BBA– II YEAR (III SEMESTER)
MANAGEMENT INFORMATION SYSTEM (MIS)
(SUBJECT CODE4 : 18UADA3)
LECTURER : Dr. M/P. "B" SECTION

UNIT 1

INTRODUCTION TO MIS

System is a group of interrelated elements or the interacting elements forming a unified whole.

Information System:

Information System is an organised combination of people, hardware, software, communication networks and data resource technologies.

Meaning of Management Information System:

MIS is a management support system(MSS – is an information system that provides information to support managerial decision making) that produces prespecified reports, displays, and responses on a periodic, exception, demand, or push reporting basis. MIS is the study of information system focusing on their use in business and management.

In 1985, Davis and Olson have mentioned that the study of MIS, arose during 1970s, to focus on computer based information systems which are aimed at the managers.

Definition of MIS:

According to Davis and Olson,‖MIS is an integrated user-machine system for providing information to support the opertions, management and decision making functions in n organisation. This system utilises computer hardware and software, manual procedures, models for analysis, planning, control and decision making, and database‖.

Nowadays, information has been accepted and recognised as, an invaluable source inorder to ensure the effective and efficient decision making. It ensures the optimality of results which are leading to the survival and prosperity of any business organisation (i.e.)without the proper information and decision making prosperity will not be there.

Hence, MIS has emerged to facilitate the effective and efficient decision making.

Data: Data is the collection of raw facts or raw observations about the physical

phenomena or the business transactions.

Data is the objective measurements of the attributes(characteristics) of entities like people, places, things and events.

DATA

PROCESSING

INFORMATION

Information:

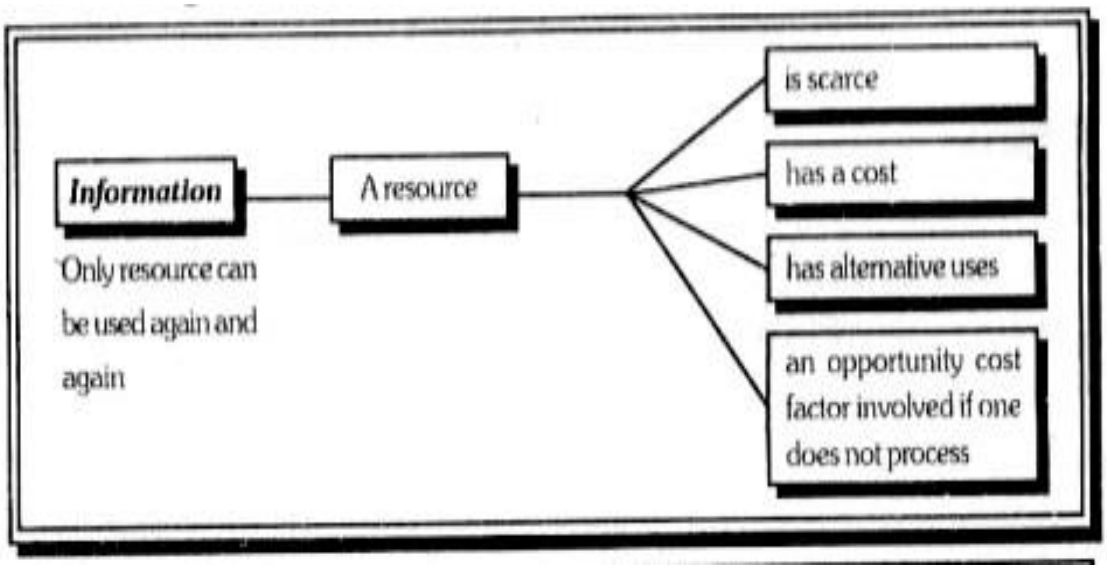
Information is processed data or data placed in a meaningful and useful context for an end user.

Definition of information:

According to Davis and Olson,‖Information is the data that have been processed into a form that is meaningful to the recipient and is of real or perceived value in the current or prospective actions or decisions‖.

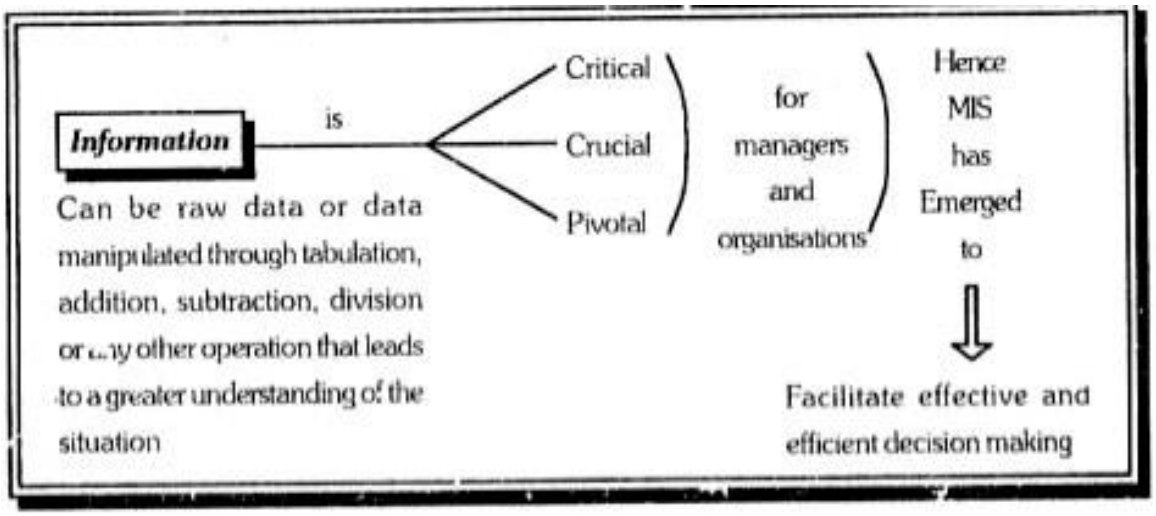
Also, information is a resource with many attributes. The following diagram shows this:

Information is a source with many attributes:



The following diagram shows about the emergence of MIS from the information:

Emergence of MIS from information:



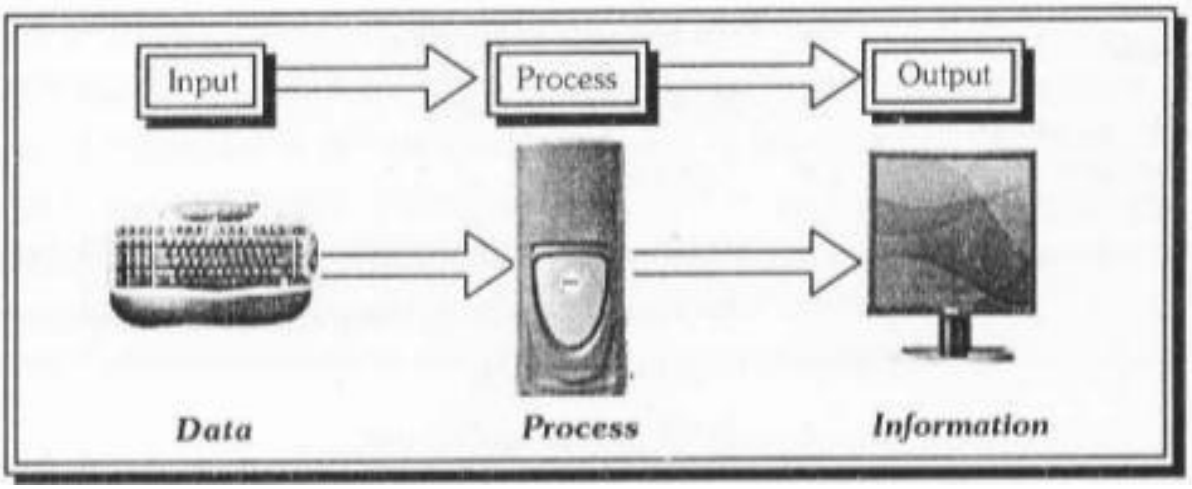
Differences between data and information:

DATA	**INFORMATION**
(1) Data are raw facts	Information is processed data.
(2) Data are user independent.	Information is user dependent.
(3) Data is a primary source.	Information is a secondary source.
(4) Data are unorganised and unstructured.	Information are organised and structured.
(5) Data are results of routine recording of events and activities taking place.	Generation of information(i.e.) selective filtering of data is user-driven, which is not always automatic.
(6) All data do not become information, because of selective filtering of data during the processing.	All information are data.

The following diagram shows about the conversion of input to output.

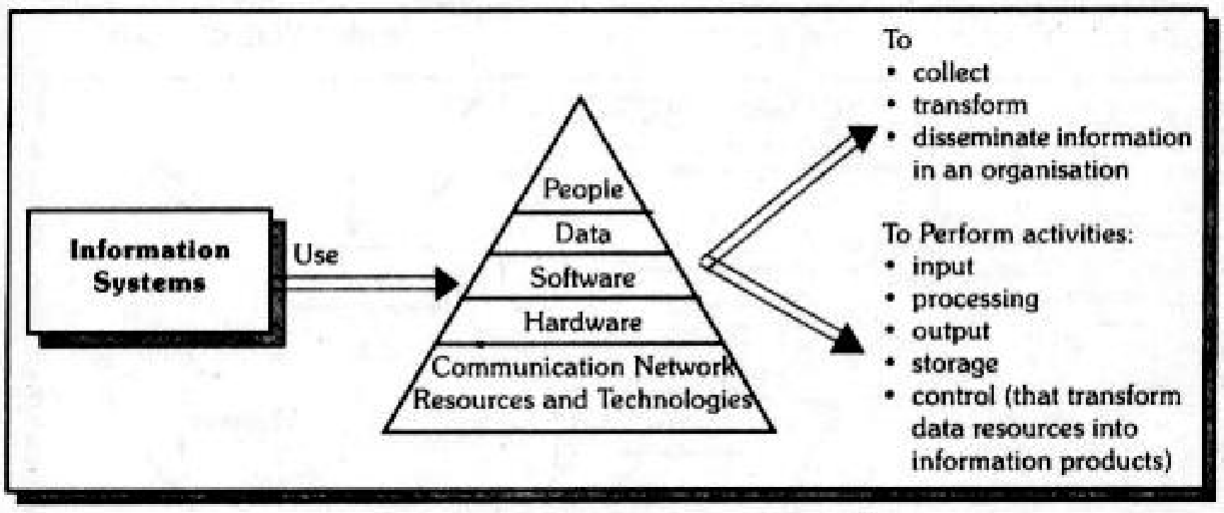
Input(Data) – Process – Output(Information):

Computer hardware executes the instructions in programs(software). People follow the instructions in procedures. Data is interface(acting like a bridge) between the machine and the people. These 5 components are common to all the information system(IS). So, inorder to perform a task both the computers and people require some specific instructions.



MIS is based on the following major components:

Basic components of MIS:



Importance of information to decision making and strategy building:

Importance of information to decision making:

Decision:

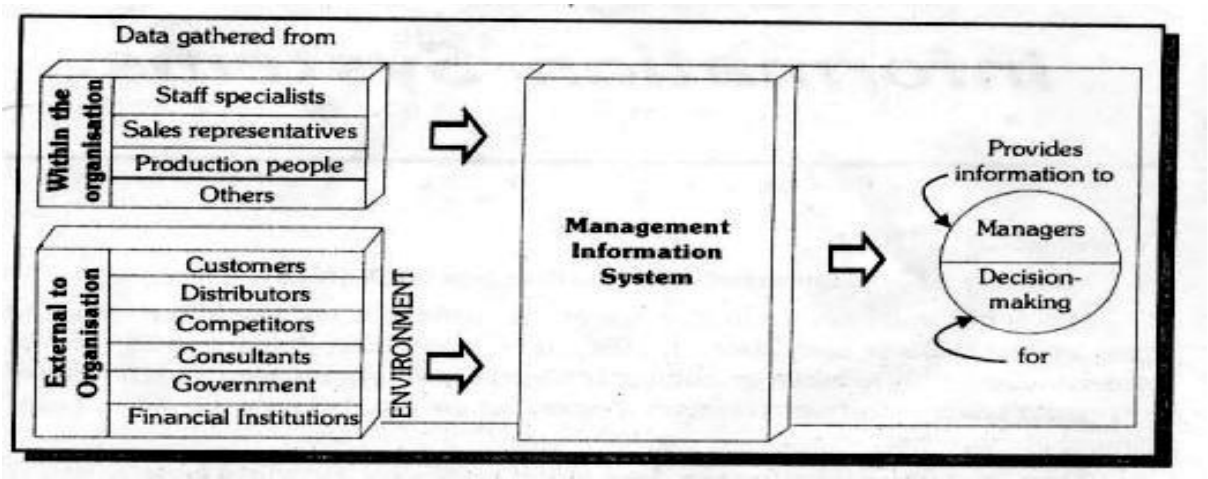
Decision is choosing a particular course of action after considering all the alternatives.

Decision making:

Decision making means to select a course of action from two or more alternatives. It is a determination to do something in a stated way and it breaks the deadlocks.

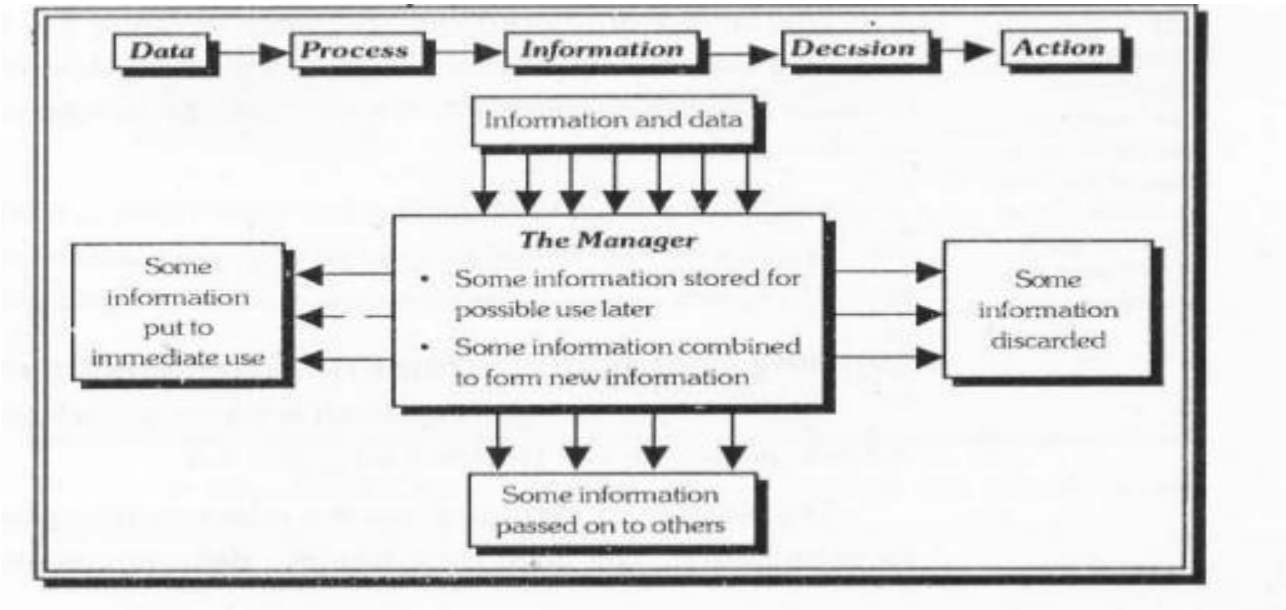
Information is the key resource for decision making, at any level of management hierarchy. Information improves the understanding of the problem to be solved with a decision. So, automatically, information improves the confidence of the decision maker, about the consequence of the decision.

The management should be provided with a continuous feedback of information for decision making. The following diagram shows the management levels and information needs:



The managers combine both the external environmental information with the internally generated information so as to properly evaluate the problem situation, and they will arrive at a solution. The following diagram shows this.

Management Information System for Decision- making:



The impact of information revolution is being felt in the different areas like,

- Government offices,
- Defence sector,
- Banks,
- Stock exchanges,
- Airlines,
- Railways,
- Universities,
- Schools and colleges,
- Sports activities, etc.

