Shiksha Mandal's

G. S. College of Commerce, Wardha

DEPARTMENT OF B. COM. COMPUTER APPLICATION

BCCA Part-II SEM-III

Database Management System

Unit –I

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Introduction

➡ **Concept of the System**

- ➡ A system is an integration of entities (data-table) alternatively defined as components which have interaction amongst them.

- ➡ For example our College and its Departments, entities are faculties , students , non teaching staff, class- rooms etc

- ➡ These entities interact with each other for Functioning of the department.

- ➡ Information system integrates four component's

  - ➡ People
  - ➡ Procedure
  - ➡ Software
  - ➡ Hardware

The stable information system will facilitate the functioning of this system for better operational efficiency.
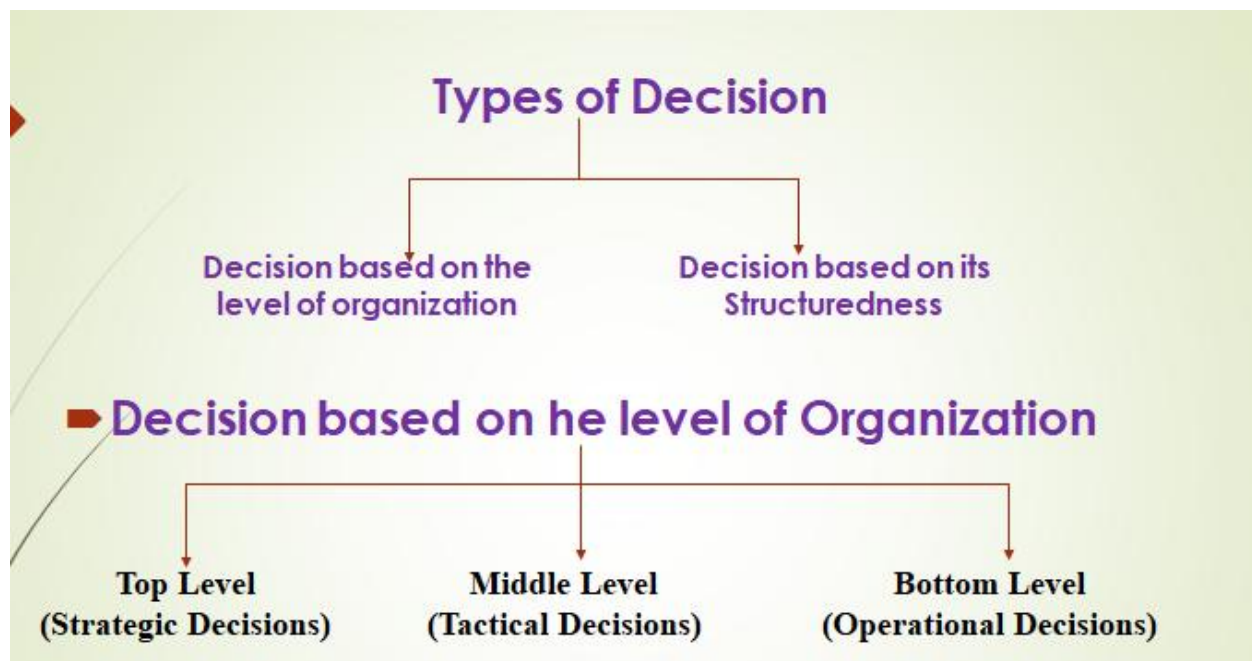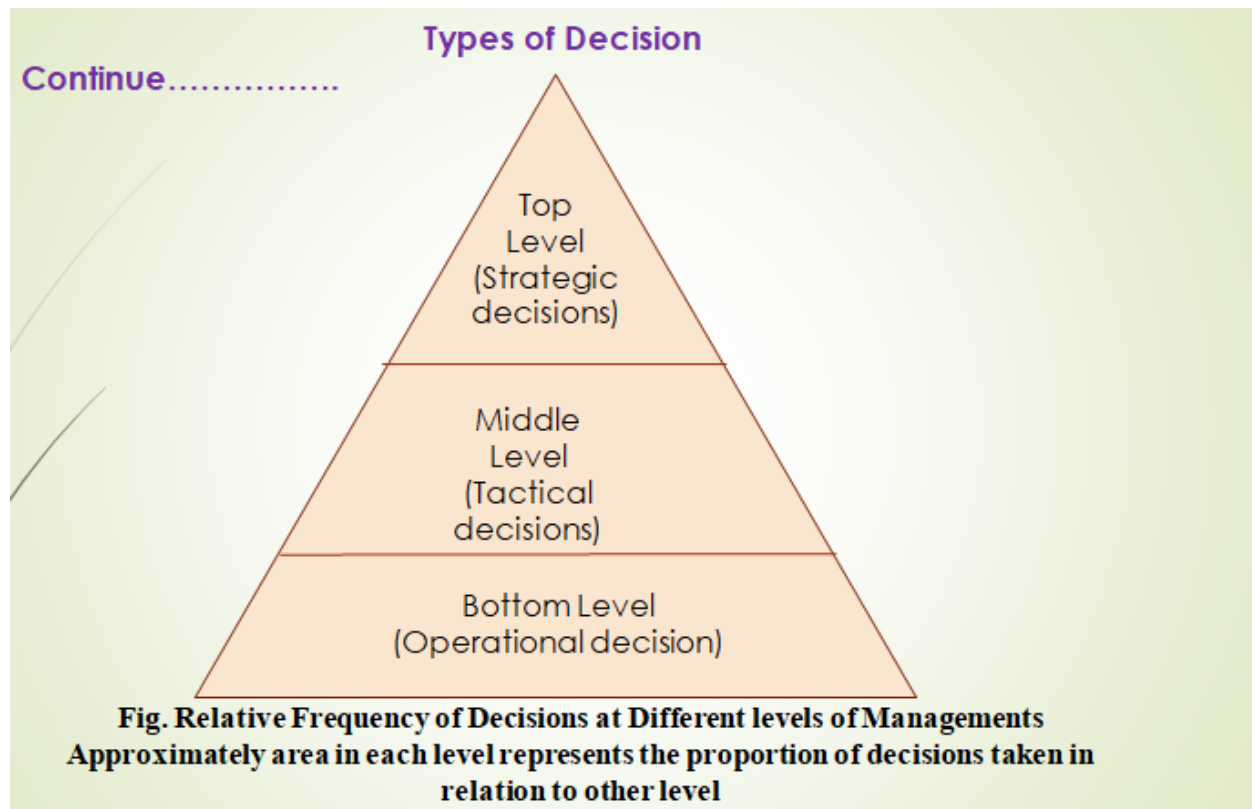
Types of Decisions

Fig. Classification of Types of Decisions

Types of Decision

Continue……………..

