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System Analysis & Design - System Planning

What is Requirements Determination?

A requirement is a vital feature of a new system which may include processing or capturing of data, controlling the activities of business, producing information and supporting the management.

Requirements determination involves studying the existing system and gathering details to find out what are the requirements, how it works, and where improvements should be made.

Major Activities in requirement Determination

Requirements Anticipation

- It predicts the characteristics of system based on previous experience which include certain problems or features and requirements for a new system.
- It can lead to analysis of areas that would otherwise go unnoticed by inexperienced analyst. But if shortcuts are taken and bias is introduced in conducting the investigation, then requirement Anticipation can be half-baked.

Requirements Investigation

- It is studying the current system and documenting its features for further analysis.
- It is at the heart of system analysis where analyst documenting and describing system features using fact-finding techniques, prototyping, and computer assisted tools.

Requirements Specifications

- It includes the analysis of data which determine the requirement specification, description of features for new system, and specifying what information requirements will be provided.
- It includes analysis of factual data, identification of essential requirements, and selection of Requirement-fulfillment strategies.

Testing and Quality Assurance

Testing

Testing is the process or activity that checks the functionality and correctness of software according to specified user requirements in order to improve the quality and reliability of system. It is an expensive, time consuming, and critical approach in system development which requires proper planning of overall testing process.

A successful test is one that finds the errors. It executes the program with explicit intention of finding error, i.e., making the program fail. It is a process of evaluating system with an intention of creating a strong system and mainly focuses on the weak areas of the system or software.

Characteristics of System Testing

System testing begins at the module level and proceeds towards the integration of the entire software system. Different testing techniques are used at different times while testing the system. It is conducted by the developer for small projects and by independent testing groups for large projects.

Stages of System Testing

The following stages are involved in testing –

Test Strategy

It is a statement that provides information about the various levels, methods, tools, and techniques used for testing the system. It should satisfy all the needs of an organization.

Test Plan

It provides a plan for testing the system and verifies that the system under testing fulfils all the design and functional specifications. The test plan provides the following information –

- Objectives of each test phase
- Approaches and tools used for testing
- Responsibilities and time required for each testing activity
- Availability of tools, facilities, and test libraries
- Procedures and standards required for planning and conducting the tests
- Factors responsible for successful completion of testing process

Test Case Design

- A number of test cases are identified for each module of the system to be tested.
- Each test case will specify how the implementation of a particular requirement or design decision is to be tested and the criteria for the success of the test.
- The test cases along with the test plan are documented as a part of a system specification document or in a separate document called **test specification** or **test description**.

Test Procedures

It consists of the steps that should be followed to execute each of the test cases. These procedures are specified in a separate document called test procedure specification. This document also specifies any special requirements and formats for reporting the result of testing.

Test Result Documentation

Test result file contains brief information about the total number of test cases executed, the number of errors, and nature of errors. These results are then assessed against criteria in the test specification to determine the overall outcome of the test.

Types of Testing

Testing can be of various types and different types of tests are conducted depending on the kind of bugs one seeks to discover –

Unit Testing

Also known as Program Testing, it is a type of testing where the analyst tests or focuses on each program or module independently. It is carried out with the intention of executing each statement of the module at least once.

- In unit testing, accuracy of program cannot be assured and it is difficult to conduct testing of various input combination in detail.
- It identifies maximum errors in a program as compared to other testing techniques.

Integration Testing

In Integration Testing, the analyst tests multiple module working together. It is used to find discrepancies between the system and its original objective, current specifications, and systems documentation.

- Here the analysts are try to find areas where modules have been designed with different specifications for data length, type, and data element name.
- It verifies that file sizes are adequate and that indices have been built properly.

Functional Testing

Function testing determines whether the system is functioning correctly according to its specifications and relevant standards documentation. Functional testing typically starts with the implementation of the system, which is very critical for the success of the system.

Functional testing is divided into two categories –

- **Positive Functional Testing** – It involves testing the system with valid inputs to verify that the outputs produced are correct.
- **Negative Functional Testing** – It involves testing the software with invalid inputs and undesired operating conditions.

Rules for System Testing

To carry out system testing successfully, you need to follow the given rules –

- Testing should be based on the requirements of user.
- Before writing testing scripts, understand the business logic should be understood thoroughly.
- Test plan should be done as soon as possible.
- Testing should be done by the third party.
- It should be performed on static software.
- Testing should be done for valid and invalid input conditions.
- Testing should be reviewed and examined to reduce the costs.
- Both static and dynamic testing should be conducted on the software.
- Documentation of test cases and test results should be done.