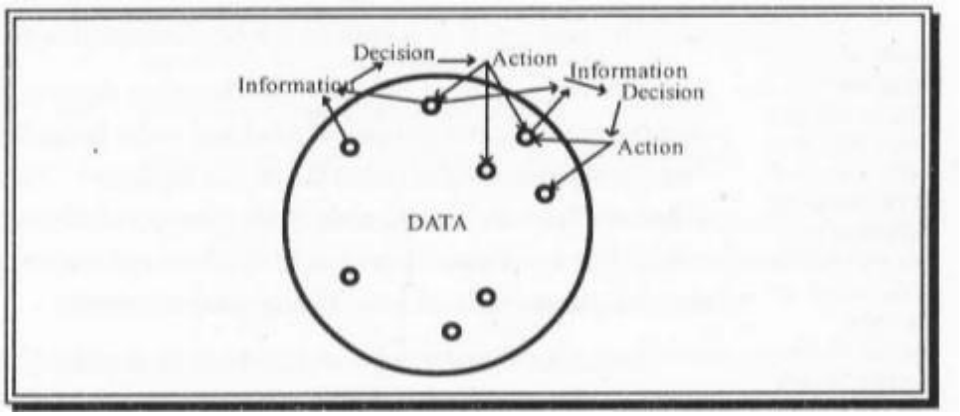
Because of the products of information revolution like

- Fax,
- E-Mail,
- Satellite based communication,
- Digital transmission,
- EDI, etc.

Quick communication, accurate communication and cost effective communication are made possible.

All the decisions are made on the basis of these information, which inturn help the organisations to meet the bench marking standard. The results of these decisions are actions, which inturn generate further data and this can be incorporated into another cycle of decision making process. The following diagram shows about this:

Data – An essential ingredient in Information decision-making:



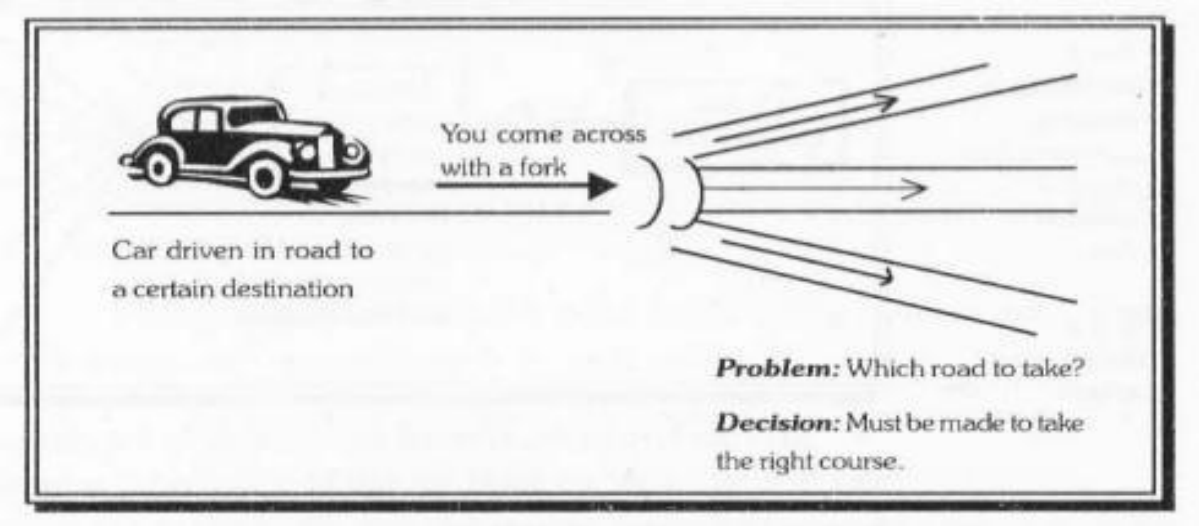
The major amount of managerial work is decision making. The success of the organisation depends upon the quality of the decisions which are taken by the managers. The quality of the decisions are the yardsticks of the effectiveness and value of the organisations, and so information is very essential for taking good decisions so as to reach sustainable developments into diversified fields.

Information facilitates a more comprehensive analysis and adding value for decision making and problem solving. It is the information that guides a decision maker to take the right decisions and as a result right actions. As a result information enables the organisation to think globally and to act globally.

Optimum utilisation of resources involves the excercising of various choices. Inorder to have the best choice or best decision, information is very important for decision making.

The following digram shows about **an example** for the decision making process.

An example for the decision making process:-



Importance of information to strategy building:

Managerial decisions and actions determine the long term performance of any organisation, normally. Such decisions and actions follow from an accepted set of intended behaviours of an organisation, which is pre-determined as its strategy. Strategies are the decisions and actions that determine the long run performance of an organization.

Context of strategy:

Strategy is formulated and implemented in a context created by the following factors:

- Vision: Vision is a broad brush picture about the future of the organisation
- Mission: Mission gives the basic purpose for which the organisation is created.
- Objectives: Objectives and goals are the time-bound milestones to be reached.
- Policies and programmes: Policies and programmes are formulated so as to achieve the mission or purpose of the organisation

Strategy building: Strategy building is an information intensive activity and reliable information is required about the company's present, past and future activities and also about its actual and expected performance. Strategy formulation is mostly done in an uncertain environment. The critical activities involved here are

- SWOT analysis,
- Competitor analysis
- Consumer research, etc.

Some of the sources for strategy formulation are

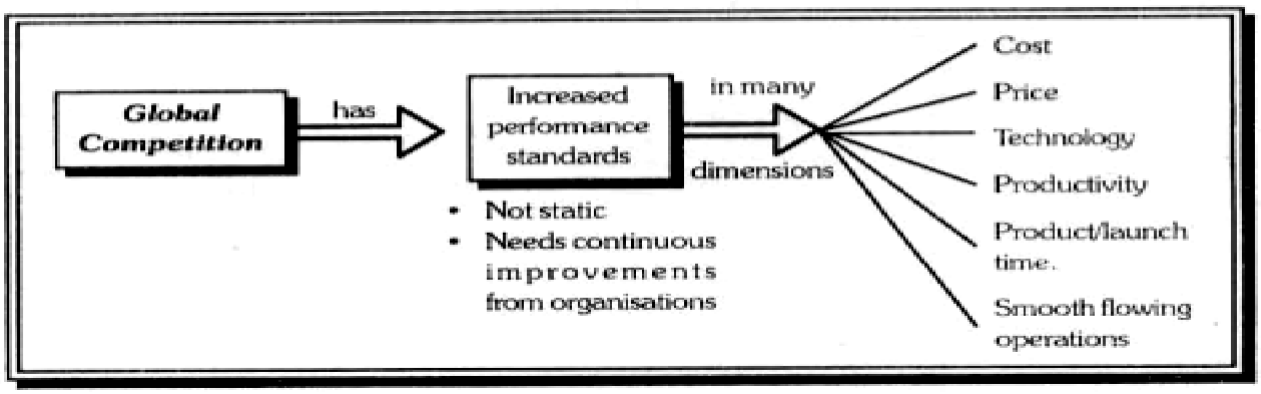
- Corporate databases,
- information service providers,
- business intelligence, etc.

Competition in the present day is

- severe,
- increasing or intensifying,
- becoming more global
- fierce, etc.

The following diagram shows about the various dimensions of the increased performance standards of the global competition:

Global Competition:



Inorder to survive, succeed and prosper in the present day competitive situation, strategic competition would have to be achieved by the company. First, they have to reach the competitor's level and then they have to surpass them.

The survival, success and prosperity of any organisation depends upon,

- the ability to capture and collect useful information,
- transform it into usable knowledge, and
- disseminate it fast, throughout the organisation.

The competitor's move, their future planning, technology, R & D efforts and product decisions should be found out. Then, they have to act fast in reaching that level, just in a few days time, and they have to surpass them, by showing competitive dynamics. The organisations should accept this challenge to gain strategic or competitive advantage over their competing rival firms.

Meaning of Competitive advantage: Competitive advantage is changing the balance of power between a firm and its competitors in the industry into that firm's favour, by which a dominative position is reached. Competitive advantage is developing products, services, processes, or capabilities that give a company a superior business position, relative to its competitor's and other competitive forces.

It can be shown in the following diagram:

If a company obtains the right type of information and also adapts

proper strategies, after studying the competitor's activities

It builds **strategic** advantage

Resuts in the competitive advantage **globally**

Such a company can be called –Agile‖

Therefore, the company has to build up a questionnaire and examine their answers in the right spirit of competition, and this would help an organisation to prepare an anticipated response profile for each competitor about

- the competitor's activities in the future,

- when an organisation gets an advantage over its competitors(i.e.) competitive advantage,
- after this gaining how will this change the organisational relationship with the competitors.

According to Porter and Miller, IT is affecting the competition in 3 vital ways as follows:

1. It changes the industry structure and in doing so, it affects the rule of competitions.
2. It spawns with the new businesses, often from within the company's existing operations.
3. It creates competitive advantage by giving companies to outperform their rivals.

They are explained as follows:

Changes in the industry structure - Competitive forces model:

Information, IT and Information Revolution are giving birth to new industries.

- It makes new technology feasible,
- It spawns new business by creating the derived demand for new products,
- It helps to spawn business within the existing old business itself.

Draw the diagram in pg. no.8 --fig-1.8

(3) New ways to outperform their rivals:

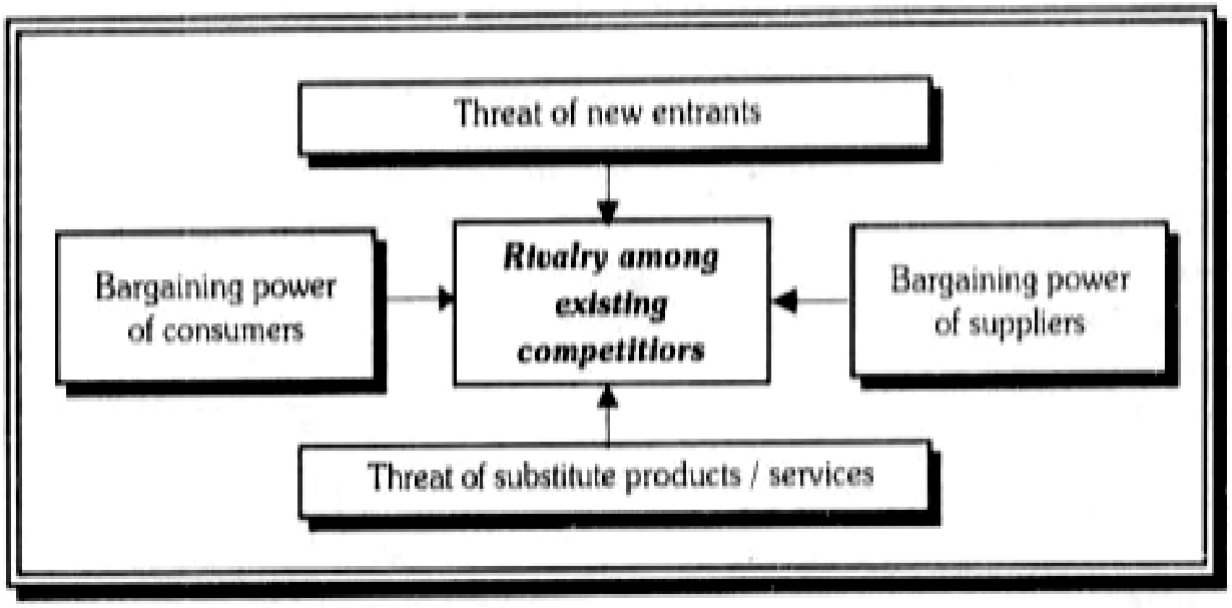
Information and IT facilitates the development of new ways of doing the old things in a different way, for getting competitive advantage.

The specific uses of information can be of 2 types:

(a) Functional uses, and
(b) Strategic uses.

Its brief explanation is as follows:

(2) Spawning of new businesses:



(a) Functional uses:

- Information helps the organizations to meet the bench marking standards.
- Information and information systems help in:

* Facilitating product delivery

* Adding value to the quality

* Improving Product Quality

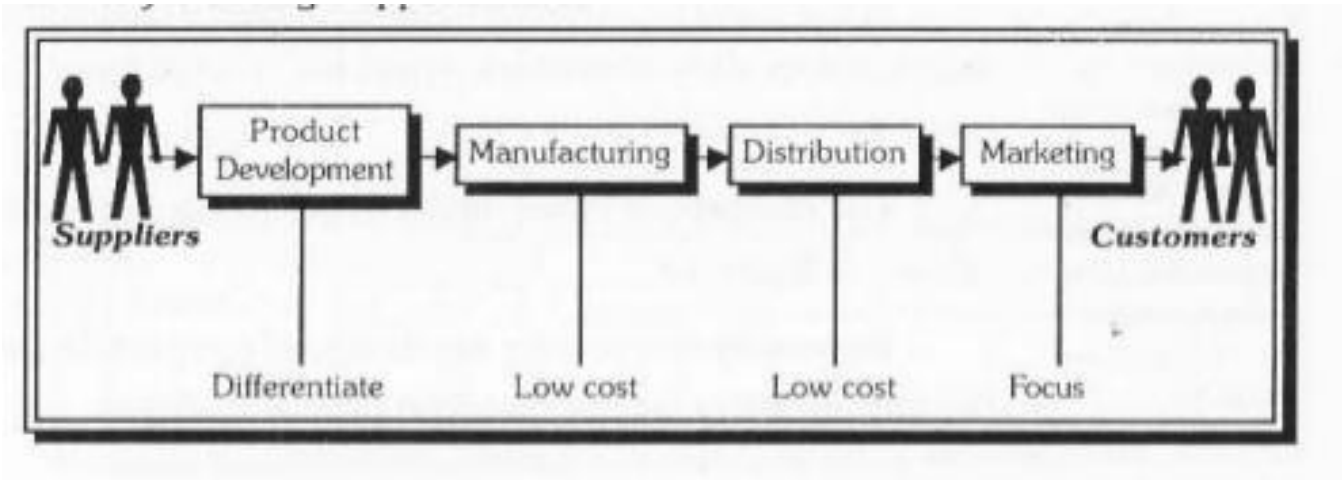
- Information helps in simplifying the products, product processing, the cycle time of the products.
- Information helps to transform the activities of the physical processing component into information component leading to value addition.
- Information bestows(award, honour, gift, etc.) the organizations with speed and ability to move quickly into the market as the first mover, resulting in competitive advantage and also results the organization to command a competitive premium.
- Information helps to increase the quality, better the service and lowers tha cost by the Value Chain Concept. Competitive advantage results as a function of cost/value chain.

(b) <u>Strategic uses:</u>

(1) Information gives the organization the new ways to perform their rivals.
(2) Information helps an organization in gaining a competitive advantage supports many competitive strategies like differentiation, cost leadership, innovation, growth and alliance.
(3) New intensity of information makes it possible for more precise development of strategies, planning, forecasting and monitoring.
(4) Information facilitates the availability of the exact data thereby facilitating a more comprehensive analysis for decision making and problem solving.
(5) Information and IT helps the development of new ways of doing the old things differently and helps to increase the organization's abilities to create competitive advantage.
(6) Information enables the organization to think globally and act locally.
(7) Information provides strategic oppurtunities and enables to change the rules of the competition fast and bestows competitive advantage.
(8) Information and IT helps the organization to make flexible and responsive management layers, to restructure work flows and provides more competitive advantage.
(9) Information and IT helps the organizations to acquire strategic flexibility, which refers to the set of capabilities the firms use to respond to the various demands and oppurtunities.

Information helps to increase the quality, better the service, and lowers the cost by the value chain concept. Competitive advantage results as a function of cost/value chain, which is as follows:

Cost/value chain:



Meaning of value chain model:

Value chain is an analytical framework to disaggregate a firm into different inter dependent activities, that add value to its raw materials and bring a firm's product or service to the customers.

This concept was developed by Porter and later considered by Porter and Miller. This value chain concept is a useful framework for identifying the Information Technology(IT) oppurtunities. This framework highlights, where the competitive strategies can best be applied (i.e.) managerial end users should try to develop the strategic information systems(SIS) for those basic activities that add the most value, to a particular firm's products or services.