Top
Level
(Strategic
decisions)

Middle
Level
(Tactical
decisions)

Bottom Level
(Operational decision)

**Fig. Relative Frequency of Decisions at Different levels of Managements
Approximately area in each level represents the proportion of decisions taken in
relation to other level**

- ➡ **The Strategic decision s(Top Level):** This type of decisions are taken at top level . The nature of this type of decision may be defining the goals, making policies determining the objectives

- ➡ **The Tactical Decisions(Middle Level) :** This decision include gaining of resources , plant location new product establishments and monitoring budget etc.

- ➡ **The Operational decisions (Bottom Level):-** This type of decisions are taken at bottom level of the management. Some example under this categories are effective and efficient use of existing facilities and resources to carry out activities within the budget constraints
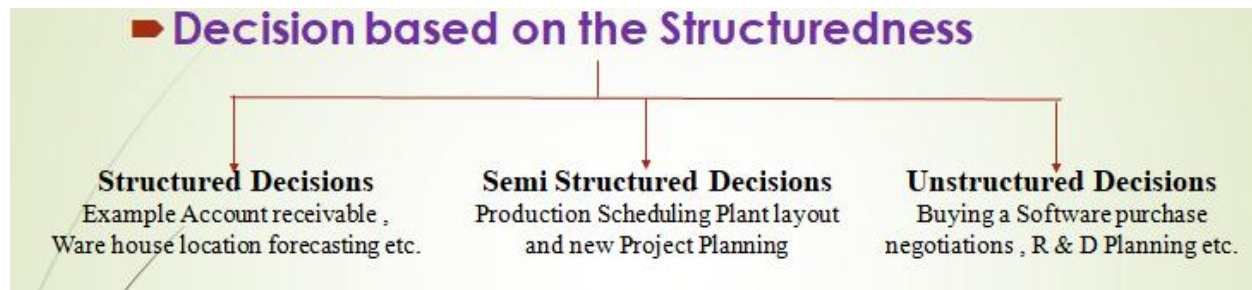
Fig. Classification of Decision based on the Structuredness

• The Frequency of Structured Decisions will be more at the bottom level

• The Frequency of Unstructured Decisions will be more at the Top level

• The Frequency of Semi Structured Decisions will be more at Middle level

In the process of managing various subsystem of an organization executives at different levels of the organization need to take several management decisions.

➢ **Information System**

➥ Information System are tools to enable the execution to functions efficiently and effectively .

➥ Almost Information System are computer based mainly because of volume of data (big data storage) to be processed and speed at which the decisions are to be taken and reports are to be generated for effective functioning of the executives in today's competitive business environments .

➥ An information system is the software that helps organize and analyze data. The purpose of an information system is to turn raw data into useful information that can be used for decision making in an organization.

➥ **Components of the information system are as follows:**

➥ An Information system is a combination of hardware and software and telecommunication networks that people build to collect, create and distribute useful data, typically in an organisational, It defines the flow of information within the system. The objective of an information system is to provide appropriate information to the user, to gather the data, processing of the data and communicate information to the user of the system.
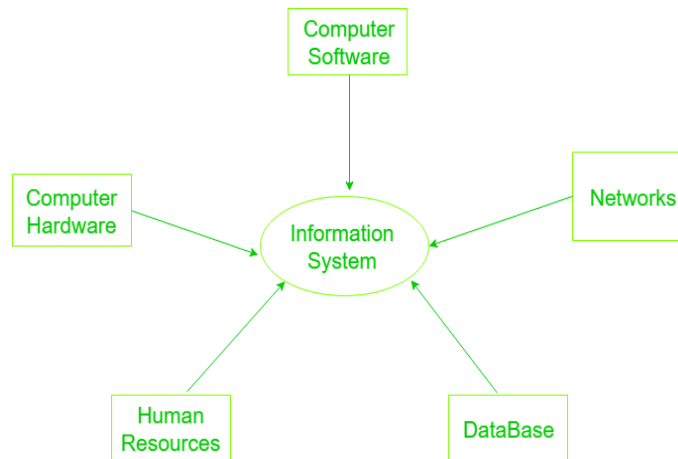
1. Computer Hardware:

Physical equipment used for input, output and processing. What hardware to use it depends upon the type and size of the organisation. It consists of input, an output device, operating system, processor, and media devices. This also includes computer peripheral devices.

2. Computer Software:

The programs/ application program used to control and coordinate the hardware components. It is used for analysing and processing of the data. These programs include a set of instruction used for processing information.

Software is further classified into 3 types:
1. System Software
2. Application Software
3. Procedures

3. Databases:

Data are the raw facts and figures that are unorganised that are and later processed to generate information. Softwares are used for organising and serving data to the user, managing physical storage of media and virtual resources. As the hardware can't work without software the same as software needs data for processing. Data are managed using Database management system.

Database software is used for efficient access for required data, and to manage knowledge bases.

4. Network:

- Networks resources refer to the telecommunication networks like the intranet, extranet and the internet.

- These resources facilitate the flow of information in the organisation.

- Networks consists of both the physicals devises such as networks cards, routers, hubs and cables and software such as operating systems, web servers, data servers and application servers.

- Telecommunications networks consist of computers, communications processors, and other devices interconnected by communications media and controlled by software.

- Networks include communication media, and Network Support.

5. Human Resources:

It is associated with the manpower required to run and manage the system. People are the end user of the information system, end-user use information produced for their own purpose, the main purpose of the information system is to benefit the end user. The end user can be accountants, engineers, salespersons, customers, clerks, or managers etc. People are also responsible to develop and operate information systems. They include systems analysts, computer operators, programmers, and other clerical IS personnel, and managerial techniques.

➡ Introduction to DBMS

DBMS stands for Database Management System. We can break it like this DBMS = Database + Management System. Database is a collection of data and Management System is a set of programs to store and retrieve those data. Based on this we can define DBMS like this: DBMS is a collection of inter-related data and set of programs to store & access those data in an easy and effective manner.

➡ What is the need of DBMS?

Database systems are basically developed for large amount of data. When dealing with huge amount of data, there are two things that require optimization: Storage of data and retrieval of data. One of the primary aims of a database is to supply users with an abstract view of data, hiding a certain element of how data is stored and manipulated. Therefore, the starting point for the design of a database should be an abstract and general description of the information needs of the organization that is to be represented in the database. And hence you will require an environment to store data and make it work as a database.