Quality Assurance

It is the review of system or software products and its documentation for assurance that system meets the requirements and specifications.

- Purpose of QA is to provide confidence to the customers by constant delivery of product according to specification.
- Software quality Assurance (SQA) is a techniques that includes procedures and tools applied by the software professionals to ensure that software meet the specified standard for its intended use and performance.
- The main aim of SQA is to provide proper and accurate visibility of software project and its developed product to the administration.
- It reviews and audits the software product and its activities throughout the life cycle of system development.

Objectives of Quality Assurance

The objectives of conducting quality assurance are as follows –

- To monitor the software development process and the final software developed.
- To ensure whether the software project is implementing the standards and procedures set by the management.
- To notify groups and individuals about the SQA activities and results of these activities.
- To ensure that the issues, which are not solved within the software are addressed by the upper management.
- To identify deficiencies in the product, process, or the standards, and fix them.

Levels of Quality Assurance

There are several levels of QA and testing that need to be performed in order to certify a software product.

Level 1 – Code Walk-through

At this level, offline software is examined or checked for any violations of the official coding rules. In general, the emphasis is placed on examination of the documentation and level of in-code comments.

Level 2 – Compilation and Linking

At this level, it is checked that the software can compile and link all official platforms and operating systems.

Level 3 – Routine Running

At this level, it is checked that the software can run properly under a variety of conditions such as certain number of events and small and large event sizes etc.

Level 4 – Performance test

At this final level, it is checked that the performance of the software satisfies the previously specified performance level.

Steps in the initial investigation

1.Problem definition.

Problem definition is the process of identifying the need of the user which led him to request for the system change.

2.Background analysis:-

Background analysis is the process of getting the basic information about the customer's company or organization i.e. How it really works? What people are involved in it?

Background analysis helps the system analyst to prepare the organization chart with the list of people and functions.

3.Fact finding:-

After obtaining the background information, analyst start gathering the data like input, output and cost of the existing system. Information can be gathered by following tools:-

a.)Review of written documents.

b.) On-site observations

c.) Interview and questionnaires

4.Fact Analysis :-

After the collection of data it must be organized and evaluated so that report can be prepared for the final approval from the user.

5. Determination of Feasibility:-

After organizing data, and fact analysis feasibility is evaluated and determine that any alternative proposal is possible or not for the customer's Project.

Fact Finding Method of System Analysis.

Review of Written Documents : In all organizations documents such as forms, records, reports, manuals, etc are available. These help in determining how the present system runs. The process of fact finding includes collection of all possible documents and evaluating them.

On-Site Observation : The purpose of on-site observation is to get as close as possible to the real system being studied. It is the process of recognizing and noting people, objects and occurrences to obtain information.

What kind of system is it? What does it do?

Who runs the system? Who are the important people in it?

What is the history of the system?

Performance Analysis

Performance Analysis is the process of studying or evaluating the performance of a particular scenario in comparison of the objective which was to be achieved. Performance analysis can be do in finance on the basis of profits etc. In HR, performance analysis, can help to review an employees contribution towards a project or assignment.

1. Data **Collection**: It is a process by which data related to performance of a program is collected. They are generally collected in a file, it may be presented to a real user in a real time.

2. Data **Transformation**: It is applied often to reduce the volume of data. For example, a profile recording the minutes spent in each sub routine job on each processor might be transformed to determine minutes spent in each subroutine on each processor and the standard deviation from this mean.

3.Data **Visualization:** Although data reduction techniques can reduce the volume of data, it is often necessary to explore raw data. This process can benefit much more from the use of data visualization techniques.

Efficiency Analysis

- Efficiency concerns how to generate as much output with minimum input. Here is an indication that a system can be said to be inefficient:
  Much time is wasted on the activities of human resources, machines, or computers.
- Data is input or copied to excess.
- Data processed in excess.
- Information is generated in excess.

- Effort required for these tasks are too excessive.
- Material required for these tasks are too excessive.

Service analysis

The service analysis makes a study of the broad knowledge in terms of the service provided. This also studies how the customers view the service provided. The employees are tested in their know-how, technical skills as well as their competitive awareness of the services provided by other business corporations.