This value chain views a firm as a series of basic activities, which add value to its products and services, and, so, they will add a margin of value to the firm. This value chain is composed of primary activities and support activities.

Primary activities: Primary activities are those activities which are involved in the physical creation of the product, its marketing and delivery to the buyers, and its support and service after sales.

1. Inbound logistics – expediting materials to the point of manufacture.
2. Operations – transforming the inputs into finished products.
3. Outbound logistics – storing and distributing the finished products.
4. Marketing and Sales – promotion and sales activities
5. Service-post-sale – service inorder to maintain and enhance the product value.

Examples of these activities:

The followings are the examples of how and where information technologies can be applied to our business activities using the value chain framework.

 To support **—inbound logistics** processes - **Automated just-in-time warehousing systems** are identified.

To support **—operations‖** - **storage of inventory and Computer Aided Flexible Manufacturing(CAM)** systems are identified.

To support **—Outbound logistics‖** - **Online point of sale and Order processing systems to process the customer orders** are identified.

To support **—marketing and sales‖** - an interactive **targeted marketing** capability on the Internet and the Web.

Finally, **—customer service‖** can be dramatically improved by a coordinated and integrated **Customer Relationship Management** System.

Support activities: Support activities are those activities which provides the inputs and the infrastructure which allows the primary activities to take place.

1. Corporate infrastructure – supply of entire value chain like
   *general management,
   *legal services,
   *finance,
   *public relations, etc.
2. Human Resources Management(HRM) - recruiting, hiring, training, development, etc.
3. Technology development - improving the product and manufacturing process(R & D).
4. Procurement – purchasing inputs.

Examples of these activities:

The followings are the examples of how and where information technologies can be applied to our business activities using the value chain

framework.

(a) To improve –Management and Administrative Services‖ - Collaborative workflow Intranets can be used to increase the communications and collaborations.

(b) To improve –Human Resource Management(HRM)‖ - ‖Employee benefits intranet‖ can be used to provide the employees with easy self service access for their benefits information.

(c) To improve the –Technology development‖ - Computer aided Design can be used and Extranets enable a company and its global business to use the web to jointly design the products and its processes.

(d) To improve the –Procurement of resources‖ - E-Commerce Web portals can be used to provide online marketplaces for the firm's suppliers.

Each activity(primary or support) adds value. There is a cost of adding a value in every level of chain. Suppose, if the total cost of the added values is less than what the customer pays, then, there is a profit.

⇨ Profit = Customer's payment – Total Cost of the added values in every level of chain.

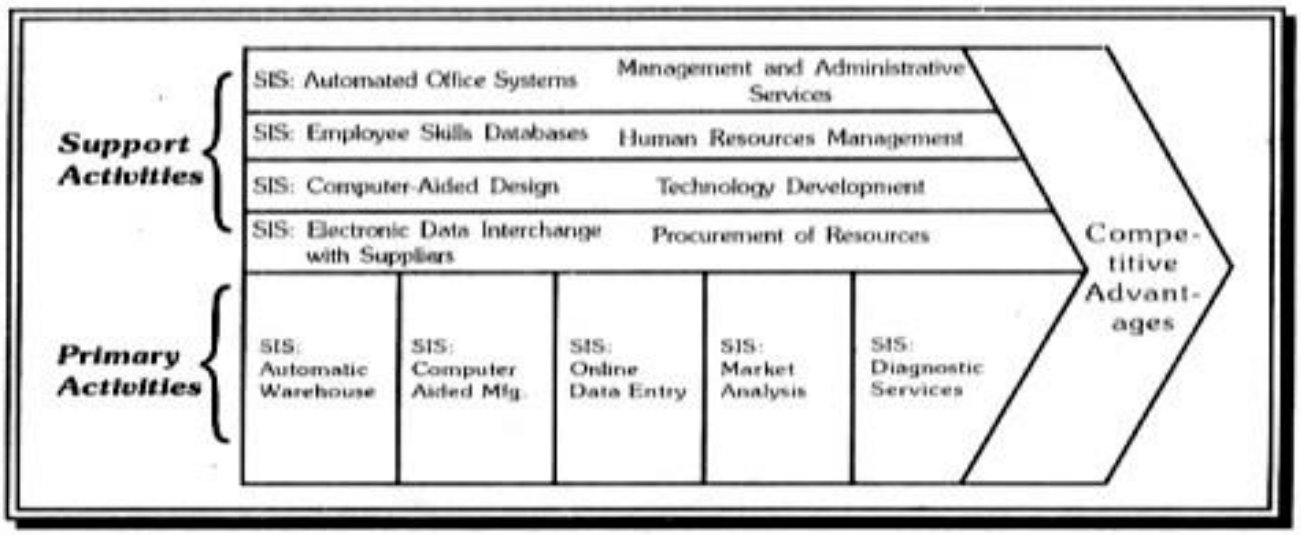
Thus, the value chain enables a company to analyse

- Where and how it can add value to the products or services, and,
- Where it can reduce the costs.

So, it is helping to identify the strategic opppurtunities. This value chain concept is a useful framework for identifying the information technology oppurtunities. IT is a structural way of looking at how, with IT, a firm can improve its profitability.

This framework can highlight where the competitive strategies can be best applied,(i.e.) managerial end users should try to develop the strategic information systems(SIS) for those basic activities which add the most value to a particular firm's products or services. The following diagram illustrates the primary activities and secondary activities.

The Value Chain model:



This value chain concept can help the managers to decide

- where to apply the strategic capabilities of information systems technology, and,
- how to apply the same.

So, accordingly, information systems which improve operational efficiency, promote innovation, and build strategic resources can thus be applied to the specific business activities, so as to help a firm to gain strategic advantages in the marketplace.

IT can be employed in all the levels of the chain.

- Product development – shortened product life cycle, develop unique product features.
- Manufacturing – reduced manufacturing cost, improved quality control.
- Distribution – move the information instead of the products.
- Marketing – supply the ordering terminals to the customers, identify the market niches. Since, the value chain is a series of interdependent activities, IT can be used not only at each level of the chain, but also between the levels.

Example: IT can be used to lower the transfer costs between the players at two or more levels. Or, information resources which exist at one level, can be used to improve the performance at the other levels .

Example: Using the information from the customer complaints at the service level to the fine-tune marketing or manufacturing or product development.

Effect of IT on Strategy and Competition:

Competitive strategy: Competitive strategy is a long term action plan, which is devised to help a company to gain the competitive advantage, over its rivals.

This type of strategy is often used in the advertising campaigns by somehow discrediting the competitor's product or service. Competitive strategies are essential to those companies which are heavily saturated with the alternatives for the consumers.

IT can support many competitive strategies and thus help a business to

1. Operate at the reduced costs,
2. Differentiate and innovate in its products and services,
3. Promote growth,
4. Develop alliances,
5. Lock in customers and suppliers,
6. Create switching costs,
7. Raise the barriers to entry,
8. Leverage its investment in the IT resources.

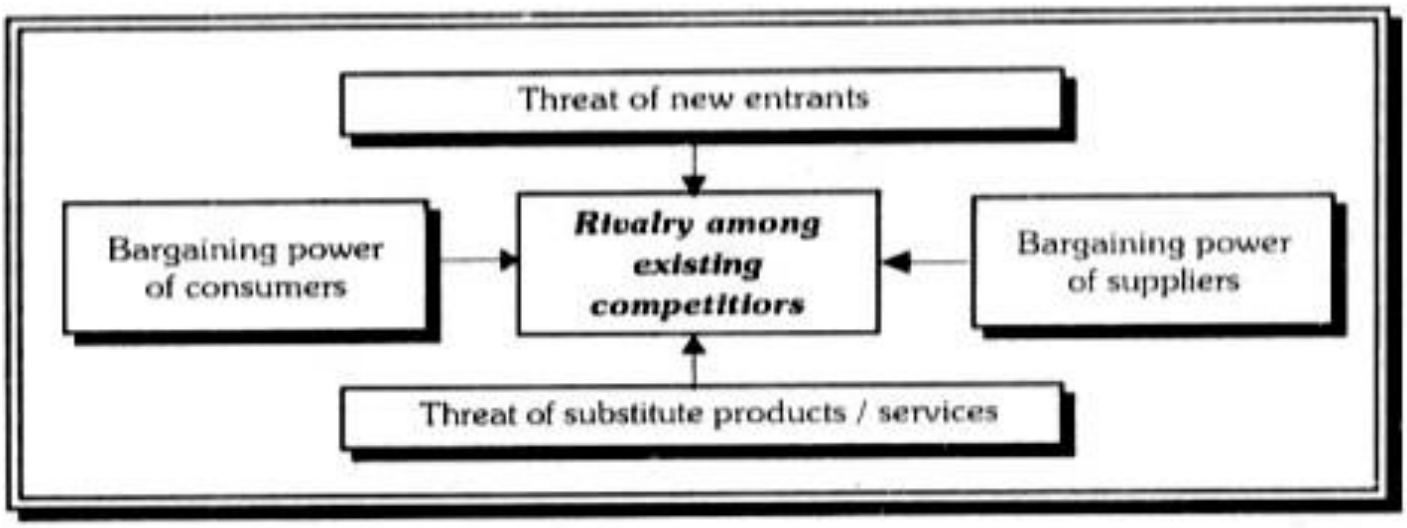
In these ways, IT can help the business to gain the the competitive advantage in its relationship with the customers, suppliers, competitors, new entrants and producers of the substitute products.

Switching costs: Switching costs are the costs in time, effort and inconvenience that it would take a customer or supplier to its business to a firm's competitors.

Barriers to entry: Barriers to entry refers to the technological, financial or legal requirements that deter(hinder or frighten) the firms from entering an industry.

The competitive forces model as per Porter and Millar is as follows:

Changes in the industry structure - Competitive forces model:



Businesses can counter the threats of competitive forces that they face, by implementing the five basic competitive strategies. The competitive strategies are shown in the following diagram.

Five basic competitive strategies:

Businesses can develop competitive strategies inorder to encounter the actions of the competitive forces they confront in the marketplace. This can be done by the combination of the above two diagrams, which gives the following diagram.

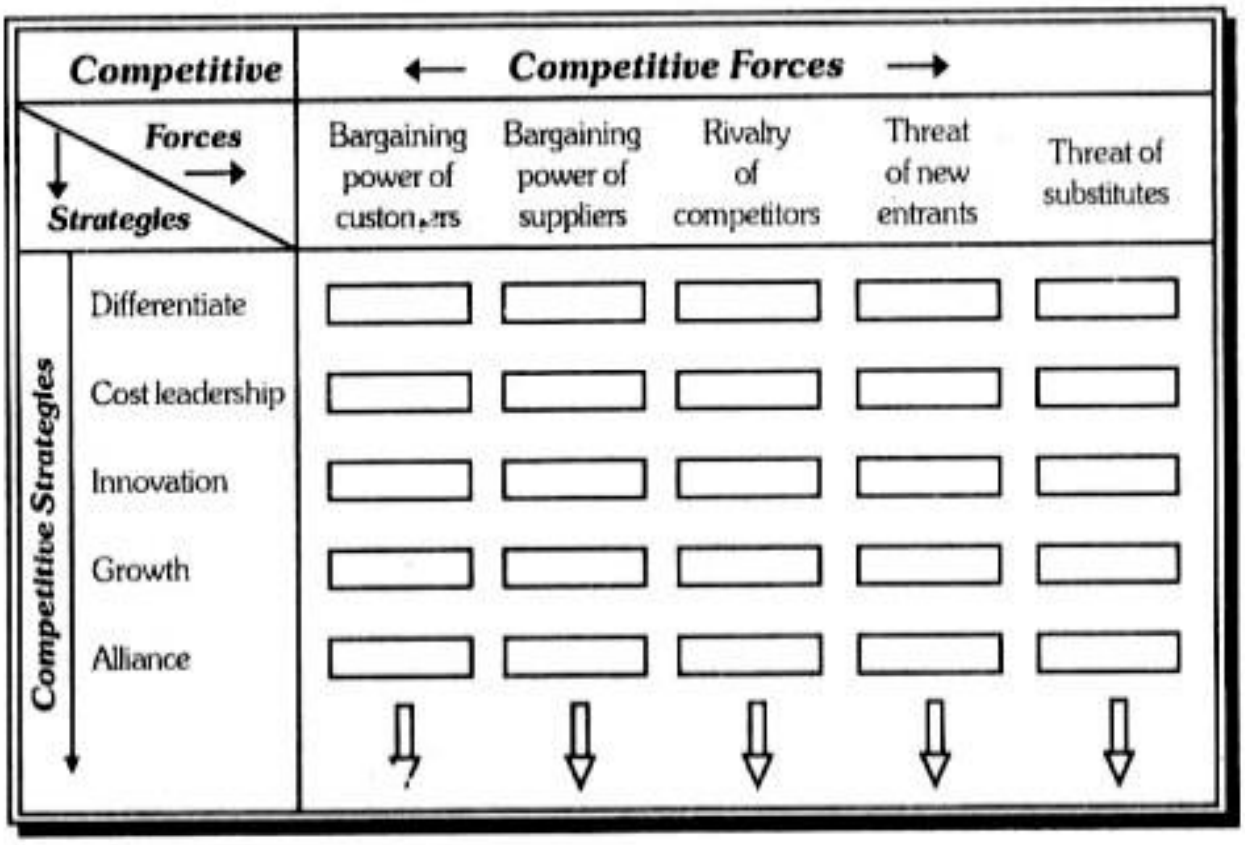
Competitive strategies to counter the competitive forces:

As a result of these competitive strategies, we will get the various business benefits, as follows:

1. Lowest price guarantee,
2. Reduced inventory cost,
3. Increase in the market share,
4. Increased sales,
5. Market leadership,
6. Agile market leadership,
7. Auction market prices,
8. Buyer set pricing

Inorder to support or shape the competitive position and competitive strategies, we will be using various SIS – Strategic Information Systems, and this SIS can be any kind of Information Systems(IS).

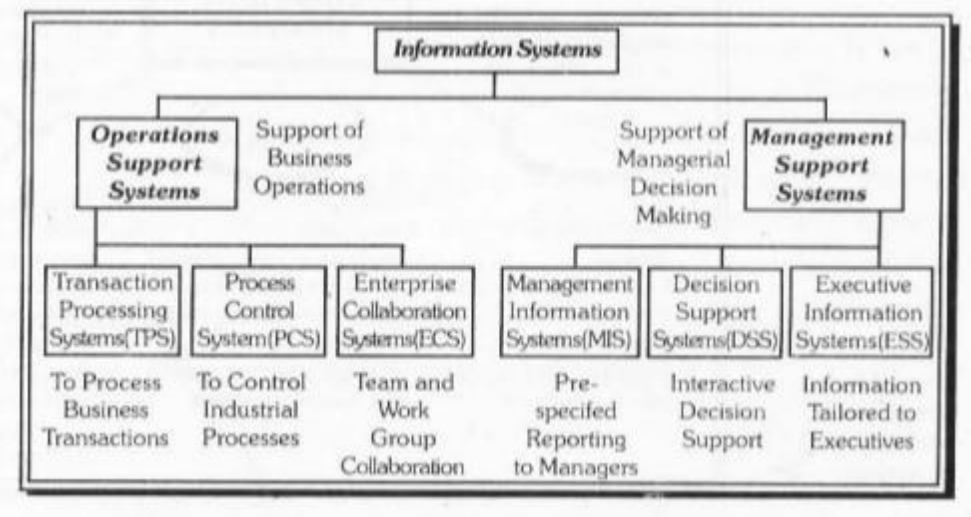
Now, we will see about the information systems and sub systems.



Information System:

Information System is an organised combination of people, hardware, software, communication networks and data resource technologies.

Conceptual Classification of Information System(IS):



Its brief explanation is as follows:

(i) Operations Support Systems(OSS):

Operations Support Systems(OSS) is an information system necessary to process the data which are generated by, and which are used in, the business operations.

OSS collects, processes, and stores the data generated by the operation systems of an organisation, and produces the data and information for inputting into a Management Information System, or, for the control of an operations system.