➥ **DATABASE ENVIRONMENT AND ITS ARCHITECTURE.**
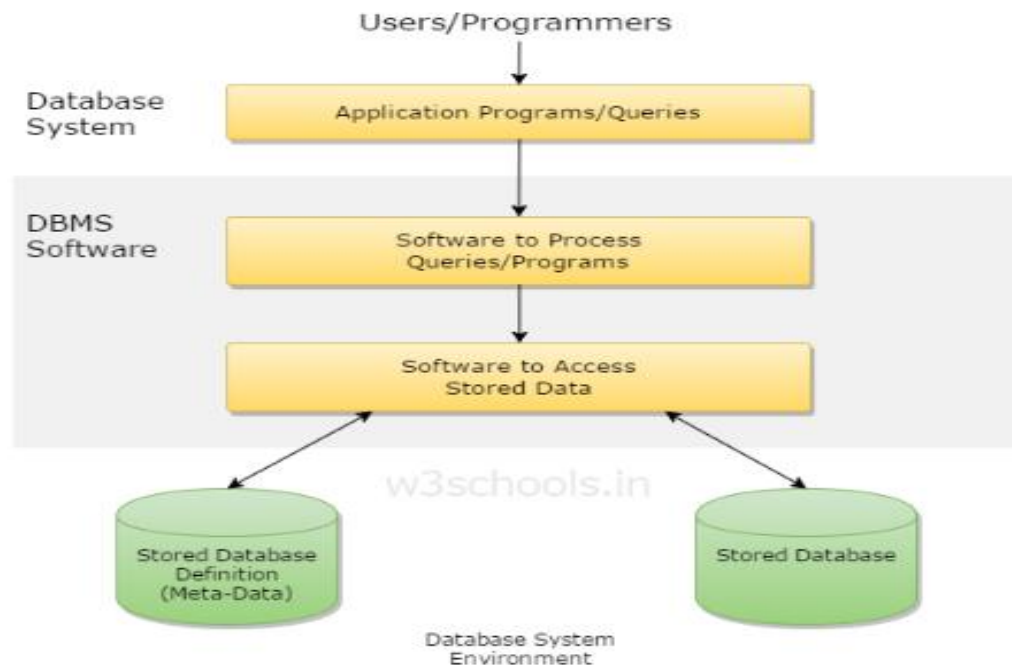
Database System

      The alternative system i.e. DataBase System which is based on data base approach, is desired because it would eliminate all the draw backs of conventional file processing system

Definition of Data Base System

      For define data base system the following terminology must be clarified

- File
- Database
- Database Management System(DBMS)

➢ **File (Table):-** It A table is a collection of related data held in a structured format within a database. It consists of columns, and rows. It also a two dimensional Table summarized the multiple instance of a set of fields of an entity.

➢ **Database:-It is collection of interrelated files (Tables). It** is a collection of related data and data is a collection of facts and figures that can be processed to produce information.

➢ **Database Management System (DBMS):-** It is the collection of databases, database utilities (DBMS S/W) Data Dictionary/ directories, operated by user group/ application

developers and DBA. A **database management system** stores data in such a way that it becomes easier to retrieve, manipulate, and produce information.

DBMS which is free from all the drawbacks of the conventional file processing system. In the database system data is independent from program.

Eg. (Conceptual data Model of Hospital Management System)

❖ Advantages / Objectives of DBMS.
Following are some advantages of DBMS
1. Reduced data redundancy.
2. Consistency of data.
3. Flexibility of file system.
4. Enhanced data sharing.
5. Increased programmer productivity.
6. Reduced program maintenance.

- **Reduced data redundancy:-**Since the database approach suggest a single centralized database the amount of redundancy of data will be minimal and it will have various other related benefits.

- **Consistency of data:-**The reduced data redundancy will minimize the presence of the some data in different files which will lead to consistency of data.

- **Flexibility of file system:** - In database approach the database is designed based on bottom up approach which ensures that the end users have all the reports. This is possible mainly because all the reports that are currently used by various end users and also various expected future reports are taken into account while designing the database using the bottom up approach. As and when some changes in reports requirements occur, corresponding revision of the database can be done with minor changes in the database.

- **Enhanced data sharing**:- Since the database approach results in an integrated centralized database, the same file can be used in different applications. This enhances the data sharing features.

- **Increased programmer productivity**:-The programmer productivity is the measure of time taken to develop an application. In the database approach the data is separated from programs. This greatly solves the problem of data maintenance. Also there are many forth generations languages available to access and manipulate databases. Because of the

advanced capabilities of 4GLs the time taken to develop an application will be significantly less when compared to the time taken to develop it using conventional file processing system. This amounts to an increase in the programmer productivity.

- **Reduced program maintenance**:-Different applications are developed under the coordination of the database administrator ,As a result there will be an integrated effort among the development groups in terms of file design a and program design. This will reduce the task of program maintenance.

❖ **Disadvantage of DBMS:-**

A database system generally provides on-line access to the database for many users. In contrast, a conventional system is often designed to meet a specific need and therefore generally provides access to only a small number of users. Because of the larger number of users accessing the data when a database is used, the enterprise may involve additional risks as compared to a conventional data processing system in the following areas.

1. Confidentiality, privacy and security.
2. Data quality.
3. Data integrity.
4. Enterprise vulnerability may be higher.
5. The cost of using DBMS.

- **Confidentiality, Privacy and Security**

   When information is centralized and is made available to users from remote locations, the possibilities of abuse are often more than in a conventional data processing system. To reduce the chances of unauthorized users accessing sensitive information, it is necessary to take technical, administrative and, possibly, legal measures. Most databases store valuable information that must be protected against deliberate trespass and destruction.

- **Data Quality**

   Since the database is accessible to users remotely; adequate controls are needed to control users updating data and to control data quality. With increased number of users accessing data directly, there are enormous opportunities for users to damage the data. Unless there are suitable controls, the data quality may be compromised.

- **Data Integrity**

Since a large number of users could be using a database concurrently, technical safeguards are necessary to ensure that the data remain correct during operation. The main threat to data integrity comes from several different users attempting to update the same data at the same time. The database therefore needs to be protected against inadvertent changes by the users.

- **Enterprise Vulnerability**

  Centralizing all data of an enterprise in one database may mean that the database becomes an indispensible resource. The survival of the enterprise may depend on reliable information being available from its database. The enterprise therefore becomes vulnerable to the destruction of the database or to unauthorized modification of the database.

- **The Cost of using a DBMS**

  The database approach provides a flexible alternative where new applications can be developed relatively inexpensively. The flexible approach is not without its costs and one of these costs is the additional cost of running applications that the conventional system was designed for. Using standardized software is almost always less machine efficient than specialized software.

❖ Components of DBMS.

A schematic representation of components of DBMS is shown in the fig. (Already have in your note book) It is clears from the fig. that core subsystem of the DBMS is consists of DBMS Utilities, database and data dictionary/Directory, DBA, Usergroups,Application developers.

- **DBMS Utilities** are like Oracle, Sybase, Focus, IDMS, IMS, etc. These are the database languages which are in turn used to develop different applications. Many of these languages belong to Fourth generation's language. Which have many distinct features when compared to DbaseIII, Dbase, and FoxPro. These GLs has the capabilities of generating source code for different applications just by clicking buttons through a menu driven option.

