System Design and Modeling

Requirements and specifications are very important company components in the development of any system. Requirements analysis is a the first step in the system design process, where user's Requirements should be simplified and document to generate the corresponding specifications.

There is a distinct difference between requirements and specifications. A requirement is a condition needed by a user to solve a problem or achieve an objective. A specification is a document that specifies, in a complete, precise, verifiable manner, the requirement, design, behavior, or other characteristics of a system, and often, the procedures for determining whether these provisions have been satisfied. For example, a requirement for a car could be that the maximum speed to be at least 120 mph. The specification for this requirement would include technical information about specific design aspects.

System design is the specification or construction of a technical, computer based solution for the business requirements identified in system analysis phase. During design, system analysts convert the description of the recommended alternative solution in to logical and then physical system specification.
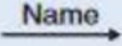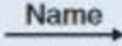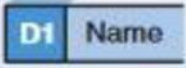
Process Modelling

process modelling involves graphically representing the functions or processes, which capture, manipulate, store and distribute data between a system and its environment and between components within a system. A common form of a process model is data flow diagram. It represents the system overview.
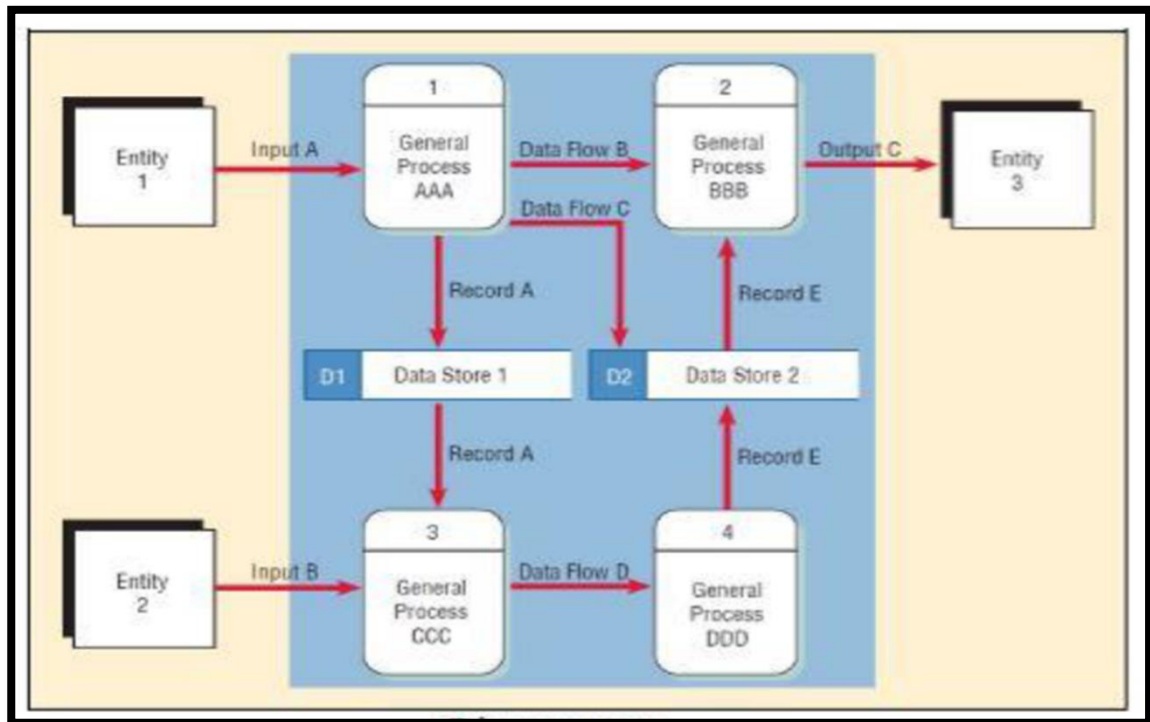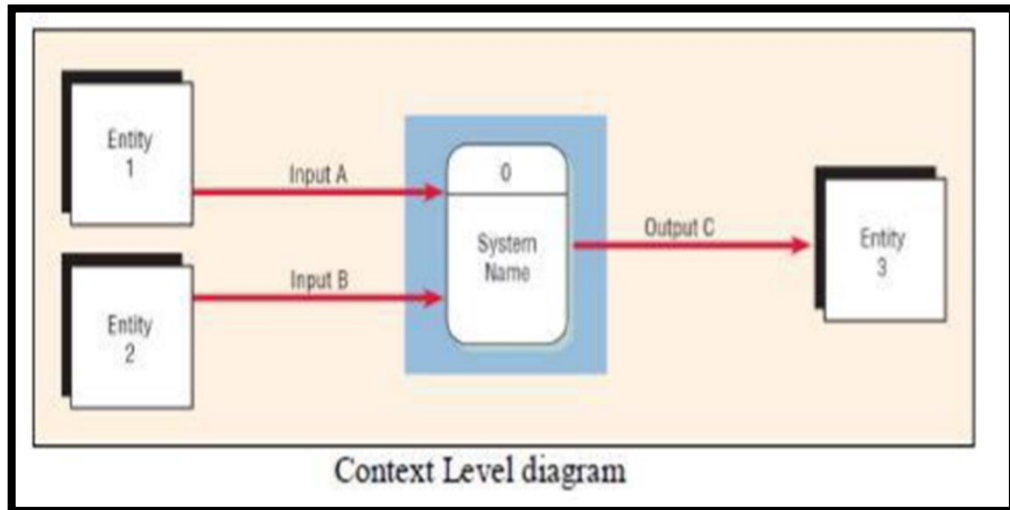
Data Flow Diagrams