Meaning of Operations System: Operations System is a basic sub system of a business firm, that constitutes its input, processing and output components. It is also called a Physical system.

The following are the important roles or examples of OSS.

(1) Transaction Processing System(TPS):

Transaction Processing System(TPS) records or process the data resulting from the business transactions(i.e.) it records and process the business transactions and it supports the day to day operations.

Examples:

- Order – entry system,
- Cheque processing system,
- Accounts receivable system,

- Accounts payable system,
- Payroll system,
- Ticket reservation system, etc.

Transaction Processing System(TPS) is the oldest type of information system and can be called as the ―work horse‖ in the industry of IS, for the last 50 years. Generally, transactions are processed in the following 2 basic ways.

- (a) Online Batch Transaction Processing, and,
- (b) Online Realtime Batch Transaction Processing(OLRTP)

They are explaned as follows:

(a) Online Batch Transaction Processing:

Online involves a direct connection between the operator and the TPS program, and so they provide immediate results.

In case of Batch Processing, transactions are grouped together and processed periodically as a unit.

Example: We can take the case of Cheque processing system in a bank. Here, all the cheques which are received in a particular time frame, say, on a particular day, are first grouped together. Then, they are sorted out by the account number and processed in a batch.

(b) Online Realtime Transaction Processing(OLRTP):

Real time processing means that, not only the input data is processed immediately, but, the output results are available fast enough so as to meet the immediate information needs of the end-user.

Here, data are processed immediately after a transaction occurs.

Example: Airlines enquiry for ticketing, railway ticketing, point-of-sale(POS) systems at many retail stores use electronic cash register terminals to electronically capture and transmit the sales data over the telecommunications links to the regional computer centers for the immediate(real-time) or nightly(batch) processing.

(2) Process Control Systems(PCS):

Process Control Systems(PCS) monitors and controls then physical processes.

Example: In case of petroleum refineries, it uses some electronic sensors linked to the computer monitor of the chemical process and, so, real time(immediate) adjustments are made to control the refinery processes.

(3) Enterprise Collaboration Systems(ECS):

Enterprise Collaboration Systems(ECS) is an information system that creates, processes, stores, modifies, displays and communicates the business correspondence, in the written,

verbal or video form, among the individuals, work groups and organisations, so as to enhance team and work group communications and productivity. Enterprise Collaboration Systems(ECS) is sometimes called OAS – Office Automation Systems. The followings are some examples.

Examples:

- Usage of E-Mails to send and receive the electronic messages,
- Video conferencing to hold the electronic meetings, etc.

(ii) Management Support Systems(MSS):

Management Support Systems(MSS) is an information system that provides information and support for the effective managerial decision making by the managers. Providing information and support for the effective decision making by all type of managers and business professionals is a difficult task and all the applications when it is focussed on the above are called Management Support Systems(MSS).

The following roles are played by the major categories of MSS.

(1) Management Information System(MIS):

Management Information System(MIS) provides information in the form of reports and displays them to the managers and business professionals to support business decision making. Management Information System(MIS) is the study of information system focusing on their use in business and management.

Examples: Sales analysis, production performance, cost-trend reporting systems, etc.

(2) Decision Support Systems(DSS):

Decision support system (DSS) is a set of expandable, interactive IT techniques and tools designed for processing and analyzing data and for supporting managers in decision making. To do this, the system matches individual resources of managers with computer resources to improve the quality of the decisions made.

Decision support system (DSS) provides interactive and adhoc support for the decision making process of the managers and the other business professionals

Examples: Product pricing, profitability forecasting, risk analysis systems, etc.

(3) Executive Information Systems(EIS or ESS):

Executive Information Systems(EIS or ESS) provides the critical information from many sources, which are tailored according to the information needs of the top management or senior executives. ESS is the newest.

Examples: Systems for easy access to the analysis of business performance, competitor's actions, economic development to support the strategic planning, etc.

The following table shows about the comparison of OSS and MSS:

Comparison of OSS and MSS:

Information Systems					
Operations Support Systems			*Management Support Systems*		
TPS	***PCS***	***ECS***	***MIS***	***DSS***	***EIS***
Process data resulting fr-om business transactions, update operational databases, produce business documents	Monitor and control industrial process	Support team, workgroup and enterprises. Communi-cation and collaboration	Provide information in the form of pre-sepecified reports and displays to support business decision making	Provide interactive ad hoc support for the decision-making process of managers and other business professionals	Provide critical information from many sources tailored to the needs of executives
Eg:- Sales and Inventory Processing, Accounting Systems	Petroleum refining, power generation, steel production, phama-ceuticals	e-mail, chat, video-conferencing, group ware systems	Sales analysis, production, performance, cost trend reporting systems	Product pricing, profitability forecasting, risk analysis systems	Systems for easy access to analysis of business performance, competitors actions, economic development to support strategic planning

Other classifications of Information Systems:

(1) Expert System(ES)
(2) Knowledge Management System(KMS)
(3) Strategic Information System(SIS)
(4) Business Information System(BIS)
(5) Integrated Information System

Its brief explanation is as follows:

(1) Expert System(ES):

Expert System(ES) is a computer based information system in which knowledge is presented in data, in which the processing of that knowledge is directed, primarily by the computer programs. Expert advice for the managerial decision making is provided by the Expert Systems.

An Expert System captures the expertise of an expert or a group of experts in a computer based information system and thus, it can outperform a single human expert in many problem situations. An Expert System can have the knowledge of several experts and does not get tired or distracted by the overwork or stress. An Expert System can preserve and reproduce the knowledge of experts.

They allow a company to preserve the expertise of an expert, before he leaves the organisation, and this expertise can then be shared, by reproducing the software and knowledge base of the expert system. They build a knowledge based database for the organisation.

(2) Knowledge Management System(KMS):

Knowledge Management System(KMS) is a computer based information system for organising and sharing the diverse forms of business information created within an organisation.

Simply, Knowledge Management is the set of processes developed in an organisation to create, gather, store, maintain, and disseminate the firm's knowledge. It includes

(a) managing the project and enterprise document libraries, (b) discussion database,

(c) hypermedia website database, and other types of knowledge bases. Success KMS creates techniques, technologies, systems, rewards, etc. For geeting the employees to share, what they know and to make better use of accumulated work place and enterprise knowledge. Knowledge Based Information Systems (KBIS) adds a knowledge base to the major components found in the other types of computer based information systems(CBIS).

(3) Strategic Information System(SIS):

Strategic Information System(SIS) is a computer based information system which provides a firm with the application of IT to a firm's competitive products ans services to help to achieve their strategic advantage over its competitors in the marketplace.

Example:

- Online stock trading,
- Shipment tracking, etc.

(4) Business Information System(BIS):

Business Information System(BIS) is a computer based information system within a business organisation which support one of the traditional functions of business like marketing, finance or production. This can be either Operations Information System or Management Information System.

(5) Integrated Information System:

Integrated Information System is the integrated combination of several types of information systems mentioned above.

This conceptual classification of Information Systems(IS) are designed to emphasise many different roles of Information Systems(IS). These roles are integrated into composite or cross functional information systems which provide a variety of functions.

System Concept:

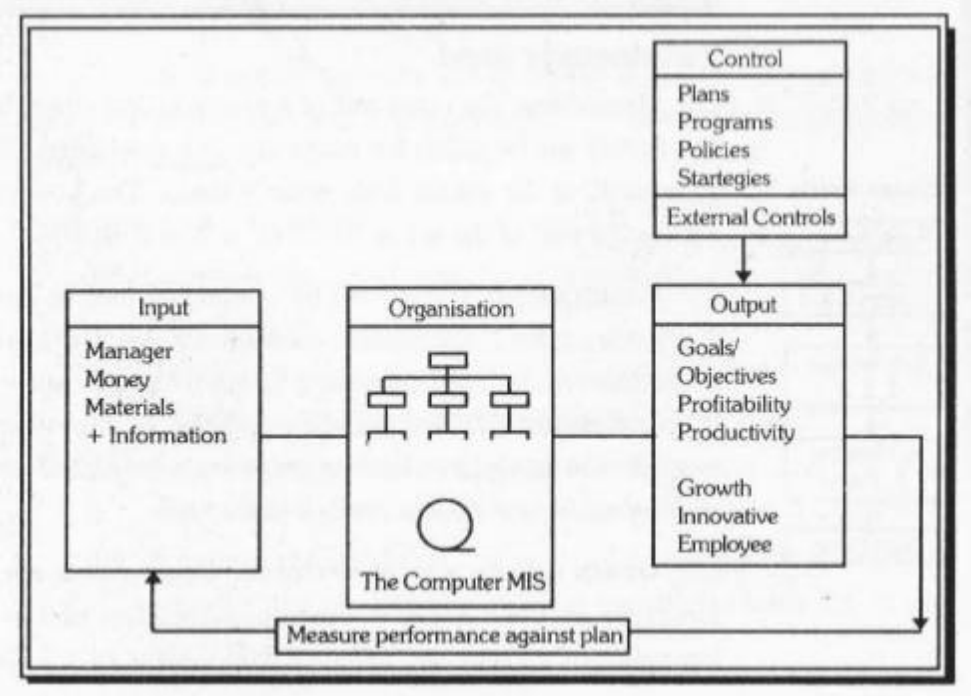
System Concept is the most in MIS. It is a way of thinking about managing optimally, in a wholistic perspective. It could be considered as framework to visualise and analyse both internal and external environments and the factors affecting these environments in an integrated manner.

Definition of a SYSTEM:

1. System is a group of interrelated or interacting elements forming an unified whole.
2. A system can be defined as any collection of components which respond to the inputs inorder to produce the desired output.
3. A system can be defined as a collective entity consisting of a group of elements that are interrelated, interdependent and interacting.
4. A system can be defined as a set of procedures that constitute the activities that are logically grouped together to form one unique function within an organisation.

Organisation is a system. The following diagram shows the organisation as a system:

The organisation as a System:



Computer Based Information System(CBIS):

Computer Based Information System(CBIS) is a set of software packages, which provides information for decision making.

Systems Concept is very important while developing MIS, as it allows us to new individual elements, subsystems in the larger perspective of the whole system leading to the optimal solutions and synergy. Systems are ali pervasive as it exist in all the fields, like,

social system, political system, economic system, educational system, human system, production system, business system, etc.

The use of system concepts to decompose the information system and define the boundaries and interfaces of each subsystem is generally called Structured Design.

The System Analyst is responsible for examining the total flow of data throughout the organisation.

Various elements of a system:

1. Boundary,
2. Sub system or components,
3. Environment,
4. Interface,
5. Input,
6. Output,
7. Processor,
8. Feedback,
9. Control

Its brief explanation is as follows:

(1) Boundary:

The outer wall of a system is the boundary. All the components of the system will be within the boundary. The system's environment is outside the system, and the system boundary separates the system from its environment. This establishes the limit of a system, by separating one system from the other system. This boundary of the system denotes the end of the scope.

(2) Sub system or Components:

Sub system or components are the irreducible part or the aggregation of parts, which builds a system. A system has several sub systems. Simple concept of a component is very powerful.

The components are interrelated. The function of one sub system is tied to the function of the others. The structure of the system is the inter relationship between and interaction between the different components or the sub systems, which form a system. The function of one is tied to the function of the others.

Example:

In a business system, production sub system and marketing sub system, etc. are all interrelated.

Constraints: Constraints are the limit to what a system can accomplish. A system faces several constraints while functioning, because of the limitations like capacity, speed, capabilities, etc. regarding what it can do, and how a system can achieve the results within the environment.

(3) Environment:

Environment is the source of the external elements that impinge upon the system, and a system will be within this environment.

A system does not exist in a vacuum, rather, it exists and functions in an environment. The environment determines how a system should function.

Example:

For a business organisation system – suppliers, government, customers, competitors, etc. acts as the environment.

(4) Interface:

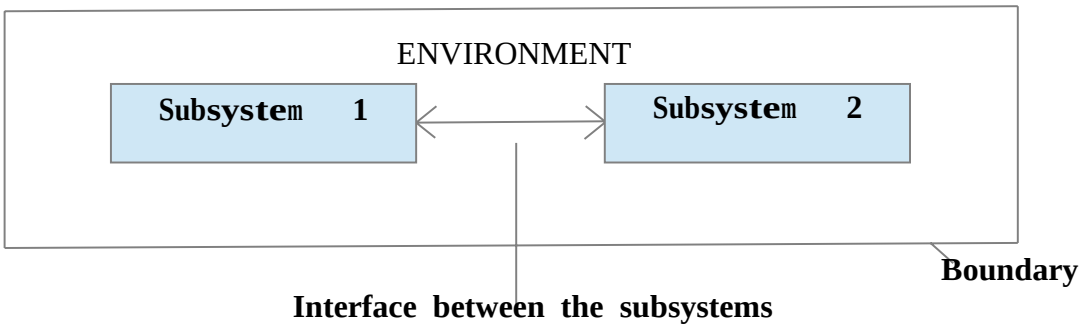
Interface is the interconnections or the interactions or point of contact between the sub systems or where a system meet its environment. Interface occurs at the boundary of every sub system and takes the form of inputs and outputs.

An interface has several special, important functions. It provides

- security in protecting the system from the undesirable elements,
- filtering unwanted data,
- coding and decoding for the incoming and outgoing messages,
- buffering – providing a layer of slack between the system and its environment so as to work on different cycles and at differenct speeds'
- summarising raw data and transforming them into the level of detail format needed throughout the system for an input or output interface.

The following diagram shows about the boundary, interface and environment of a Sytem:

Boundary, interface and environment of a Sytem:



(5) Input:

Input involves capturing and assembling the elements, which enter the system to be processed. Normally, a system takes input from the environment to function.

Example:

- Machines takes the raw materials as the input,
- Man takes food, water, air, etc.

These input elements must be secured and organised for processing.

(6) Output:

Output involves the transferring of those elements, which have been produced by the transformation process, to their ultimate destination. Whatever may be the nature of output like goods, services or information, it must be in line with the expectations of the intended user.

Example:

- Finished products,
- Human services,
- Management information

All these outputs should be transmitted to the human users.

(7) Processor:

Processor is the operational element of the system. It involves the actual transformation of input into output.

Examples:

- Manufacturing process,
- Data calculations,
- Human breathing process, etc.

(8) Feedback:

Feedback is the data about the performance of the system. Feedback is using the variations between the actual and desired outputs(from a system goal) to change the system behaviour. It is the idea of monitoring the current system output and compare it to the system goal. The variations are fed back into the system for adjustments and to ensure that it meet its goal. A system with its feedback and control components is sometimes called the **―cybernetic system‖ (i.e.) a self monitoring and self regulating system.**

Feedback measures the output against a standard, in some form of cybernetic procedures which includes feedback and control. After the comparison of output with the performance standards, changes can result in input, output, or processing.

(9) Control:

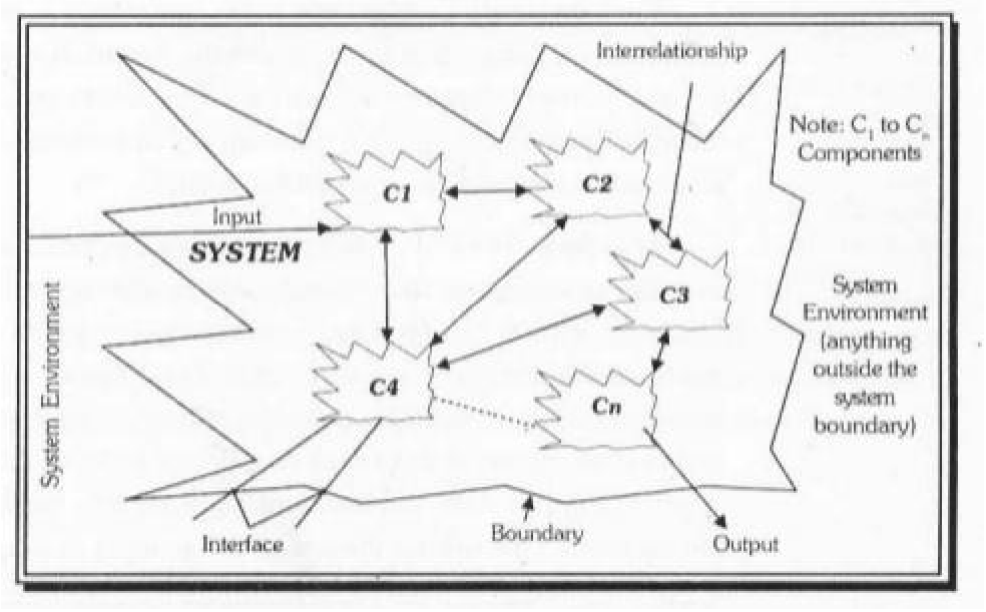
Control is a major system function, which monitors and evaluates the feedback, inorder to determine whether the system is moving towards the achievement of its goals.