- **Database is a collection of interrelated files**. In DBMS which has an integrated single database all the problems of conventional file system will be minimized even though the

time taken to design and implement a robust database will be relatively longer when compared to the design of files in the conventional file processing system.

- **Data dictionary /Directory** are a system which maintains data about data in the database. It is also known as system containing metadata. This will contain information about following.

    - Number of files in the database.
    - Name of the files
    - Association between files
    - Structure of each file, which includes the list of fields in it, type of each field length of each field, key filed and alternate name of each field.

- **Application Developer**: These are the qualified programmer /analyst who are available with the company to develop different applications which are required for the users. They use other DBMS component to develop different applications for satisfying organizational information need.

- **User Group**: These are the people belonging to different sub systems of a company. These user groups will use the different applications which are developed by the application developers of the company.

- **Database Administrator: -** It is the apex body which controls all the software entities, database entities, application developers and user group.

The different arrows in fig show the existence of interface between the respective pair of components of the total system. The DBA has association with all other entities. The application developer has association with the database management system, database and DD/D. The user groups have association with the database management system and DBA. The DBMS and DD/D are closely together. Database systems are divided into four parts for different functions. Some functions may be provided by the operating system. The database management system is structured and interfaces with various users as shown.

❖ The Components of SQL

Data definition language compiler: DDL compiler converts the data definition statements into a set of tables. These tables contain the metadata concerning the database and are in a form that can be used by other components of the DBMS.

• **Data Manager:** It is the central software component of the DBMS. It is sometimes referred to as the database control system. One of the function of the data manager is to convert operations in the user's queries coming directly via the query processor or indirectly via an application program from the user's logical view to physical file system. The data manager is responsible for interfacing with the file system. In addition the task of enforcing constraints to maintain the consistency and integrity of the data as well as its security are also performed by the data manager.

• **File manager:** Responsibility for the structure of the files and managing the file space rests with the file manager. It is also responsible for locating the block containing the required record, requesting the block from disk manager. • Query processor: The database user retrieves data by formulating a query in the data manipulating language provided with the database. The query processor is used to interpret the online user's query and convert it into an efficient series of operations in a form capable of being sent to the data manager for execution.

• **Telecommunication system:** Online users of a computer system whether remote or local, communication with it by sending or receiving messages over communication lines. These messages are routed via an independent software system called a telecommunication system or a communication control program. It is not the part of the DBMS but the DBMS works closely with this system. The online users may communicate with the database directly or indirectly via a user interface and an application program.

• **Data Files:** It contains the data portion of the database.

• **Data dictionary: DD** is a database itself which documents the data. Each database user consults the DD to learn what each piece of data and various data field of it.

❖ <u>Economic Justification of Database Approach</u>

This is important task before it is taken up for development. This involves listing down cost and benefits of developing and implementing the database system for a given reality and comparing them for economical justification.

<u>Cost:-</u>

The different consideration of costs using database approach is as listed below

1. Cost of DBMS Software/utilities
2. Cost of procuring hardware
3. Incremental cost of employing application developers and database administrator with special skills.
4. Cost of training the application developers and database administrator
5. Cost of training the user groups
6. Incremental cost of designing and implementing the database

Benefits:-

The deferent benefits of using database approach are as listed below

1. Reduction in salary of user groups
2. Reduction in cost due to improved maintenance of database due to reduce data redundancy and reduces related problem.
3. Saving in the cost due to reduction of time in generating different reports
4. Estimated reduction in costs due to reduction in improper/ delayed information to different user groups which include deferent section of **production function, marketing function, finance function, personnel function, and logistic subsystem.**

❖ Data Base Concepts

Introduction

The concept of data base is more understandable by the concepts of Data, Information and Metadata etc. with its several terminologies of database concepts.

• Data

The center of any information system is data, the basic facts upon which a company's information need are generated. A System consists of interrelated entities each of which has a set of attributes. **Data are some instances of the attributes of the entities of the system.** Consider an organization such as college who provide education. The entities of these systems are student, staff. Each of these has certain attributes for **ex. roll no, class, subject etc.** are the attributes of **student**. So Occurrences of all these attributes of each of the entities are known as data. In the other words we can say that data is the unprocessed material of any system.

• Information:

Processed data is called as information. In other word we can say that data is like a raw material and the information is like the product made using the raw material.
        For ex. In company details of all employees data are maintained in proper file. The master file such as employee_info, leave_info files contain all the basic information such as employees date of birth, his date of joining, salary designation, leave id ,leave

type etc where as transaction file such as salary-transaction, leave-transaction which contain the details of salary ,leave taken by different employee. Transaction in the transaction files are done by using all masters file.

       The information of a particular subsystem will act as data for another subsystem. In the above table employee master file act as data for salary transaction file. Similarly Leave Master file act as data for Leave transaction File.

- **Metadata:-**
         Metadata is the data about the data i.e. information for accessing data.

1. Consider the ex. of a textbook which has index page or content page. This page contains the chapter numbers as well as page numbers or one can access given topic/subtopic using the indicated page numbers in the contents. In this ex. Content pages or index page is form the metadata.
2. Similarly in the database environment the data about the organization of files in the database is collectively stored in a domain. This domain is called as metadata or data dictionary.
3. Metadata or data dictionary contains the data such as fieldname, field type, and field size of a table. It also contains the description about the constraint applied on a field, keys and Relationship of a table with another table.

❖ Terminologies of A File (Tables)

The hierarchy of terminologies of files is presented below

1. Field
2. Records
3. Files
4. Key Fields/ Primary Key
5. Non Key Fields /Secondary Key
6. Schema
7. Subschema

- Field / Attribute: - It is lowest level of an entity is called as Field or an Attribute of that entity. (A field is part of a record and contains a single piece of data for the subject of the record.) eg. Stud_no, Stud_name, Address are fields of Student entity. Each and every field or attributes is defined to store data about Student.

- Record: - Record is collection of fields / attributes of an entity in a desired sequence
  Eg.

Stud_no	Stud_Name	Address
1	ABC	Nagpur

- File: - File is Collection of records having the same set of fields arranged in same sequence.

  Eg.

Stud_no	Stud_Name	Address
1	ABC	Nagpur
2	XYZ	Wardha
3	PQR	Nagpur

- Key Field / Primary Key:-A Field is said to be Key Field / Primary Key if it can identify record is uniquely in File.

  Eg. Emp_Id in Employee File

  Stud_no in Student File and so on….

  In the above case there will be only one record in the respective file having the specified key field content.

- Non Key / Secondary Key: - A Key is said to be Non Key Field or Secondary Key if it is not identified record uniquely in a file.

  Eg. Emp_name, Stud_ Name are Non key fields in Employee and Student respectively which are not identified records uniquely.

- Schema:- It is schematic representation or overview of all files in the database. The arrangement of all the files for an entire organization is an example of Schema.