Prototyping Model

The prototyping model is a systems development method in which a prototype is built, tested and then reworked as necessary until an acceptable outcome is achieved from which the complete system or product can be developed. This model works best in scenarios where not all of the project requirements are known in detail ahead of time. It is an iterative, trial-and-error process that takes place between the developers and the users.

Advantages of the prototyping model

Using a prototype model can bring multiple advantages, including:

- Customers get a say in the product early on, increasing customer satisfaction.
- Missing functionality and errors are detected easily.
- Prototypes can be reused in future, more complicated projects.
- It emphasizes team communication and flexible design practices.
- Users have a better understanding of how the product works.
- Quicker customer feedback provides a better idea of customer needs.

Disadvantages of the prototyping model

The main disadvantage of this methodology is that it is more costly in terms of time and money when compared to alternative development methods, such as the spiral or Waterfall model. Since in most cases the prototype is discarded, some companies may not see the value in taking this approach.

Additionally, inviting customer feedback so early on in the development lifecycle may cause problems. One problem is that there may be an excessive amount of change requests that may be hard to accommodate. Another issue could arise if after seeing the prototype, the customer demands a quicker final release or becomes uninterested in the product.

UNIT- 4 START FROM HERE

Information Gathering Techniques

The main aim of fact finding techniques is to determine the information requirements of an organization used by analysts to prepare a precise SRS understood by user.

Ideal SRS Document should –

- be complete, Unambiguous, and Jargon-free.
- specify operational, tactical, and strategic information requirements.
- solve possible disputes between users and analyst.
- use graphical aids which simplify understanding and design.

There are various information gathering techniques –

Interviewing

Systems analyst collects information from individuals or groups by interviewing. The analyst can be formal, legalistic, play politics, or be informal; as the success of an interview depends on the skill of analyst as interviewer.

It can be done in two ways –

- **Unstructured Interview** – The system analyst conducts question-answer session to acquire basic information of the system.
- **Structured Interview** – It has standard questions which user need to respond in either close (objective) or open (descriptive) format.

Advantages of Interviewing

- This method is frequently the best source of gathering qualitative information.
- It is useful for them, who do not communicate effectively in writing or who may not have the time to complete questionnaire.
- Information can easily be validated and cross checked immediately.
- It can handle the complex subjects.
- It is easy to discover key problem by seeking opinions.
- It bridges the gaps in the areas of misunderstandings and minimizes future problems.

Questionnaires

This method is used by analyst to gather information about various issues of system from large number of persons.

There are two types of questionnaires –

- **Open-ended Questionnaires** – It consists of questions that can be easily and correctly interpreted. They can explore a problem and lead to a specific direction of answer.
- **Closed-ended Questionnaires** – It consists of questions that are used when the systems analyst effectively lists all possible responses, which are mutually exclusive.

- **Advantages of questionnaires**

- It is very effective in surveying interests, attitudes, feelings, and beliefs of users which are not co-located.

- It is useful in situation to know what proportion of a given group approves or disapproves of a particular feature of the proposed system.
- It is useful to determine the overall opinion before giving any specific direction to the system project.
- It is more reliable and provides high confidentiality of honest responses.
- It is appropriate for electing factual information and for statistical data collection which can be emailed and sent by post.

Review of Records, Procedures, and Forms

Review of existing records, procedures, and forms helps to seek insight into a system which describes the current system capabilities, its operations, or activities.

Advantages

- It helps user to gain some knowledge about the organization or operations by themselves before they impose upon others.
- It helps in documenting current operations within short span of time as the procedure manuals and forms describe the format and functions of present system.
- It can provide a clear understanding about the transactions that are handled in the organization, identifying input for processing, and evaluating performance.
- It can help an analyst to understand the system in terms of the operations that must be supported.
- It describes the problem, its affected parts, and the proposed solution.

Observation

This is a method of gathering information by noticing and observing the people, events, and objects. The analyst visits the organization to observe the working of current system and understands the requirements of the system.

Advantages

- It is a direct method for gleaning information.
- It is useful in situation where authenticity of data collected is in question or when complexity of certain aspects of system prevents clear explanation by end-users.
- It produces more accurate and reliable data.
- It produces all the aspect of documentation that are incomplete and outdated.

Joint Application Development (JAD)

It is a new technique developed by IBM which brings owners, users, analysts, designers, and builders to define and design the system using organized and intensive workshops. JAD trained analyst act as facilitator for workshop who has some specialized skills.