Supposing, if there is a need for some adjustments to be done in the system, for the proper output, then that can be done. Actually, control element guides the system. In an organisational context, management as a decision making body controls

- the inflow,
- the handling, and
- the outflow

of all those activities which affect the welfare of the business.

A System:



Black Box:

Black Box represents **the conversion process**. Black Box is also a sub system, where the inputs and outputs are defined, but not the processes. Black Box performs or provides the facility to perform some part of the defined transformation processes.

Example:

A class room in case of an educational system.

Concept of Black Box:

In case of systems development the concept of Black Box is used to simplify the systems design. Initially, the transformation process of a system is left out (i.e.) initially, the transformation process of a system is assumed to be unknown or black box. That is, first, output is defined. Once the output requirements are clearly defined, the designers turn to inorder to identify the input requirements, so to generate the specified output.

So, after defining the input and output, the last step in design is to specify the black box operation. Black Box represents **the conversion process**. The steps in these conversion process are specified so as to convert the specified input into the specified output.

This approach to the systems design is highly scientific and is often used in the information system design. The following diagram shows the concept of Black Box:

The concept of Black Box:

Normally, systems exist in an infinite number of levels of scale.

Example:

The education system can be classified as

- Global education system,
- national education system,
- state education system,
- district education sytem,
- block education system,
- panchayat education sytem, etc.

Each subsystem may have inputs and outputs. Between subsytems many interconnections(i.e) interfaces are required for the exchange of input and output.

The number of these interconnections rapidly raises when the number of subsystems rises.

Alzebraically, the formula is,

$$\text{The number of interconnections in a system} = \frac{1}{2}N(N-1)$$

If the number of interconnections in a system is 8,(i.e.) N = 8, then there will be 28 interconnections.
N = 8

$$\frac{1}{2} N(N-1) = \frac{1}{2} * 8 * (8-1)$$

$$= \frac{1}{2} * 8 * 7$$

$$= 28 \text{ interconnections}$$

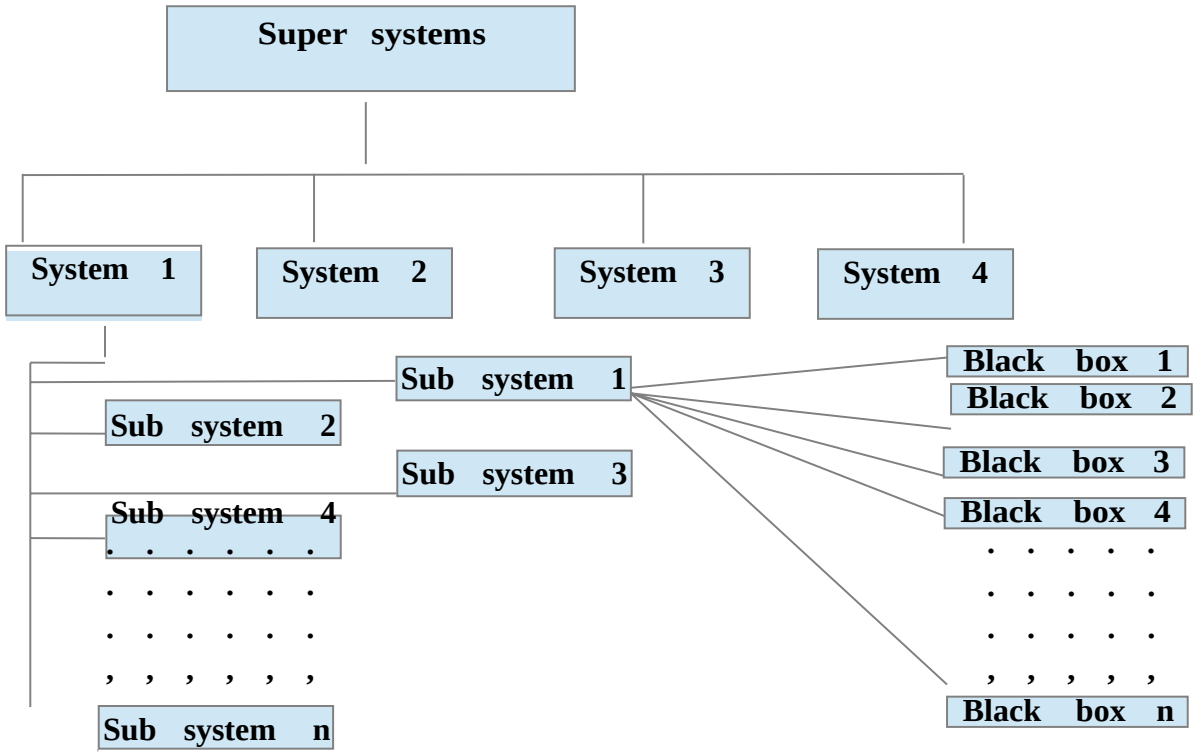
Factoring of a system:

A system, for the sake of operational efficiency, is divided into sub systems. Each subsytem is further divided into lower level systems, until we get an unit which is considered to be easy to manage. This process is called factoring of a system.

Super systems:

Super systems refer to extremely large and complex systems.

Hierarchy of systems:



Characteristics of a system:

(1) Each system has certain goals.
(2) A system has several sub systems or modules, and all are collectively called a system.
(3) The structure of the system is the representation of the interaction and the inter relationship between different subsystems or different components.
(4) A system does not exist in vacuum.
(5) At the same time, systems in our real life, do not operate in isolation.

Example: In the human system, there will be a combination of several subsystems like respiratory system, digestive system, circulatory system, Reproductive system, excretory system, etc.

(6) The life cycle of a system is the expression of the various phasesin the active usage life of the system.
(7) Systems operate interms of goals and pre-determined scope.

Types of systems:

(1) Conceptual systems and Empirical systems
(2) Natural systems and Artificial systems
(3) Social system, People – machine system and Machine system
(4) Open system and Closed system
(5) Adaptive system and Non-adaptive system,
(6) Probailistic system and Deterministic system,
(7) Permanent system and Temporary sytem,
(8) Stationary system and Non-stationary system.

Its brief explanation is as follows:

(1) Conceptual and Empirical system:

Conceptual – only based on ideas

Conceptual system:

Conceptual system is a theoretical framework which may or may not have any counterpart with the real world. (counterpart – corresponding part or Complementary part). They are just the systems of explanations or classifications.

Examples:

- Economic theory,
- General sytem of relativity
- Organization theory.

They may also appear in the practical management affairs in the form of

- Plans,
- Accounting system,
- Classification of policies and procedures.

Empirical system:

Empirical systems are generally the concrete operational systems made up of people, machines, materials, energy and other physical things.(empirical – based on experience or scientific experiments and not only on ideas.) Also, thermal, electrical, chemical, information and other such systems also fall in this category.

Empirical systems are derived from or based upon the conceptual systems and thus represent the conversion of concepts into practice.

(2) Natural system and Artificial system:

Natural system:

Natural systems are those systems which are not the result of human effort. They are plenty in the nature. The entire ecology of life is a natural sytem.

Example:

- Solar system
- Water system

Artificial system:

Artificial systems are man made systems and are formed when people first gathered in groups to live and to hunt together. They now appear in infinite variety and extend from the manufacturing system of a company to the system of space exploration.

Example:

- Transport system,
- Communication system,
- Production sytem,
- Accounting system,
- National defence system, etc.

(3) Social system, People – machine system and Pure Machine system:

Social system:

Social systems are those systems which are made up of people, apart from the other system's activities and processes.(Here, we should not consider the system's processes).

Example:

(1) Business organizations,
(2) Government agencies,
(3) Political parties,

(4) Social clubs, etc.

People – machine system:

People – machine system is a system composed of people, who utilize certain equipments inorder to achieve their objectives. Most of the empirical systems fall into the category of people – machine system.

Pure Machine system:

Pure Machine systems are those systems which would have to obtain their own inputs and maintain themselves.

Example:

Solar power system may be put in this category, except for its creation.

Note:

Although, some electrical power generating systems approach self sufficiency and self repairing, completely, self sufficient machine systems are still in the category of science fiction.(something which is not true or real)

(4) Open system and Closed system:

Open system:

Open systems are those systems which react with the environment and exchange information, material or energy with the environment.

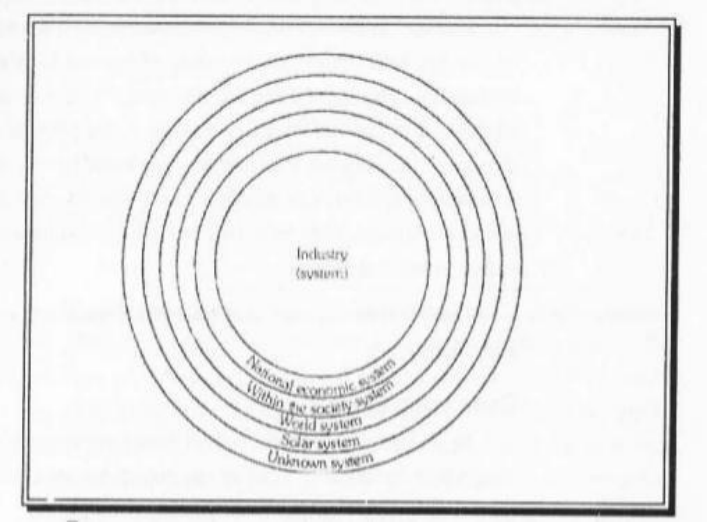
All systems containing the living organisms are obviously open systems because they are affected by what is sensed by the organisms. Also, here receiving and evaluating feedback allows a system to determine how well it is operating. Let us consider a business, which is producing some low quality goods and services with higher prices. Here, the feedback will be people are not buying regularly. So, as a result of the evaluation of this feedback, management should adjust the price and quality, to bring inline with the expectations of the people, and then only there will be good sales.

Let us consider ‒an organization‖. Organizations are usually systems operating within the larger systems and are therefore open systems. This organization is inturn, is a system within the larger ‒industry system‖.

This industry is a part of the ‒national economic system‖. This national economic system is a sytem within our ‒society‖. Society is a system within the ‒world‖. Again, world is a part of the ‒solar system‖. Solar system is within the ‒Unknown system‖ which we attribute to the divine system creator, God.

This is shown in the following figure.

Industry system within a series of system:



Closed system:

Closed system is a self contained system and it does not interact with its environment. It has a well defined boundary which keeps the environment from influencing the system directly. It does not exchange material, information or energy with its environment. But, in reality, a closed system never exists.

Example:

A computer program is a relatively closed system, because, it accepts only the previously defined inputs, process them and provides the previously defined outputs.

Open systems can be further classified as

- Adaptive system, and
- Non-adaptive system.

(5) Adaptive system and Non-adaptive system:

Adaptive system:

Adaptive system is a system which reacts environment in such a way as to improve its functioning, achievement, probability of survival is called an adaptive system.

Example:

Most biological systems are adaptive systems.

All the successful businesses which are able to adapt and react according to the environment, are also adaptive systems.

Non-adaptive system:

Non-adaptive system is a system which does not change with the changes in the environment. It is free from its environmental influences and may degenerate(becoming worser) eventually(at the end).

(6) Deterministic system and Probabilistic system:

Deterministic system:

Deterministic system is a system which is based on the predictability of outcomes and it operates in a predictable manner(i.e.) it is possible to predict the outputs accurately from its inputs.

Example:

- Mathematical formulae,
- Chemical formulae,
- Programs in the computers, etc.
-

Probabilistic system:

Probabilistic system is a system by which some of its states can be predicted from its previous states, that too, only with a certain amount of error(i.e.) inexactness is always there.

Example:

(a) In an inventory system, the average stock, average demand, etc. may be predicted, but, the exact values of these factors at any given time, cannot be known in advance.

(b) The behaviour of the human beings.

(7) Permanent system and Temporary sytem:

Permanent system:

For the practical purposes, those systems which are enduring for a time span and which is long relative to the operations of the humans, may be said to be a permanent system. Generally, there exists very few ‒people made systems‖ which are considered to be permanent systems.

Example:

The policies of a business organization are considered to be permanent, as far as year to year operations are concerned.

Temporary sytem:

Temporary systems are those systems which are designed to last only for a limited period of time. Once, the purpose is achieved, such systems will stop to exist. These temporary systems are important for the accomplishment of the specific tasks in business and science.

Example:

A small group research project in the laboratory is a temporary system.

(8) Stationary system and Non-stationary sytem:

Stationary system:

Stationary system is a system, whose properties and operations, either, do not vary significantly, or else, vary only in the repetitive cycle.

Example:

Supermarket store operations, etc.

Non-stationary sytem:

Non-stationary sytem is a system, whose properties and operations, change very frequently.

Example:

- An advertising organization,
- A research and development Laboratory, etc.

System concepts as applied to MIS:

According to Davis and Olson,‖MIS is an integrated user-machine system for providing information to support the opertions, management and decision making functions in n organisation. This system utilises computer hardware and software, manual procedures, models for analysis, planning, control and decision making, and database‖.

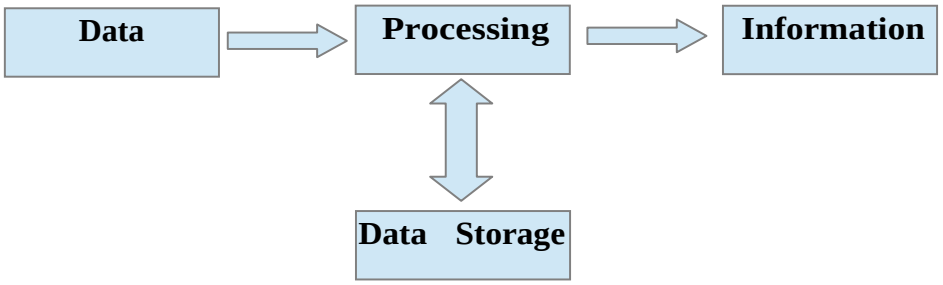
MIS is management oriented, management directed. It is an integrated system, it avoids redundancy in data storage. It has a common database. It works on sub system concept.

MIS is basically an integrated system which transforms the Input (i.e.)data and procedures into information (i.e.)output, which is used for decision making through the processings and with the various components of an Information System like people, hardware, software, database and procedures. **MIS is based on making use of computers for processing and providing information.** This is similar to a normal system which receives input, process them and provide its outputs.

Apart from this, in case of MIS, all the necessary inputs do not arise all of a sudden. Data is emerging all the time, and so they are captured and they have to be stored also, as and when they are occuring. So, this stored data is also becoming the input along with the already processed data(i.e.) information which are all awaiting for the future uses.