- Subschema: - A portion of the schema of data base is called as Subschema. The arrangement of files presenting to specific subsystem of an organization is an example of Subschema.

❖ Association Between Fields

Association between the fields of a file is the relationship in terms of occurrence of the data of a file. The association between the fields of a file can be classified in to….

- One - to – One [1:1]
- One - to – Many [1: M]
- Many - to – One [M : 1]
- Many - to – Many [M:M]
- One – To – One Conditional Association

➢ **One - to – One [1:1]:-** In this type of association value of one field of a file is associated with only one value of another field of that table.

For ex in an employee file one employee_no is associated with only one employee address.

➢ **One - to – Many [1: M]:-** In this type of association value of one field of a file is associated with many values of another field of that table.

For eg. In a college a teacher can teach many subjects which is shown in the figure.

- ➢ **Many - to – One [M : 1]:-** In this type of association many values of one field of a file is associated with many values of another field of that table.
  For eg. In a college a student can take many subjects for his semester and a subject can be elected by many students.
- ➢ **Many - to – Many [M: M]:-** In this type of association many values of one field of a file is associated is associated with one values of another field of that table.
  For eg. In a hospital many patient can visit the ward i. e. general ward.
- ➢ **One – To – One Conditional Association: -** In this type association one value of a column is associated with one value another column only when some sort of condition is true.
  For eg. In a hospital a bed_no has one to one association with a patient only when it is assigned to him. Hence this type of association is known as one to one conditional association.
  Fig. Example…..

❖ <u>Association Between Files (Record Types)</u>

Association between the files is the relationship between the records of these two files or between any two record types. These types of association between the files can be classified in to….

1. One - to – One [1:1]
2. One - to – Many [1: M]
3. Many - to – One [M : 1]
4. Many - to – Many [M:M]
5. One – To – One Conditional Association
6. Multiple Association
7. Recursive association

- ➢ **One - to – One [1:1]:-** In this type of association, a record of one file is associated with only on record of another file.
- ➢ **One - to – Many [1: M]:-** A record of one file will be associated with one or more record of another file.
- ➢ **Many - to – One [M: 1]:-** In this type of association many records of the one file will be associated with single record of another file.
- ➢ **Many - to – Many [M : M]:-** Each record of a one file is associated with one or many record of another file.
- ➢ **One – To – One Conditional Association: -** In this type association a particular record of a file will be associated with only one record another file for only certain period of time(temporary) if the condition is satisfied.
- ➢ **Multiple Association: -** In some situation, there will be more than one type of association between the two files. This type of association is known as multiple associations.
- ➢ **Recursive Association**: - Recursive association is a association between entities of the same entity class. Recursive association may be classified in to…

1. One- to-Many Recursive Association
2. Many- to-Many Recursive Association

❖ <u>File Organization</u>

File Organization defines how file records are mapped onto disk blocks. We have three types of File Organization to organize file records

- Sequential File Organization
- Indexed Sequential File Organization
- Direct/Random access File Organization

<u>Terminologies of Storage Area</u>

The files are stored in the secondary storage area normally called as magnetic disk. A disk is divided into tracks, cylinders, Blocks and sectors.

- **A track** is a circular storage position on that disk area. It is that portion of a disk which passes under a single stationary head during a disk rotation, a ring 1 bit wide.
- **A Block** is a sector of a track which stores set of records
- **A cylinder** is a collection of tracks of different magnetic disk mounted one over another with a constant radius or a collection of adjacent tracks in the same disk.
- **A Sector** A track is divided into segments of sectors, which is the basic unit of storage. It is a subdivision of a track on a magnetic disk or optical disc. Each **sector** stores a fixed amount of user-accessible data,
- **Access assembly** is consist of access arm and read/ write heads . the Read/Write heads move along the access arm to position themselves at the different cylinder of the magnetic disk.

A track is divided into segments of sectors, which is the basic unit of storage.

➢ **Sequential File Organization**

Every file record contains a key field to uniquely identify that record. In sequential file organization, records are placed in the file in some sequential order based on the unique key field or search key. Practically, it is not possible to store all the records sequentially in physical form.

➢ **Indexed Sequential File Organization**

The records of the file are stored in the physical storage area as per the desired order of the key field in that type of file organization we have create set of Index values

which will help in accessing the records from the physical storage area randomly without accessing other records from the beginning of the to the location of that record.

Advantages:

An Indexed Sequential file can be accessed in two ways

1. Sequentially reading through each of the records from the beginning in the Main data file – i.e. exactly the same way as a sequential file

 OR

2. Using the Index file (which is a MUCH smaller file) to determine the location on disk of the Record – and then accessing that Record using the Direct manner.

3. They can be quite efficiently used for sequential processing of high activity ratio applications.

Disadvantages:

1. An Indexed file has problems with lots of records that are added and deleted i.e. deleted records are not really deleted – they are "flagged" as deleted and additions to the file are not placed in sequential order in the main data file – they are placed in any available space – and this is catered for in the Index file.

2. The Indexed Sequential File is not really suitable for Volatile files i. e. the files in which a lot of records are being written and deleted.

➢ Direct file organization

A Direct file is one whose records are stored in such a way that access to any one of them is direct – that is without going through a lot of records to get to the one(s) you want. Records in a Direct File are not placed one after the other – rather a location for the file is set aside on disk and then the records are written to any location that is free within this area. The Direct file organization can be of two types

1.Relative address Direct File Organization

2.Hashed Address Direct File Organization

• Relative address Direct File Organization

In this type of file organization the relative address of desired record from the base address must be given by the user.

FOR EXAMPLE 15th record of the file or 7th record of the file etc. if a particular record is to be accessed then the user should refer the base document and identify the relative address of the record to be accessed before submitting it to computer

- **Hashed Address Direct File Organization**

   A technique known as **"hashing"** uses a Key to produce the location on the disk for each of the Records – and it is through this that individual records can be accessed directly. A Direct file provides the fastest possible access to records. ISAM (indexed-sequential-access method) also provides users with direct access to individual records. Direct file is typically the best when access time is critical and when batch processing is not necessary. Access time is the interval between the moment at which an instruction control unit initiates a call for data and the moment at which delivery of the data is completed.

   For example, direct access memory is faster than sequential access memory.

   A Direct file uses a formula to transfer the primary key to the location of each record. This formula is called a **Hashing algorithm.** Therefore, no index is needed to locate individual records. Many hashing algorithms have been developed.

   In general, the primary key value is divided by a prime number, which corresponds to the maximum number of storage locations allocated for the records of this file. The reminder obtained in this division is then used as the relative address of a record, but relative address can be translated into physical locations on the storage medium. For example you input a Student ID Number, a mathematical formula is applied to it, and the resulting value is the value that points to the storage location on disk where the record can be found.

