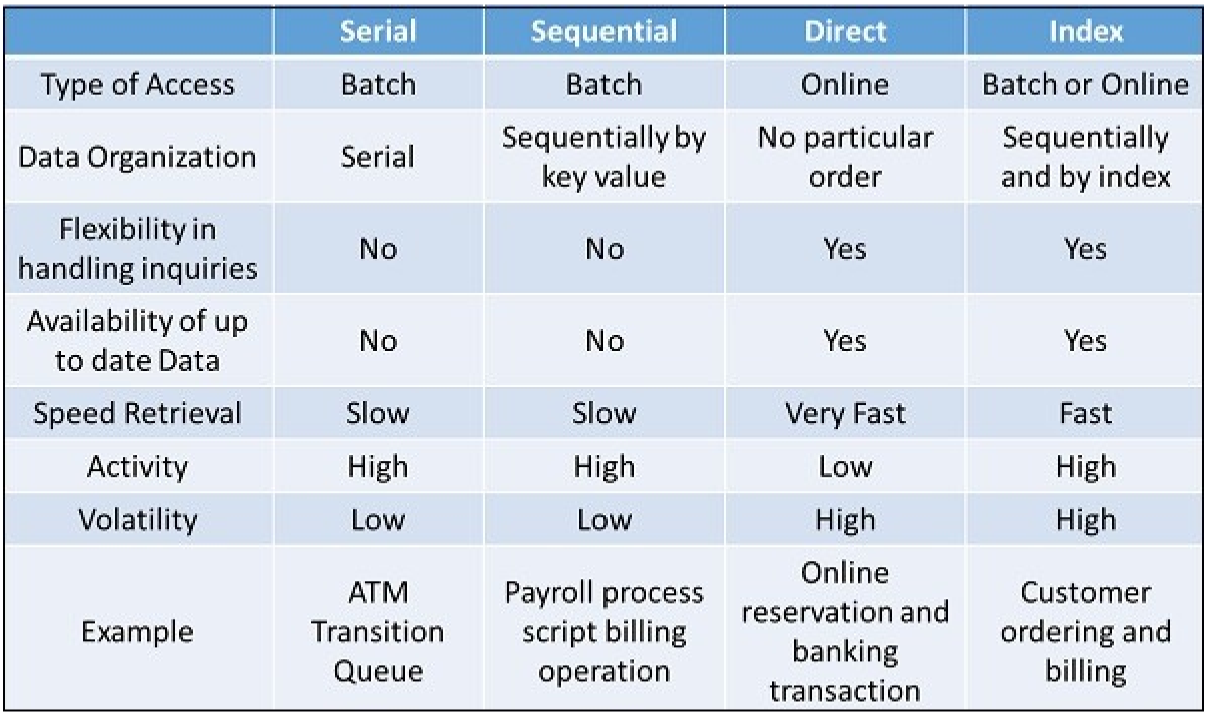
File Organization

It describes how records are stored within a file.

There are four file organization methods −

- **Serial** − Records are stored in chronological order (in order as they are input or occur). **Examples** − Recording of telephone charges, ATM transactions, Telephone queues.
- **Sequential** − Records are stored in order based on a key field which contains a value that uniquely identifies a record. **Examples** − Phone directories.
- **Direct (relative)** − Each record is stored based on a physical address or location on the device. Address is calculated from the value stored in the record's key field. Randomizing routine or hashing algorithm does the conversion.
- **Indexed** − Records can be processed both sequentially and non-sequentially using indexes.

Comparision



	Serial	Sequential	Direct	Index
Type of Access	Batch	Batch	Online	Batch or Online
Data Organization	Serial	Sequentially by key value	No particular order	Sequentially and by index
Flexibility in handling inquiries	No	No	Yes	Yes
Availability of up to date Data	No	No	Yes	Yes
Speed Retrieval	Slow	Slow	Very Fast	Fast
Activity	High	High	Low	High
Volatility	Low	Low	High	High
Example	ATM Transition Queue	Payroll process script billing operation	Online reservation and banking transaction	Customer ordering and billing

File Access

One can access a file using either Sequential Access or Random Access. File Access methods allow computer programs read or write records in a file.

Sequential Access

Every record on the file is processed starting with the first record until End of File (EOF) is reached. It is efficient when a large number of the records on the file need to be accessed at any given time. Data stored on a tape (sequential access) can be accessed only sequentially.

Direct (Random) Access

Records are located by knowing their physical locations or addresses on the device rather than their positions relative to other records. Data stored on a CD device (direct-access) can be accessed either sequentially or randomly.

Types of Files used in an Organization System

Following are the types of files used in an organization system −

- **Master file** − It contains the current information for a system. For example, customer file, student file, telephone directory.
- **Table file** − It is a type of master file that changes infrequently and stored in a tabular format. For example, storing Zipcode.
- **Transaction file** − It contains the day-to-day information generated from business activities. It is used to update or process the master file. For example, Addresses of the employees.
- **Temporary file** − It is created and used whenever needed by a system.
- **Mirror file** − They are the exact duplicates of other files. Help minimize the risk of downtime in cases when the original becomes unusable. They must be modified each time the original file is changed.
- **Log files** − They contain copies of master and transaction records in order to chronicle any changes that are made to the master file. It facilitates auditing and provides mechanism for recovery in case of system failure.
- **Archive files** − Backup files that contain historical versions of other files.