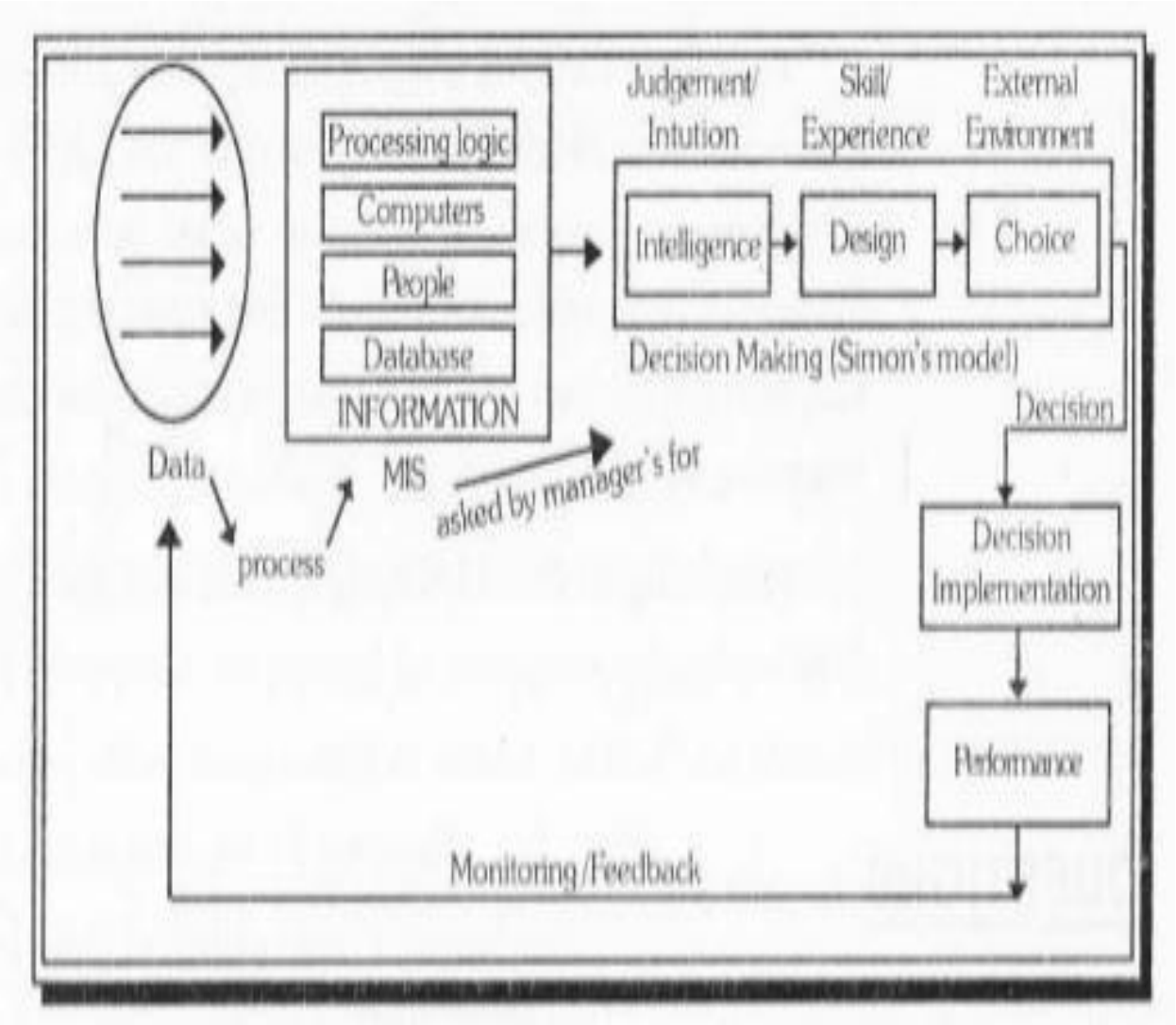
So, this storage function is also added up along with the basic system model of inpu-processing-output. The following figure shows about this model.

Model of an Information system with its Data Storage:



MIS concept is shown in the following diagram.

MIS concept:

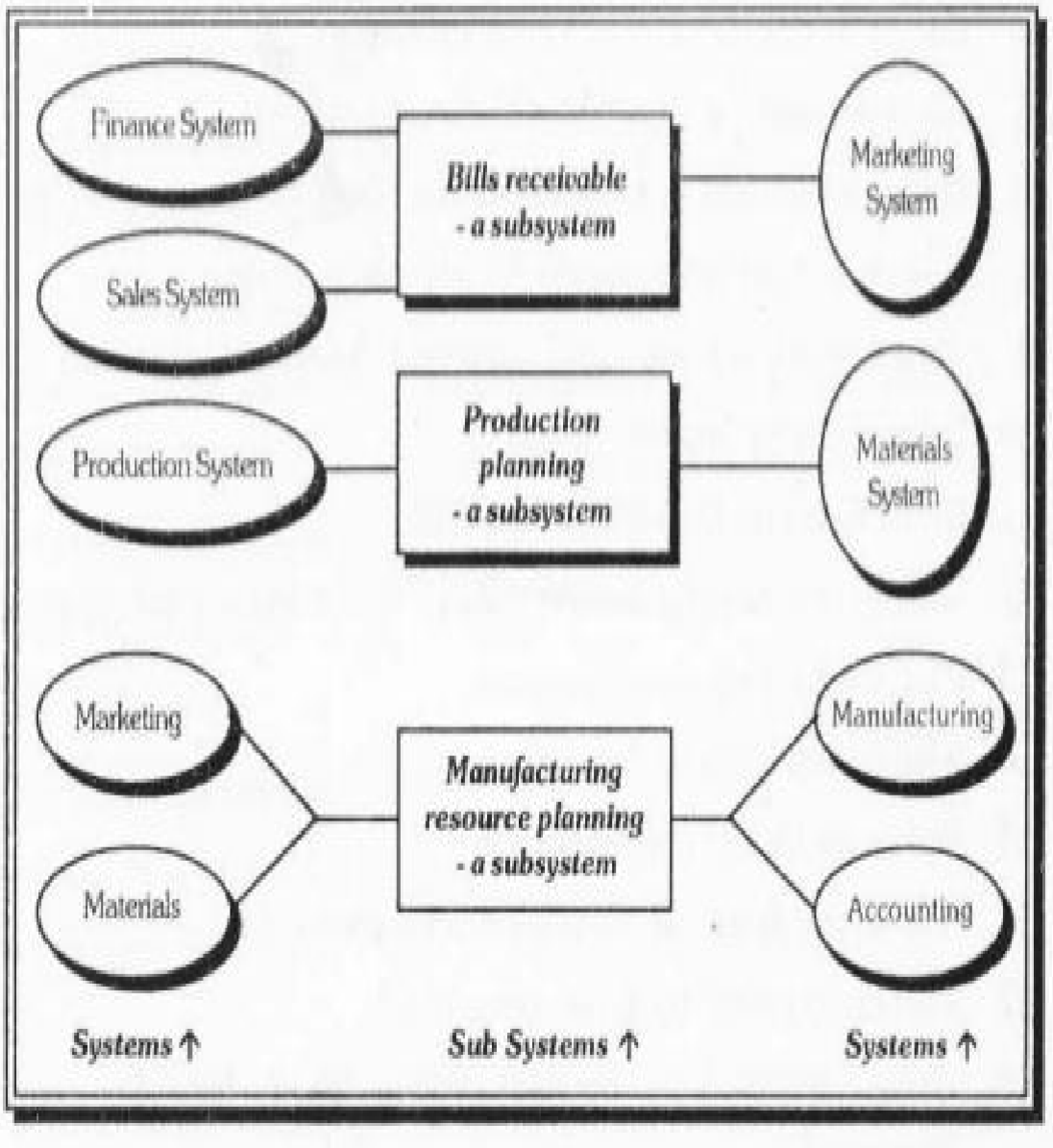


This diagram shows about, MIS as an integrated system tranforms data into information, which is used for decision making through the processings(by using people, hardware, software, database, and communication networks).

So, MIS is based on making use of computers for the purpose of processing and providing information. Also, the variations between the actual output and the desired output, are fed back into the system for the adjustments so that the goals are achieved.

The following diagram shows about the systems and sub systems in a business organisation.

Systems and sub systems in a business organisation:



Types of control in systems:

Feedback in the key for systems control. Information about the transformation process is fed to the control centre, which may be a manager or a computer system, so that the processings can be assessed and corrected, if necessary.

The control is systems can be classified as follows:

(1) Open loop system
(2) Closed loop system, and
(3) Cybernetic system.

Its brief explanation is as follows:

(1) Open loop system:

Open loop systems are those systems where no feedback loop exists and also control is external to the system(i.e.) control is not an integral part of the system.

The following diagram shows this.

Open loop system:

Eventhough, this system transforms the input into output, it lacks feedback and it provides no oppurtunity for the management control. Suppose, if the output is not satisfactory, there is no provision for modifying the input or the process. Operating such a system is analogous to drive a car while blindfolded.

(2) Closed loop system:

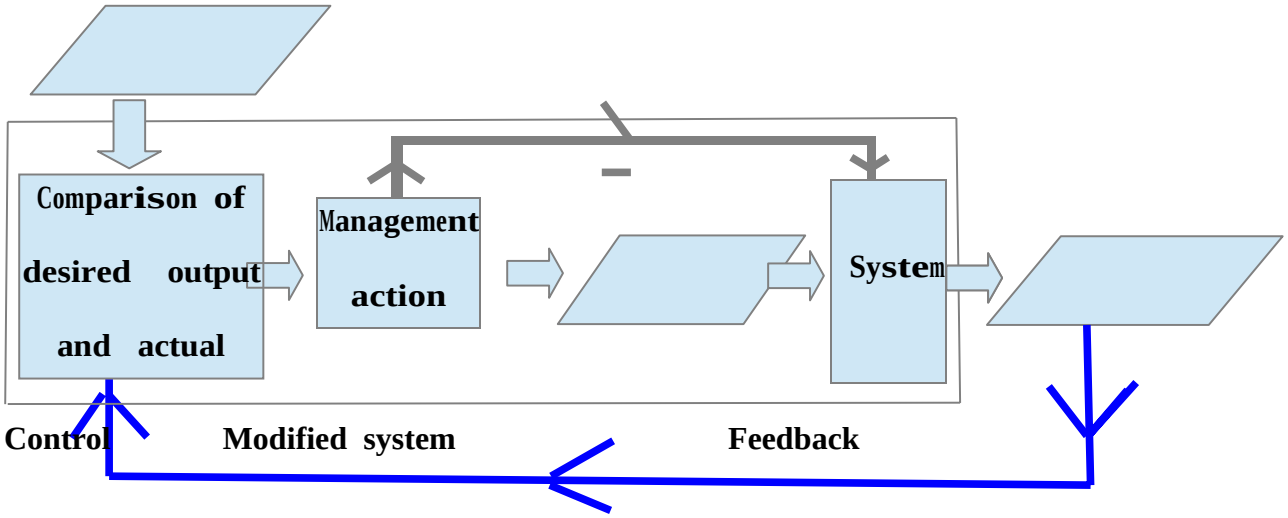
Closed loop system is a system where the feedback on the output measurement is fed back to make more appropriate alterations to the input.

Example:

Let us consider the control system of stock level. Stock level control system has a planned level of stock, for each and every item(i.e.) for each and every item, this system has a planned stock level. The actual stock level of each item is measured and compared with this planned level. Adjustments are made so as to bring the stock level up or down, to conform to that planned level.

The following diagram shows the closed loop system:

Closed loop system:



All true mangement systems are closed loop systems.

Since, MIS is a feedback system, it is more complex to design than the open loop systems. Feedback systems are effective in closed loop systems.

(3) Cybernetic system:

A system with its feedback and control components is sometimes called the ‑cybernetic system‖ (i.e.) a self monitoring and self regulating system.

Feedback measures the output against a standard, in some form of cybernetic procedures which includes feedback and control. After the comparison of output with the performance standards, changes can result in input, output, or processing.

IMPORTANT QUESTIONS TAKEN FROM THE VARIOUS QUESTION PAPERS:

Section – A:

1) What is MIS?
2) What is meant by System?
3) What is meant by Information System?
4) Define MIS.
5) Define OAS.
6) What is CBIS?
7) What is electronic data processing?
8) What is SIS?

Section – B:

1) Differentiate between Data and Information
2) What are the features of information?
3) Explain the steps in data processing.
4) Explain about the various components of IS with a suitable diagram.
5) Explain the various types of Information system.
6) Explain the importanace of information to decision making and strategy building.
7) What are the characteristics of a system?
8) Explain the various elements of a system.
9) Write about business organization as a system.
10) Explain about Cybernetic system.

Section – C:

1) Define MIS. What are its objectives and functions?
2) Explain the various categories of a system.
3) Explain the various elements of a system.
4) Explain the needs, benefits and functions of MIS.

UNIT – 2:

CONCEPTUAL FOUNDATIONS:

The decision making process:

Generally, decision is choosing a particular course of action, after considering the possible alternatives.

Meaning of a decision:

Decision is a choice which involves the commitment of resources to a course of action.

Decision making:

Decision making means to select a course of action from two or more alternatives. It is a determination to do something in a stated way and it breaks the deadlocks.

Decision making is an all - pervasive management fuction. Each function of management requires decisions to be taken.

Decision-making is a process by which a decision (course of action) is taken. Decision-making lies embedded in the process of management. It is a continuous process. Decision-making is an indispensable component of the management process itself. Decision-making is an essential aspect of modern management. It is a primary function of management. A manager's major job is sound/rational decision-making.

According to Peter Drucker, "Whatever a manager does, he does through decision-making". A manager has to take a decision before acting or before preparing a plan for execution. Moreover, his ability is very often judged by the quality of decisions he takes. Thus, management is always a decision-making process. It is a part of every managerial function. This is because action is not possible unless a firm decision is taken about a business problem or situation.

This clearly suggests that decision-making is necessary in planning, organising, directing, controlling and staffing. For example, in planning alternative plans are prepared to meet different possible situations. Out of such alternative plans, the best one (i.e., plan which most appropriate under the available business environment) is to be selected. Here, the planner has to take correct decision. This suggests that decision-making is the core of planning function. In the same way, decisions are required to be taken while performing other functions of management such as organising, directing, staffing, etc. This suggests the importance of decision-making in the whole process of management.

The effectiveness of management depends on the quality of decision-making. In this sense, management is rightly described as decision-making process. According to R. C. Davis, "management is a decision-making process." Decision-making is an intellectual process which involves selection of one course of action out of many alternatives. Decision-making will be followed by second function of management called planning. The other elements which follow planning are many such as organising, directing, coordinating, controlling and motivating.

Definitions of Decision-making:

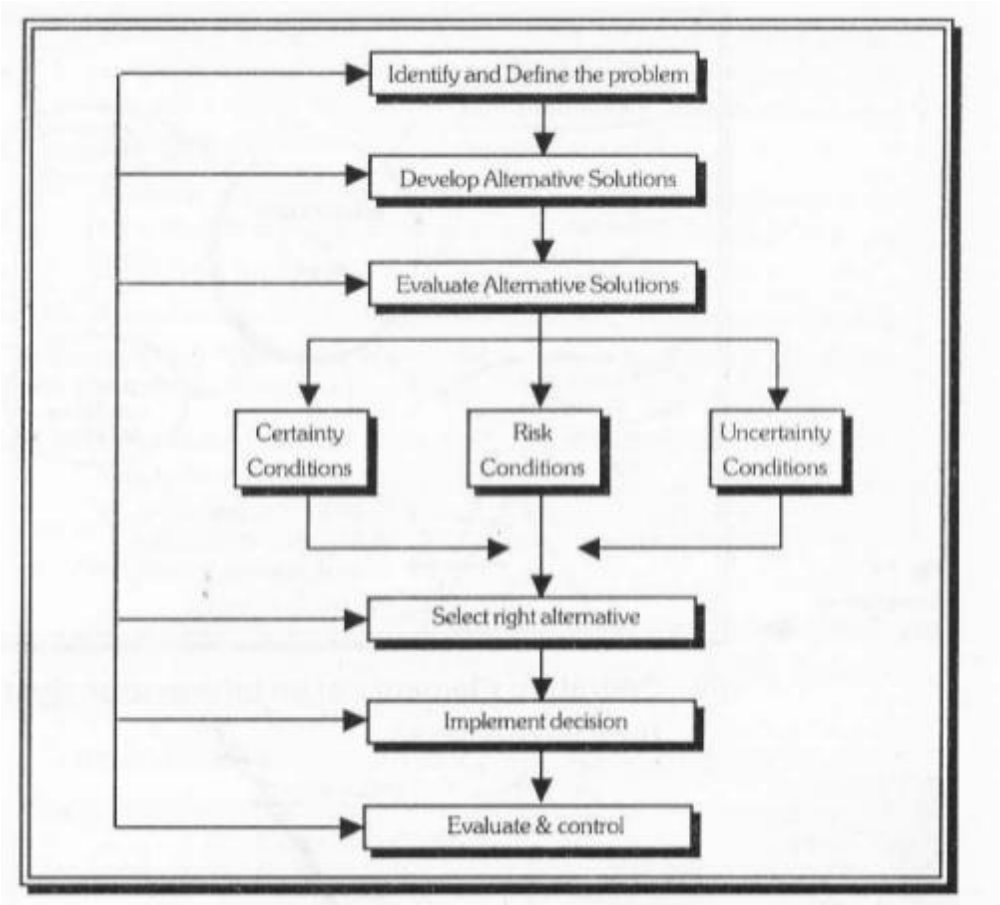
1. The Oxford Dictionary defines the term decision-making as "the action of carrying out or carrying into effect".