Advantages of JAD

- It saves time and cost by replacing months of traditional interviews and follow-up meetings.
- It is useful in organizational culture which supports joint problem solving.
- Fosters formal relationships among multiple levels of employees.
- It can lead to development of design creatively.
- It Allows rapid development and improves ownership of information system.

Secondary Research or Background Reading

This method is widely used for information gathering by accessing the gleaned information. It includes any previously gathered information used by the marketer from any internal or external source.

Advantages

- It is more openly accessed with the availability of internet.
- It provides valuable information with low cost and time.
- It act as forerunner to primary research and aligns the focus of primary research.
- It is used by the researcher to conclude if the research is worth it as it is available with procedures used and issues in collecting them.

Feasibility Study

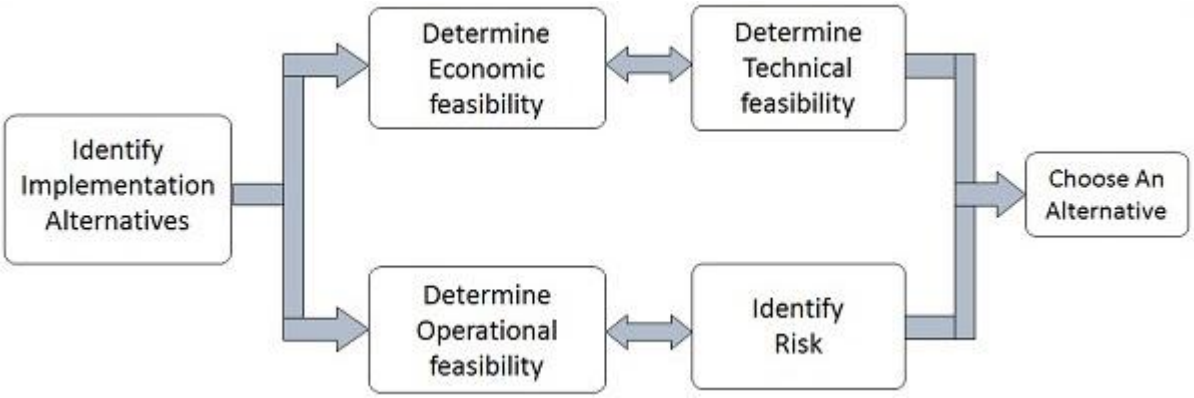
Feasibility Study can be considered as preliminary investigation that helps the management to take decision about whether study of system should be feasible for development or not.

- It identifies the possibility of improving an existing system, developing a new system, and produce refined estimates for further development of system.
- It is used to obtain the outline of the problem and decide whether feasible or appropriate solution exists or not.
- The main objective of a feasibility study is to acquire problem scope instead of solving the problem.
- The output of a feasibility study is a formal system proposal act as decision document which includes the complete nature and scope of the proposed system.

Steps Involved in Feasibility Analysis

The following steps are to be followed while performing feasibility analysis –

- Form a project team and appoint a project leader.
- Develop system flowcharts.
- Identify the deficiencies of current system and set goals.
- Enumerate the alternative solution or potential candidate system to meet goals.
- Determine the feasibility of each alternative such as technical feasibility, operational feasibility, etc.
- Weight the performance and cost effectiveness of each candidate system.
- Rank the other alternatives and select the best candidate system.
- Prepare a system proposal of final project directive to management for approval.



Types of Feasibilities

Economic Feasibility

- It is evaluating the effectiveness of candidate system by using cost/benefit analysis method.
- It demonstrates the net benefit from the candidate system in terms of benefits and costs to the organization.
- The main aim of Economic Feasibility Analysis (EFS) is to estimate the economic requirements of candidate system before investments funds are committed to proposal.
- It prefers the alternative which will maximize the net worth of organization by earliest and highest return of funds along with lowest level of risk involved in developing the candidate system.

Technical Feasibility

- It investigates the technical feasibility of each implementation alternative.
- It analyzes and determines whether the solution can be supported by existing technology or not.
- The analyst determines whether current technical resources be upgraded or added it that fulfill the new requirements.
- It ensures that the candidate system provides appropriate responses to what extent it can support the technical enhancement.