Advantages

- It can reduce system downtime, cut costs, and speed up maintenance tasks.
- It provides the clear description of formal flow of present system and helps to understand the type of input data and how the output can be produced.
- It provides effective and efficient way of communication between technical and nontechnical users about system.
- It facilitates the training of new user so that he can easily understand the flow of system.
- It helps the user to solve the problems such as troubleshooting and helps the manager to take better final decisions of the organization system.
- It provides better control to the internal or external working of the system.

Types of Documentations

When it comes to System Design, there are following four main documentations −

- Program documentation
- System documentation
- Operations documentation
- User documentation

Program Documentation

- It describes inputs, outputs, and processing logic for all the program modules.
- The program documentation process starts in the system analysis phase and continues during implementation.
- This documentation guides programmers, who construct modules that are well supported by internal and external comments and descriptions that can be understood and maintained easily.

Operations Documentation

Operations documentation contains all the information needed for processing and distributing online and printed output. Operations documentation should be clear, concise, and available online if possible.

It includes the following information −

- Program, systems analyst, programmer, and system identification.
- Scheduling information for printed output, such as report, execution frequency, and deadlines.
- Input files, their source, output files, and their destinations.
- E-mail and report distribution lists.
- Special forms required, including online forms.
- Error and informational messages to operators and restart procedures.
- Special instructions, such as security requirements.

User Documentation

It includes instructions and information to the users who will interact with the system. For example, user manuals, help guides, and tutorials. User documentation is valuable in training users and for reference purpose. It must be clear, understandable, and readily accessible to users at all levels.

The users, system owners, analysts, and programmers, all put combined efforts to develop a user's guide.

A user documentation should include −

- A system overview that clearly describes all major system features, capabilities, and limitations.
- Description of source document content, preparation, processing, and, samples.
- Overview of menu and data entry screen options, contents, and processing instructions.
- Examples of reports that are produced regularly or available at the user's request, including samples.
- Security and audit trail information.
- Explanation of responsibility for specific input, output, or processing requirements.
- Procedures for requesting changes and reporting problems.
- Examples of exceptions and error situations.
- Frequently asked questions (FAQs).
- Explanation of how to get help and procedures for updating the user manual.

System Documentation

System documentation serves as the technical specifications for the IS and how the objectives of the IS are accomplished. Users, managers and IS owners need never reference system documentation. System documentation provides the basis for understanding the technical aspects of the IS when modifications are made.

- It describes each program within the IS and the entire IS itself.
- It describes the system's functions, the way they are implemented, each program's purpose within the entire IS with respect to the order of execution, information passed to and from programs, and overall system flow.
- It includes data dictionary entries, data flow diagrams, object models, screen layouts, source documents, and the systems request that initiated the project.
- Most of the system documentation is prepared during the system analysis and system design phases.
- During systems implementation, an analyst must review system documentation to verify that it is complete, accurate, and up-to-date, and including any changes made during the implementation process.

What is Database Design?

Database Design is a collection of processes that facilitate the designing, development, implementation and maintenance of enterprise data management systems. Properly designed database are easy to maintain, improves data consistency and are cost effective in terms of disk storage space. The database designer decides how the data elements correlate and what data must be stored.

The main objectives of database designing are to produce logical and physical designs models of the proposed database system.

Why Database Design is Important ?

It helps produce database systems

1. That meet the requirements of the users
2. Have high performance.

Who Is A DBA (Database Administrator)

A Database Administrator is a person or a group of person who are responsible for managing all the activities related to database system.

The **Database Administrator (DBA)** who is like the super-user of the system. Individual in the association who controls the plan and the utilisation of the database alludes as DBA

The role of the DBA is very important and is defined by the following functions.

- **Defining the Schema** The DBA defines the schema which contains the structure of the data in the application. The DBA determines what data needs to be present in the system ad how this data has to be represented and organized. As per this construction, database will be produced to store required information for an association.
- **Defining Storage Structure and Access Method**: The DBA chooses how the information is to be spoken to in the put away database.
- **Liaising with Users** The DBA needs to interact continuously with the users to understand the data in the system and its use.The DBA figures out which client needs access to which part of the database
- **Defining Security & Integrity Checks** The DBA finds about the access restrictions to be defined and defines security checks accordingly. Data Integrity checks are also defined by the DBA.
- **Defining Backup / Recovery Procedures** The DBA also defines procedures for backup and recovery. Defining backup procedures includes specifying what data is to backed up, the periodicity of taking backups and also the medium and storage place for the backup data.
- **Monitoring Performance** The DBA has to continuously monitor the performance of the queries and take measures to optimize all the queries in the application.
- **Assistance to Application Programmers**: The DBA gives help to application software engineers to create application programs.