2. According to Trewatha & Newport, "Decision-making involves the selection of a course of action from among two or more possible alternatives in order to arrive at a solution for a given problem".

Steps Involved In Decision Making Process:

The following is the chart for the decision making process:

The process of decision making in a flowchart:



Decision-making involves a number of steps which need to be taken in a logical manner. It involves the following six steps:

1. Defining / Identifying the managerial problem,
2. Analyzing the problem,
3. Developing alternative solutions,
4. Selecting the best solution out of the available alternatives,
5. Converting the decision into action, and
6. Ensuring feedback for follow-up.

Its brief explanation is as follows:

1. **Identifying the Problem:** Identification of the real problem before a business enterprise is the first step in the process of decision-making. It is rightly said that a problem well-defined is a problem half-solved. Information relevant to the problem should be gathered so that critical analysis of the problem is possible. This is how the problem can be diagnosed. Clear distinction should be made between the problem and the symptoms which may cloud the real issue. In brief, the manager should search the 'critical factor' at work. It is the point at which the choice applies. Similarly, while diagnosing the real problem the manager should consider causes and find out whether they are controllable or uncontrollable.

2. Analyzing the Problem: After defining the problem, the next step in the decision-making process is to analyze the problem in depth. This is necessary to classify the problem in order to know who must take the decision and who must be informed about the decision taken. Here, the following four factors should be kept in mind:

1. Futurity of the decision,
2. The scope of its impact,
3. Number of qualitative considerations involved, and
4. Uniqueness of the decision.

Collecting Relevant Data: After defining the problem and analyzing its nature, the next thing is to obtain the relevant information/ data about it. There is information flood in the business world due to new developments in the field of information technology. All available information should be utilised fully for analysis of the problem. This brings clarity to all aspects of the problem.

4. **Developing Alternative Solutions**: After the problem has been defined, diagnosed on the basis of relevant information, the manager has to determine available alternative courses of action that could be used to solve the problem at hand. Only realistic alternatives should be considered. It is equally important to take into account time and cost constraints and psychological barriers that will

restrict that number of alternatives. If necessary, group participation techniques may be used while developing alternative solutions as depending on one solution is undesirable.

5. Selecting the Best Solution: After preparing alternative solutions, the next step in the decision-making process is to select an alternative that seems to be most rational for solving the problem. The alternative thus selected must be communicated to those who are likely to be affected by it. Acceptance of the decision by group members is always desirable and useful for its effective implementation.

6. **Converting Decision into Action:** After the selection of the best decision, the next step is to convert the selected decision into an effective action. Without such action, the decision will remain merely a declaration of good intentions. Here, the manager has to convert 'his decision into 'their decision' through his leadership. For this, the subordinates should be taken in confidence and they should be convinced about the correctness of the decision. Thereafter, the manager has to take follow-up steps for the execution of decision taken.

7. Ensuring Feedback: Feedback is the last step in the decision-making process. Here,the manager has to make built-in arrangements to ensure feedback for continuously testing actual developments against the expectations. It is like checking the effectiveness of follow-up measures. Feedback is possible in the form of organised information, reports and personal observations. Feed back is necessary to decide whether the decision already taken should be continued or be modified in the light of changed conditions.

The following table shows about the decision making styles/tools:

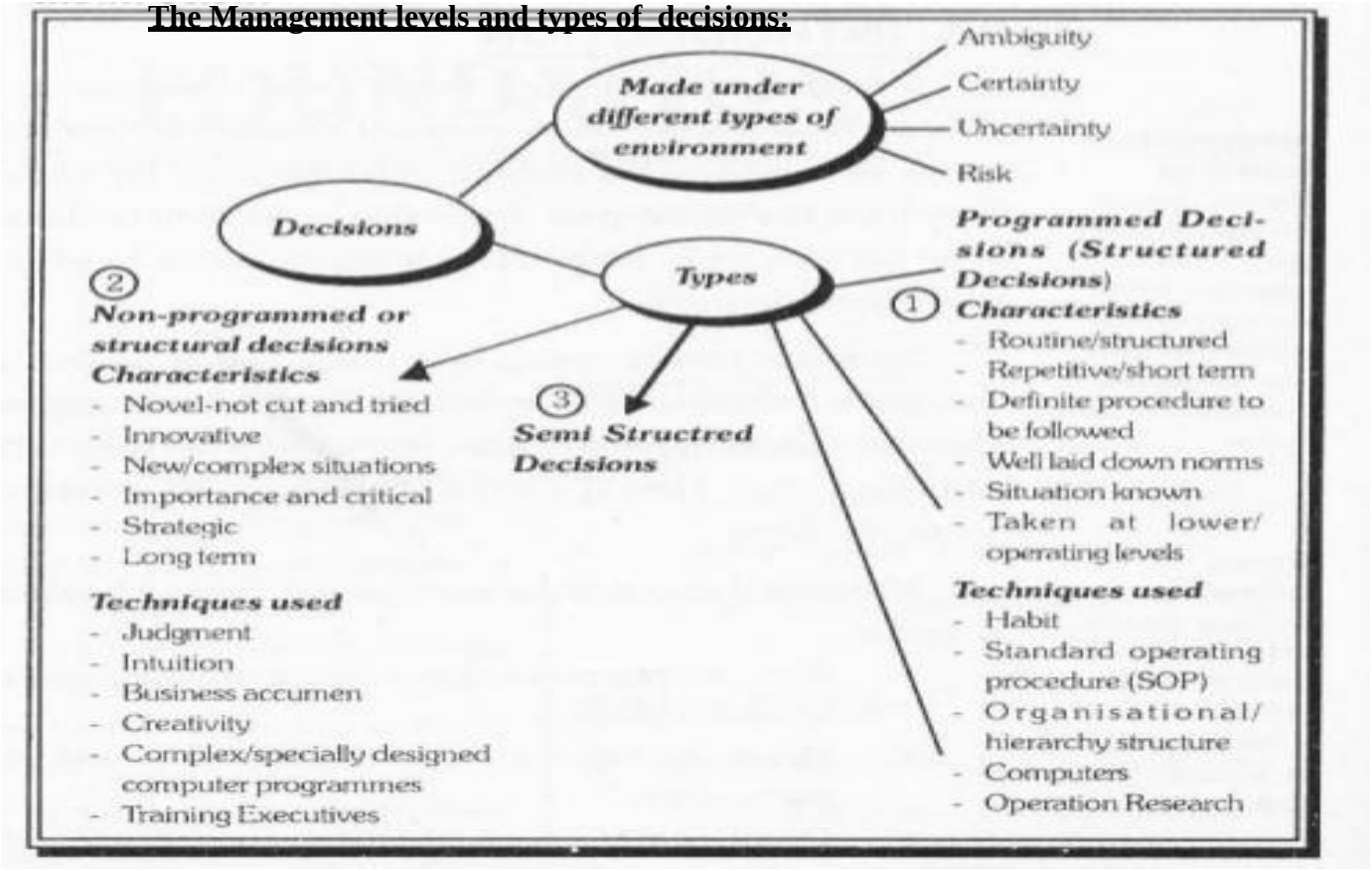
The decision making styles/tools:

Styles	*Tools*
• Taken by the Individual manager • Consultative Decisions - Formal consultations - Informal cosultations • Group Decsions by: - Co-actions - Task groups - Industrial groups - Brain storming - Delphi Techniques - Normal Grouping Technique - Consensus mapping - Synetics	• Pay off matrix • Decision Tree • Decision Tables • Queing methods • Distribution models • Games Theory • Devils advocate • Multiple advocacy • Dialectic inquiry

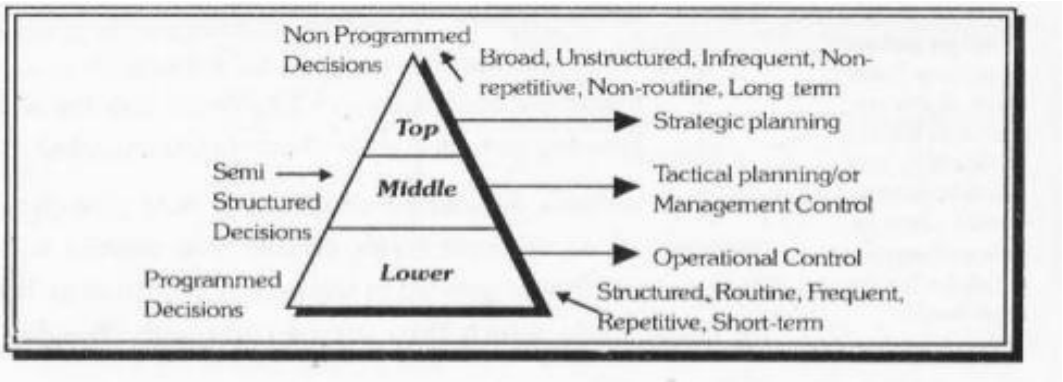
The environment under which the decisions are taken are ambiguity, certainty, uncertainty, risk, etc. The conditions under which decisions are made and its types are shown in the following figure:

The conditions under which decisions are made and its types:

The Management levels and types of decisions:



The Management levels and types of decisions are shown in the following diagram.



Based upon the problem situation in the decision-making, the decisions are classified as

- Programmable decisions or Structured decisions,
- Non-programmable decisions or Unstructured decisions
- Semi – structured decisions.

And this classification is based upon the amount of uncertainty involved in the decision-making.

Its brief explanation is as follows:

- **Programmable decisions or Structured decisions:**

These are the decisions where the steps leading from the problem identification upto selecting a solution, can be specifically stated(i.e.) a decision rule can be developed. This can be expressed as a set of steps to take when confronted with the need for a specific decision. The decision rule is contained in the agreement, contract, company policy or regulation, etc. Routine problems fall in this category. Since the problems are routine, the decision-maker is familiar with the problem situation, and hence knows how to approach the problem and how to solve it.

Example: A decision to replenish inventory is an example for the structured decision.

Here, the decision maker can develop certain criteria, called the decision rule, for reorder decision. These decisions are taken by the lower or the operating levels of management.

The information systems requirements for this structured decisions are clear and unambiguous procedures to ensure correct and complete input using the decision logic, and the output of the programmable decision in the form that is useful for the action.

- **Non-programmable decisions or Unstructured decisions:**

Unstructured decisions are those decisions which are new and non-routine. There is a lot of uncertainty about the situation. Since, the same kind of problem was not faced previously, the decision-maker does not have a decision rule to apply.

These decisions are taken by the top management.

Unstructured decision has no pre established decision procedure. The support requirements of these decisions are access to data and a variety of analysis and decision procedures thst can be applied to the solution of the problem.

Advertising budgets, new product decisions, acquisition and merger considerations, board member selection, and similar problems illustrate the non-programmable decisions that cannot be automated.

Examples: Introduction of Macintosh Computer by Apple Computer Inc., the development of 4 wheel drive passenger car by Audi, marketing of small video camera by Kodak, etc.

The following table shows about the comparison of the methods and the types of decision- making:

The comparison of the methods and the types of decision-making:

Type of Decision	*Method of decision-making*	
	Old	*New*
Programmed, Repetitive and Routine	Habit, standard operating procedure, organisation structure policy etc.	Management Information Systems (includes Management Science Techniques and the Computer)
Non-programmed one shot, ill-structured	Judgement, Intuition, In-sight Experience, Training and Learning	Systematic approach to problem solving and decision- making

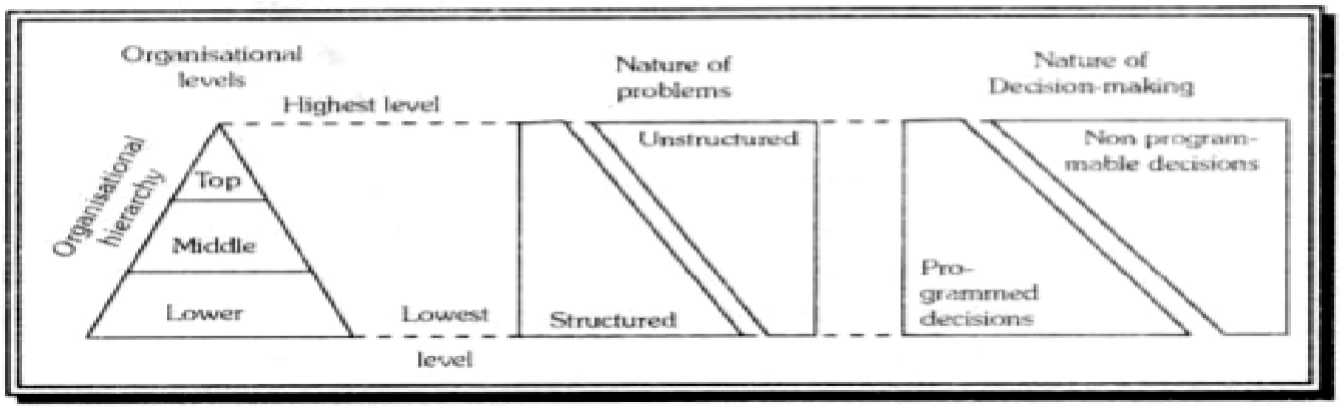
draw table in pg. no.49 in C.S.V.MURTHY table-2.3

- **Semi – structured decisions:**

Semi – structured decisions involve those problems which are neither new nor routine.
There is some amount of familiarity with the decision, but not complete.

The following diagram shows about the ‑Nature of problems and decision making in the organisation‖.

Nature of problems and decision making in the organisation:



The following table shows the different management levels and their activities:

Different levels and activities:

LEVEL	ACTIVITIES
Strategic Planning	Definition of goals, policies and general guidelines charting course for organisation. Determination of organisational objectives, choice of business direction, market strategy, product mix.
Management Control and Tactical Planning	Acquisition of resources, acquisition tactics, plant location, new products establishment and monitoring of budgets, structuring of work, training of personnel.
Operational Planning and Control	Effective and efficient use of existing facilities and resources to carry out activities within budget constraints.

The type of information required by the decision-makers is related to

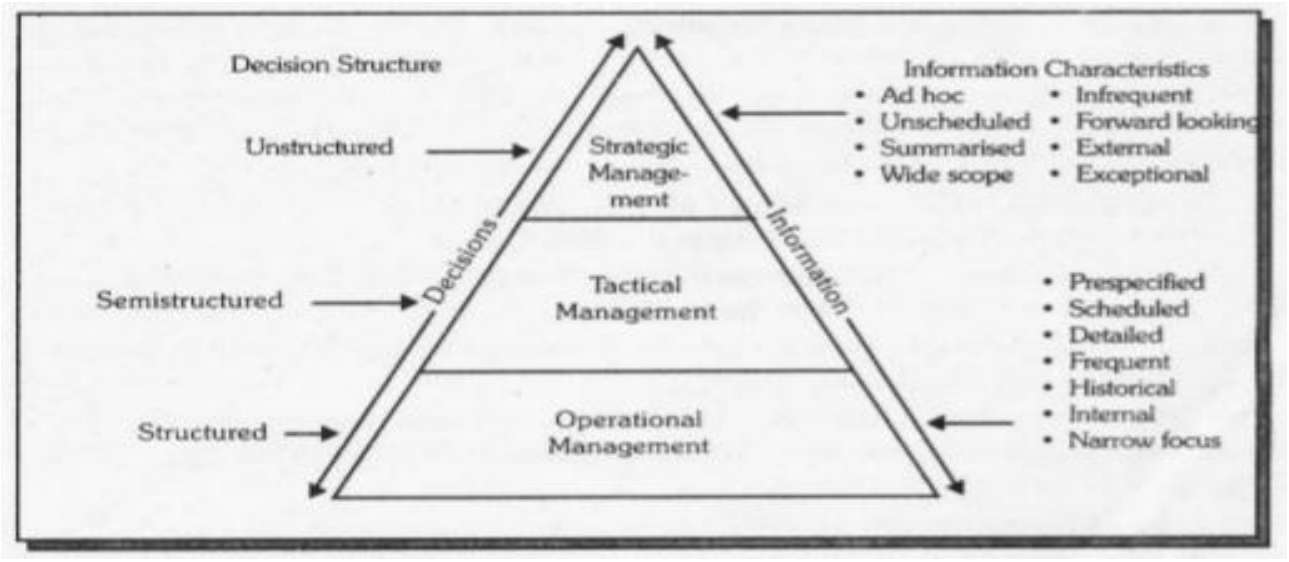
- Level of management of decision-making,
- Amount of structure in decision situations they face.