- ## Classification of Information System

In any given organization **information system** can be **classified** based on the usage of the **information**. Information system this is a tool for basic data analysis based on formulas that define relationships among the data. **Information system**, an integrated set of components for collecting, storing, and processing data and for providing information, knowledge, and digital products. Business firms and other organizations rely on information systems to carry out and manage their operations, interact with their customers and suppliers, and compete in the marketplace.

Information systems are used to run inter-organizational supply chains and electronic markets. For instance, corporations use information systems to process financial accounts, to manage their human resources, and to reach their potential customers with online promotions. Many major companies are built entirely around information systems. Therefore, an **information system** in an organization can be divided into operations support **system** and management support **system**.
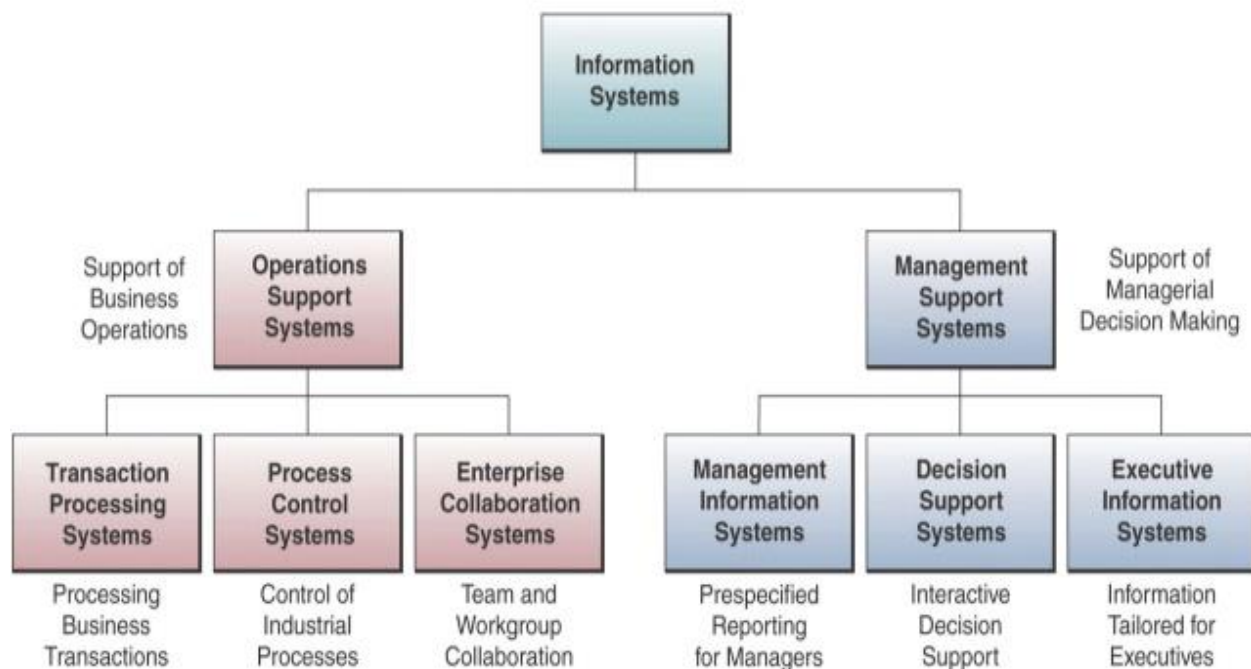

Fig. Classification of Information System

According to syllabus the information system classified into the following types, (figure shows the types of information system and its components according to RTMNU syllabus).

1. **MIS (Management Information System)**
2. **DSS (Decisions Support System**
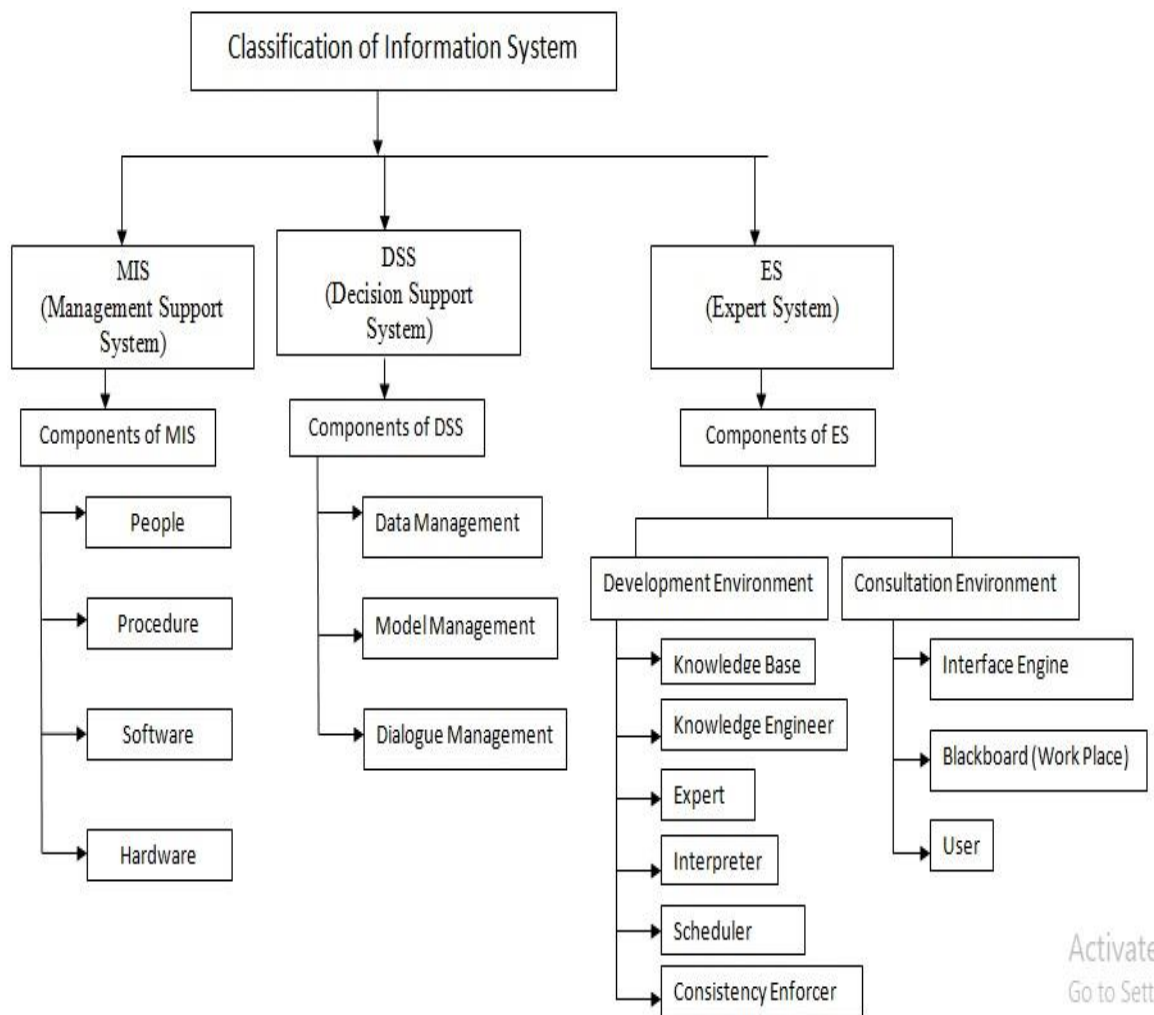3. **ES (Expert System)**

Fig. Classification of Information system and its components

- **Management Information System (MIS)**

    Management Information Systems (MIS) are used by tactical managers to monitor the organization's current performance status. The output from a transaction processing system is used as input to a management information system. The MIS system analyzes the input with routine algorithms i.e. aggregate, compare and summarizes the results to produced reports that tactical managers use to monitor, control and predict future performance.