Operational Feasibility

- It determines whether the system is operating effectively once it is developed and implemented.
- It ensures that the management should support the proposed system and its working feasible in the current organizational environment.
- It analyzes whether the users will be affected and they accept the modified or new business methods that affect the possible system benefits.
- It also ensures that the computer resources and network architecture of candidate system are workable.

Behavioral Feasibility

- It evaluates and estimates the user attitude or behavior towards the development of new system.
- It helps in determining if the system requires special effort to educate, retrain, transfer, and changes in employee's job status on new ways of conducting business.

Schedule Feasibility

- It ensures that the project should be completed within given time constraint or schedule.

- It also verifies and validates whether the deadlines of project are reasonable or not.

Structured Analysis

Analysts use various tools to understand and describe the information system. One of the ways is using structured analysis.

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 is a systematic approach, which uses graphical tools that analyze and refine the objectives of an existing system and develop a new system specification which can be easily understandable by user.

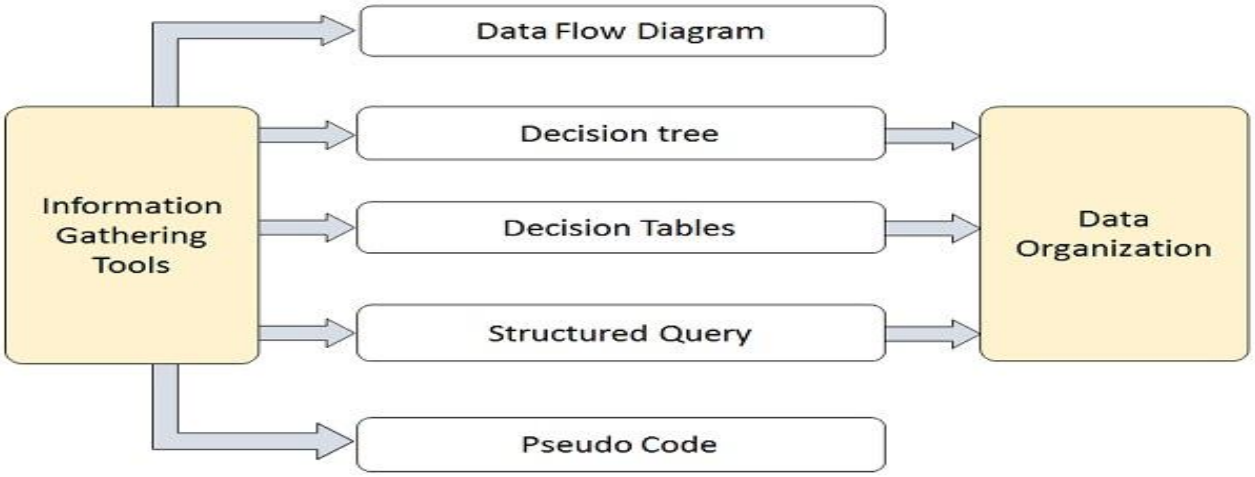
It has following attributes –

- 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



Data Flow Diagrams (DFD) or Bubble Chart

It is a technique developed by Larry Constantine to express the requirements of system in a graphical form.

- It shows the flow of data between various functions of system and specifies how the current system is implemented.
- It is an initial stage of design phase that functionally divides the requirement specifications down to the lowest level of detail.
- Its graphical nature makes it a good communication tool between user and analyst or analyst and system designer.
- It gives an overview of what data a system processes, what transformations are performed, what data are stored, what results are produced and where they flow.

Basic Elements of DFD

DFD is easy to understand and quite effective when the required design is not clear and the user wants a notational language for communication. However, it requires a large number of iterations for obtaining the most accurate and complete solution.

The following table shows the symbols used in designing a DFD and their significance –

Symbol Name	Symbol	Meaning
Square		Source or Destination of Data
Arrow		Data flow
Circle		Process transforming data flow
Open Rectangle		Data Store