A DFD can be categorized in the following forms:

- **Context diagram:** An overview of an organizational system that shows the system boundaries, external entities that interact with the system and the
major information flows between the entities and the system. In this diagram, a single process represents the whole system.

- **First level DFD:** A data flow diagram that represents a system's major processes, data flows, and data stores at a high level of detail.
- **Functional decomposition diagram:** Functional decomposition is an iterative process of breaking the description of a system down into more and more detail which creates a set of charts in which one process on a given chart is explained in greater detail on another chart.

    There is no limit on the number of levels of data flow diagrams that can be drawn. It depends on the project at hand.

Data Flow Diagram Element	Gane and Sarson Symbol	Yourdon Symbol
Every *process* has a number a name (verb phase) a description at least one output data flow at least one input data flow	1 Name	Name
Every *data flow* has a name (a noun) a description one or more connections to a process	Name →	Name →
Every *data store* has a number a name (a noun) a description one or more input data flows one or more output data flows	D1 Name	D1 Name
Every *external entity* has a name (a noun) a description	Name	Name

Context Level diagram

Rules for drawing a data flow diagram:

For process

- No process can have only outputs.
- No process can have only inputs.
- A process has a verb phrase label.

For data store

- Data cannot move directly from one data store to another data store. Data must be moved through a process.
- Data cannot move directly from an outside source to data store. data must be moved through a process that receives data from the source and places it into the data store.
- Data cannot move directly to an outside sink from a data store. Data must be moved through a process. A data store has a noun phrase label.

For external entity

- Data cannot move directly from a source to a sink. It must be moved by a process.
- A source has a noun phrase label.

For data flow

- A data flow has only one direction of flow between symbols. It may flow in both directions between a process and a data store to show a read operation before an update.
- A data flow cannot go directly back to the same process it leaves. There must be at least one other process which handles the data flow. produces some other data flow and returns the original data flow to the beginning process.
- A data flow to a data store means update (delete or change).
- A data flow form a data store means retrieve or use.
- A data flow has a noun phrase label.

Data Modelling

It is a technique for organizing and documenting a system's data. Data modelling is sometimes called database modelling because a data model is eventually implemented as database. It is also sometimes called information modelling. The tool for data modelling is entity relationship diagram.

ER Diagram

It is well suited to data modelling for use with databases because it is easy to discuss and explain. ER models are readily translated to relations.

ER modelling is based on two concepts:

•Entities, defined as tables that hold specific information (data).

•Relationships, defined as the associations or interactions between entities.

Entities

An entity is an object in the real world with an independent existence that can be differentiated from other objects.

Attributes

Each entity is described by a set of attributes (e.g., Employee = (Name, Address, Birthdate (Age), Salary).

Degree

The degree of a relationship is the number of entities that participate in the relationship.