    For example, input from a point of sale system can be used to analyze trends of products that are performing well and those that are not performing well. This information can be used to make future inventory orders i.e. increasing orders for well-performing products and reduce the orders of products that are not performing well.

Examples of management information systems include; **Sales managemen**t systems – they get input from the point of sale system Budgeting systems – gives an overview of how much money is spent within the organization for the short and long terms.

Human resource management system – overall welfare of the employees, staff turnover, etc.

Tactical managers are responsible for the semi-structured decision. MIS systems provide the information needed to make the structured decision and based on the experience of the tactical managers, they make judgment calls i.e. predict how much of goods or inventory should be ordered for the second quarter based on the sales of the first quarter.

> **Components of MIS**
>> ▪ People
>> ▪ Procedure
>> ▪ Computer (Software/Hardware)
>> ▪ Network

- ## Decision Support System (DSS)

This system assists to the managers in taking unstructured or semi-structured decisions. It has Model base which helps managers to do sensitivity analysis before arriving at the final decisions. It will provide support to persons, groups and institutes. It is used for problem that are adhoc and unique in nature

Decision support systems are used by senior management to make non-routine decisions. Decision support systems use input from internal systems (transaction processing systems and management information systems) and external systems. The main objective of decision support systems is to provide solutions to problems that are unique and change frequently. Decision support systems answer questions such as; **What would be the impact of employees' performance if we double the production lot at the factory? What would happen to our sales if a new competitor entered the market?**

Decision support systems use sophisticated mathematical models, and statistical techniques (probability, predictive modeling, etc.) to provide solutions, and they are very interactive.

Examples of decision support systems include; Financial planning systems – it enables managers to evaluate alternative ways of achieving goals. The objective is to find the optimal way of achieving the goal.

For example, the net profit for a business is calculated using the formula Total Sales less (Cost of Goods + Expenses). A financial planning system will enable senior executives to ask what if questions and adjust the values for total sales, the cost of goods, etc. to see the effect of the decision and on the net profit and find the most optimal way. Bank loan management systems – it is used to verify the credit of the loan applicant and predict the likelihood of the loan being recovered.

> **Components of DSS**
>> o Data Management
>> o Model Management
>> o Dialogue Management

Data Management: - Consist of DSS database, Database management system, Data Directory and Query Facility

Model Management:- Consist of Model Based Managements System, Model- Directory and Model Execution Integration and Command Processor

Dialogue Management:- It is part of DSS consist of software and hardware which provide user interface for DSS

- **Expert system:**

Expert system is used to distribute knowledge resource for improved and consistent result. These are backed with sound knowledge based which help gain the expertise of the specialist in in the field. So expert systems can replicate human advisers and replace them provide support to person and groups and it is used for problems which are repetitive in nature.

Expert database systems (EDS) are database management systems (DBMS) endowed with knowledge and expertise to support knowledge-based applications which access large shared databases.

Components of an expert system:
The components of an expert system are classified into two environments
1. Development Environment
2. Consultation environment
   Components of Development Environment
   - **Knowledge base:** The knowledge base represents facts and rules. It consists of knowledge in a particular domain as well as rules to solve a problem, procedures and intrinsic data relevant to the domain.
   - **Knowledge Engineer :**-dose the job of knowledge gaining form expert
   - **Expert:** - Expert adds the info from expert in the knowledge base.
   - **Interpreter: -** Choose agenda item based on the corresponding knowledge base on the rule.
   - **Scheduler:**- Maintains control over the agenda.
   - **Consistency Enforcer:-** Task of consistent representation of different solution
   - **Knowledge acquisition and learning module**: The function of this component is to allow the expert system to acquire more and more knowledge from various sources and store it in the knowledge base.
   - **Explanation module:** This module helps the expert system to give the user an explanation about how the expert system reached a particular conclusion.

   Components of Consultation Environment

- **Inference engine:** The function of the inference engine is to fetch the relevant knowledge from the knowledge base, interpret it and to find a solution relevant to the user's problem. The inference engine acquires the rules from its knowledge base and applies them to the known facts to infer new facts. Inference engines can also include an explanation and debugging abilities.
- **Blackboard(Work Place):-** To plan agenda and describe solution of the problem
- **User interface:** This module makes it possible for a non-expert user to interact with the expert system and find a solution to the problem.
-

Characteristics of an expert system:

- Human experts are perishable but an expert system is permanent.
- It helps to distribute the expertise of a human.
- One expert system may contain knowledge from more than one human experts thus making the solutions more efficient.
- It decreases the cost of consulting an expert for various domains such as medical diagnosis.
- They use a knowledge base and inference engine.
- Expert systems can solve complex problems by deducing new facts through existing facts of knowledge, represented mostly as if-then rules rather than through conventional procedural code.
- Expert systems were among the first truly successful forms of artificial intelligence (AI) software.
- Don't have human-like decision making power.
- Can't possess human capabilities.
- Can't produce correct result from less amount of knowledge.
- Requires excessive training.

Advantages:
- Low accessibility cost.
- Fast response.
- Not affected by emotions unlike humans.
- Low error rate.
- Capable of explaining how they reached a solution.

Disadvantages:
- Expert system has no emotions.
- Common sense is the main issue of the expert system.
- It is developed for a specific domain.
- It needs to be updated manually. It does not learn itself.
- Not capable to explain the logic behind the decision.