Types of DFD

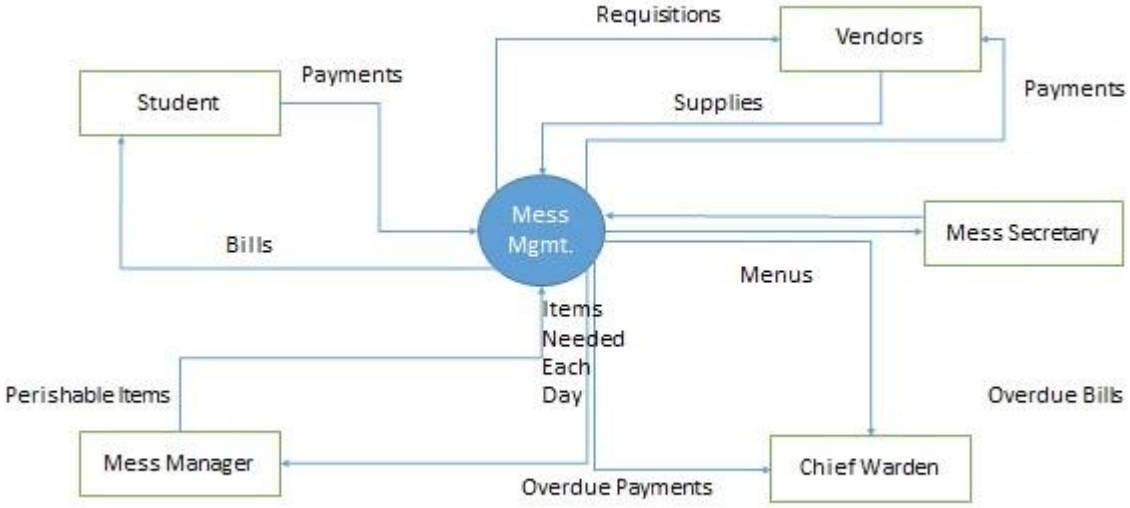
DFDs are of two types: Physical DFD and Logical DFD. The following table lists the points that differentiate a physical DFD from a logical DFD.

Physical DFD	Logical DFD
It is implementation dependent. It shows which functions are performed.	It is implementation independent. It focuses only on the flow of data between processes.
It provides low level details of hardware, software, files, and people.	It explains events of systems and data required by each event.
It depicts how the current system operates and how a system will be implemented.	It shows how business operates; not how the system can be implemented.

Context Diagram

A context diagram helps in understanding the entire system by one DFD which gives the overview of a system. It starts with mentioning major processes with little details and then goes onto giving more details of the processes with the top-down approach.

The context diagram of mess management is shown below.



Data Dictionary

A data dictionary is a structured repository of data elements in the system. It stores the descriptions of all DFD data elements that is, details and definitions of data flows, data stores, data stored in data stores, and the processes.

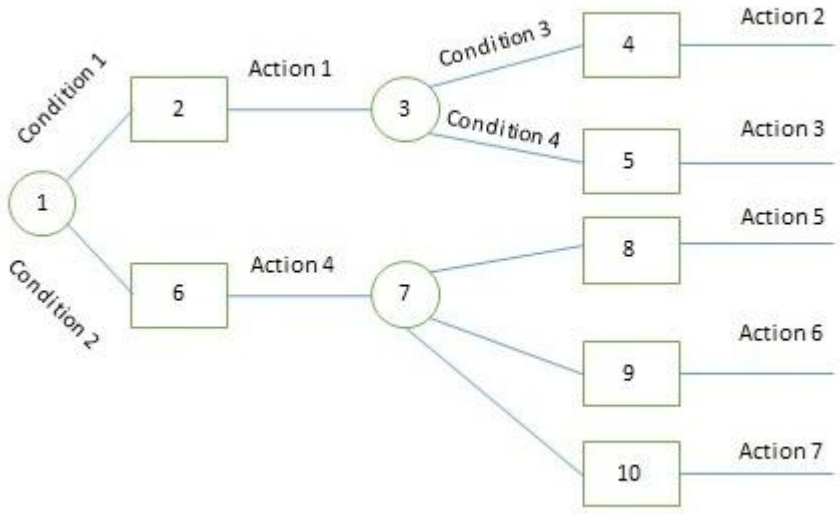
A data dictionary improves the communication between the analyst and the user. It plays an important role in building a database. Most DBMSs have a data dictionary as a standard feature. For example, refer the following table –

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

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 you can take 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.

Guidelines for Selecting Appropriate Tools

Use the following guidelines for selecting the most appropriate tool that would suit your requirements –

- Use DFD at high or low level analysis for providing good system documentations.
- Use data dictionary to simplify the structure for meeting the data requirement of the system.
- Use structured English if there are many loops and actions are complex.
- Use decision tables when there are a large number of conditions to check and logic is complex.
- Use decision trees when sequencing of conditions is important and if there are few conditions to be tested.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