Conventional File Processing System

Introduction

The information system can be either a file processing system or database system. In Conventional File Processing System, each and every sub system of the information system will have its own set of files. Therefore, there will be duplication of data in between various Files of the information system. For example, in fourth generation languages, such as C Language, Dbase, Foxpro, Foxbase, etc. will maintain the records in a file. When you maintain the any Application, the Application programs are used to extract the information from different files.
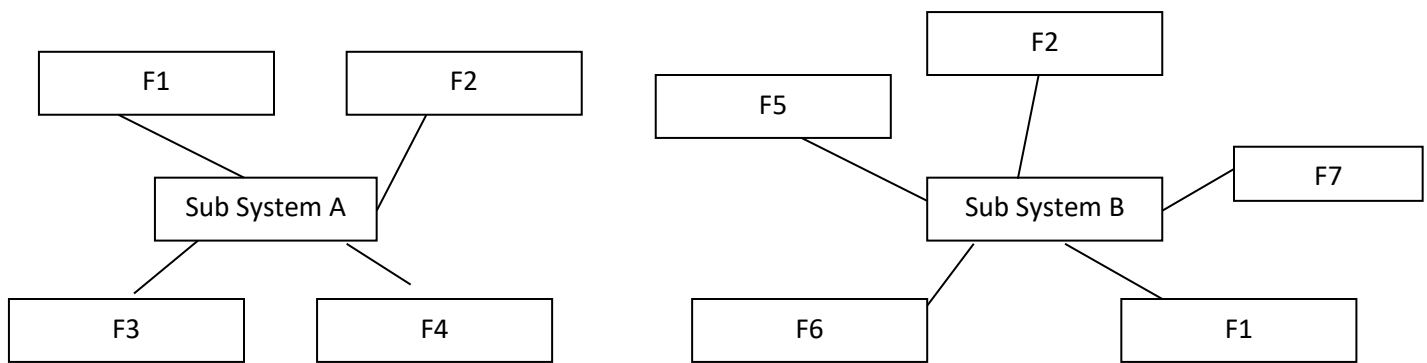

Fig. Example of Conventional File Processing System

The file system has thus drawbacks of

- **Uncontrolled Data Redundancy**
- **Inconsistency of data**
- **Inflexibility of Design system to meet future needs or demands**
- **Limited data sharing**
- **Poor enforcement standards**
- **Excessive programming maintenance**
- **Low programming productivity and so on.**

Disadvantages of File Processing system:-

1. **Uncontrolled Data Redundancy :**
   Each subsystem of an organization maintains a set of files without data sharing. It is possible that the same information may be duplicated in different files. This leads to data redundancy results in memory wastage. Data redundancy means, the same information is repeated in several files. For example, a name of a person, address and telephone number

of a particular customer appears in all accounts viz. Savings Bank Account, Current Account, Recurring Deposit Account and Loan Accounts etc. in a Bank

2. **Data Inconsistency:**

Data Inconsistency arises, when there is Data Redundancy. It means, the various copies of the same data in different files is not get updated when changes are made once. Thus the required information cannot get by an Application programs because there is no such programs in the list of Application Programs or the fields of the file may vary at the time of Application Design. Because of data redundancy, it is possible that data may not be in consistent state.

3. **Data Isolation/ Inflexibility of Design system to meet future needs or demands:-**

The data is scattered in various files with different formats. Therefore, it is difficult to write a new application program and hence difficult to retrieve appropriate data from the files.

4. **Integrity Problems:**

The data values stored in a file must be satisfied with certain data integrity constraints. The programmers need to provide integrity constraints and data must be validated from time to time. It is having limitations in the file system. Data integrity means that the data contained in the database in both correct and consistent.for this purpose the data stored in database must satisfy correct and constraints.

5. **Concurrent Access:**

The system requires allowing multiple users to access and updating the data simultaneously, instead of a Single user system. The interaction with concurrency may result inconsistency.

6. **Security Problems:**

The system should not give access to the unauthorized users to operate as the data is important and sensitive data. It should allow only some of the users who have given privileges to access and manipulate data.

7. **Limited Data Sharing:**

Data are scattered in various files also different files may have different formats and these files may be stored in different folders may be of different departments. So, due to this data isolation, it is difficult to share data among different applications.

8. **Security Problems:**

Database should be accessible to users in limited way. Each user should be allowed to access data concerning his requirements only.

Advantages of DBMS over File system –

- **Data redundancy and inconsistency –**

    Redundancy is the concept of repetition of data i.e. each data may have more than a single copy. The file system cannot control redundancy of data as each user defines and maintains the needed files for a specific application to run. There may be a possibility that two users are maintaining same files data for different applications. Hence changes made by one user does not reflect in files used by second users, which leads to inconsistency of data. Whereas DBMS controls redundancy by maintaining a single repository of data that is defined once and is accessed by many users. As there is no or less redundancy, data remains consistent.

- **Data sharing –**

    File system does not allow sharing of data or sharing is too complex. Whereas in DBMS, data can be shared easily due to centralized system.

- **Data concurrency –**

    Concurrent access to data means more than one user is accessing the same data at the same time. Anomalies occur when changes made by one user gets lost because of changes made by other user. File system does not provide any procedure to stop anomalies. Whereas DBMS provides a locking system to stop anomalies to occur.

- **Data searching –**

    For every search operation performed on file system, a different application program has to be written. While DBMS provides inbuilt searching operations. User only have to write a small query to retrieve data from database.

- **Data integrity –**

    There may be cases when some constraints need to be applied on the data before inserting it in database. The file system does not provide any procedure to check these constraints automatically. Whereas DBMS

maintains data integrity by enforcing user defined constraints on data by itself.

- System crashing –

    In some cases, systems might have crashes due to various reasons. It is a bane in case of file systems because once the system crashes, there will be no recovery of the data that's been lost. A DBMS will have the recovery manager which retrieves the data making it another advantage over file systems.

- Data security –

    A file system provides a password mechanism to protect the database but how longer can the password be protected? No one can guarantee that. This doesn't happen in the case of DBMS. DBMS has specialized features that help provide shielding to its data.

Keeping in view of all the drawbacks of Conventional file processing system, there is an alternative system designed to eliminate all the pitfalls. Thus, RDBMS if the solution to meet the requirements. However, the economic justification of the database approach is also an important task before taking a system into development.

The RBDMS provides reasonable cost and benefits for development, maintenance and implementing the database system in a given reality along with economic justifications for any organization. The various costs of using database in a real life application can be categorized as,

- o Cost of DBMS Software and its utility
- o Cost of Procuring software
- o Incrementing cost of employing application development and database administration with   specialized skills
- o Cost of training to the user groups, application development to the related application
- o Cost of designing, implementation and maintenance of the database.

The different benefits or advantages of using database system thus can be mentioned as,

1. Reduced data redundancy

2. Reduction in cost due to improved maintenance

3. Reduction in the salaries of work groups

4. Savings in costs due to reduction of time in generating reports

5. Estimated reduction in cost while developing information system to different users

6. Flexibility in designed system to meet out the requirements or as per future needs

7. Better programming maintenance with security measures

8. Consistency of data

9. Better enforcement standards

10. Increased programming productivity and

11. Enhancement and modifications for the application at any time…etc.

One has to carefully analyse the economic justification factors of the database before it's development and maintenance for better implementation.