The following table shows about the types of management, information and decisions:

Strategic	*Tactical*	*Operational*
Generally board of directors, executive committee of the CEO, Top executives	Self directed teams, Business unit managers	Members of self-directed teams, operating managers
Develop overall organisational goals, strategies, policies, objectives of a strategic planning process	Develop short and medium range plans, schedules, budgets specify the policies, procedures and business objectives for their subunits of the organisations	Develop short range plans such as weekly production schedules
Monitor the strategic performance of the organisation and its overall directions in the political, economic and competitive business environment	Allocate resources and monitor the performance of their organisational sub units, including departments, divisions, process teams, project teams and other work groups	Direct the use of resources and the performance of tasks according to procedures and within budgets and schedules. They establish it for the teams and other work groups of the organisation

The following diagram shows the information requirements at different levels of decision-makers.

The information requirements at different levels of decision-makers:



Problem analysis vs decision making:

It is important to differentiate between problem analysis and decision making. The concepts are completely separate from one another. Traditionally it is argued that problem analysis must be done first, so that the information gathered in that process may be used towards decision making.

Problem analysis:

* Problems are merely deviations from performance standards
* Problem must be precisely identified and described
* Problems are caused by a change from a distinctive feature
* Something can always be used to distinguish between what has and hasn't been effected by a cause
* Causes to problems can be deducted from relevant changes found in analyzing the problem
* Most likely, a cause to a problem is the one that exactly explains all the facts

Decision making:

* Objectives must first be established
* Objectives must be classified and placed in order of importance
* Alternative actions must be developed
* The alternative must be evaluated against all the objectives
* The alternative that is able to achieve all the objectives is the tentative decision
* The tentative decision is evaluated for more possible consequences
* The decisive actions are taken, and additional actions are taken to prevent any adverse consequences from becoming problems and starting both systems (problem analysis and decision making) all over again
* There are steps that are generally followed that result in a decision model that can be used to determine an optimal production plan.
* In a situation featuring conflict, role-playing is helpful for predicting decisions to be made by involved parties.

Systems approach to Problem Solving:

Systems approach: Systems approach is a systematic process of problem solving based on the scientific methods which defines the problemand oppurtunities in a system context.

System context: System context is recognising systems, sub systems and components of a system in a situation.

Problem: Problem is a basic condition that is causing undesirable results in an organisation.

The systems approach to problem solving uses a system orientation so as to define the problems and oppurtunities to develop the solutions. Griffin has beautifully illustrated the problem solving.According to him problem solving is a six step process and they are as follows:

- Identifying the problem,
- Gathering and sorting the relevant information,
- Developing and analysing the alternatives,
- Programming(selecting the best alternative),
- Implementing the program,

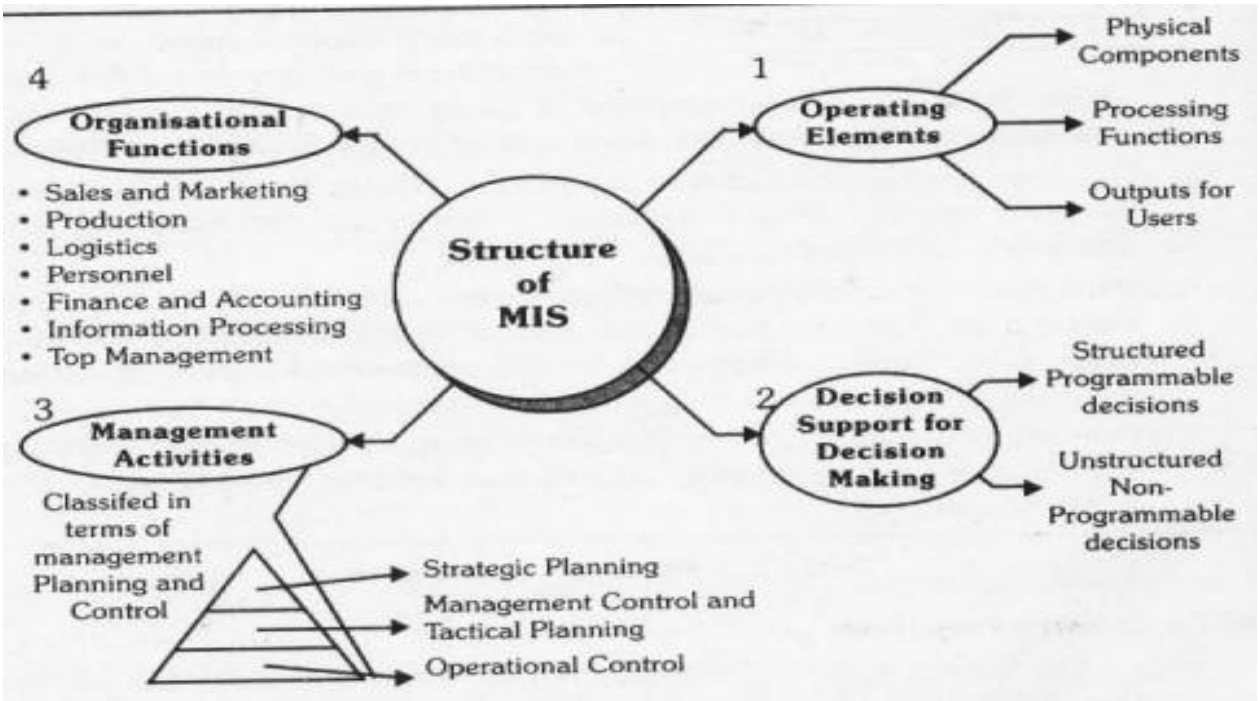
- Follow up and Evaluation.

Its brief explanation is shown as follows:

Short explanation of six step process of decision making:

Steps	Details
Recognising and defining the problem	Some stimulus indicates that a decision must be made whether it is positive or negative.
Identifying the alternatives	Both obvious and creative alternatives are desired. In general, the more significant the decision, the more alternatives should be generated.
Evaluating the alternatives	Each alternative is evaluated to determine its feasibility, its satisfactoriness and its consequences.
Selecting the best alternative	Consider all situational factors and choose the best alternative to fit the manager's situation.
Implementing the chosen alternative	The chosen alternative is implemented into the organisational system.
Follow up and Evaluation	How the chosen alternative in step 4 has been implemented in step 5 is to be seen by the manager.

The structure of a Management Information System:



Its brief explanation is as follows:

(1) Operating Elements:

The Operating elements of an information system are classified as

- Physical components,
- Processing functions, and
- Outputs for the users.

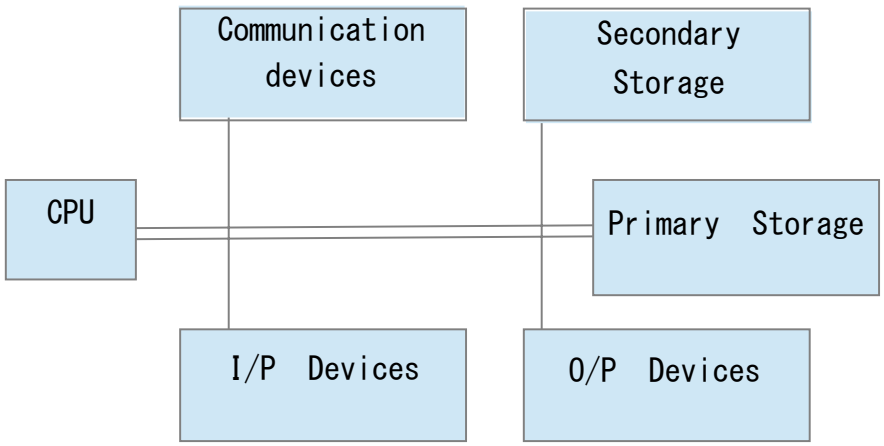
They are explained as follows:

(a) Physical components: The various physical components needed for an Information System are people, hardware, software, data resource technologies and communcation networks. All the Physical components are explained as follows:

(i) **Hardware:** The various hardware are Machines and Media; physical equipment as opposed to the computer programs or the methods of use; Mechanical, magnetic or electrical, electronic, or optical devices. Here, the machines may be computers, video monitors, magnetic disk drives, printers, optical scannners, etc. The media may be floppy disks, magnetic tape, optical disks, plastic cards, paper forms, etc. Five major functions provided by the hardware are:

- Input or entry,
- Output,
- Secondary storage for data and programs,
- Central Processors(computation, control and primary storage), and,
- Communication devices.

The following diagram shows about the major functions provided in the hardware:



(ii) **Software:** Software resources includes both the programs and procedures.

Software are detailed, programmed instructions that control and coordinate the work of computer hardware components in an information system. Two classifications of software are

- System software, and
- Application software.

* **System software:** System software is a software which executes the routine tasks.

Example: Operating systems, utility programs, language translators, communication software, etc.

* **Application software:** Application software is a software which describes the programs that are written for or by the users to apply the computer to a specific task.

Procedures: Procedures are set of operating instructions used by those people, who will use an information system to complete a task, for example, using a software package. They exist in a physical form such as a manual or instruction booklet. These are user instructions, instructions for the preparation of input, operating instructions, data entry procedures, error correction procedures, etc.

(iii) Data resources: The data resources may be product descriptions customer records, employee files, inventory databases, etc. It includes

(a) databases, which hold processed and organized data. Database is a centrally controlled, integrated collection of logically organised data, which

* minimises data redundancy,
* facilitates the storage of massive data,
* facilitates the quick retrieval of data, and
* ensures data security.

(b) knowledge bases, that hold knowledge in a variety of forms like facts, rules, and case examples of successful business practices. Knowledge bases are used by Knowledge Management Systems(KMS) and Expert Systems(ES) to share the kmowledge or to give expert advice on specific subjects.

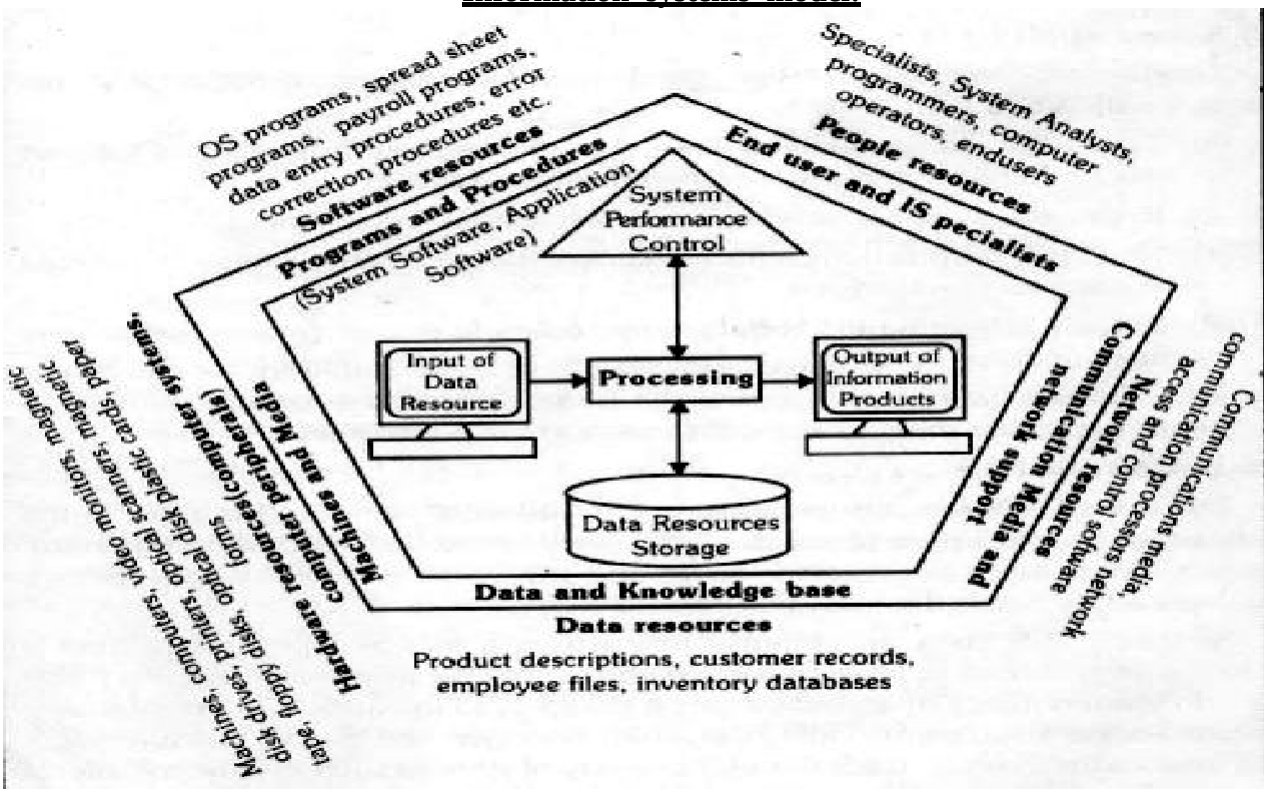
(iv) **Operating personnel or People:** It includes specialists like system analysts, programmers, computer operators, data preparation personnel, information systems management, data administrators, etc. and also the end-user(i.e.) anyone who uses the information systems.

(iv) Communication network resources: It includes

- **communication media like cellular, satellite wireless technologies, etc.**
- **communication processors like modems, internetwork processor, etc.**
- **network access and control software like internet browser packages, etc**

The information systems model is shown in the following figure:

Information systems model:

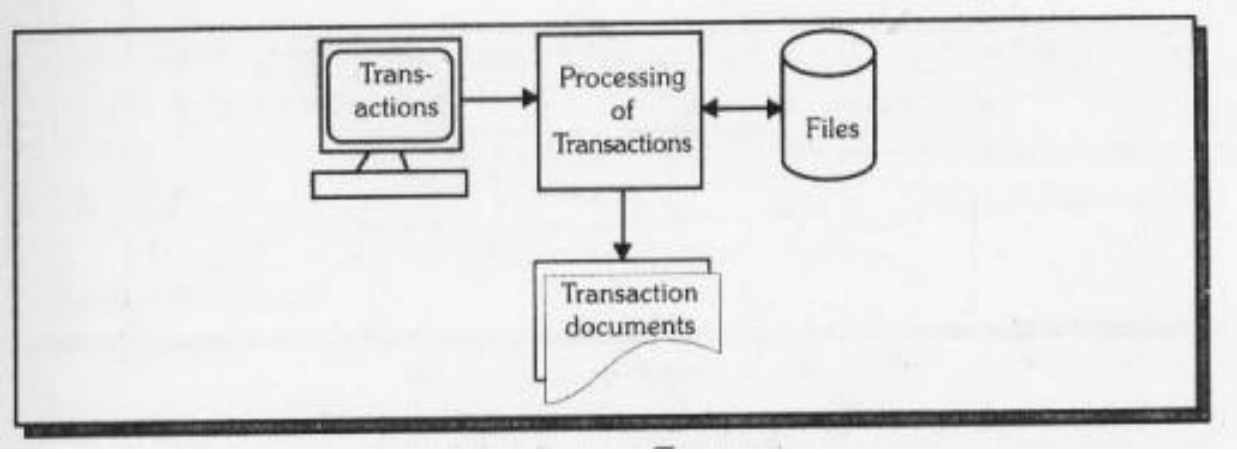


(b) Processing functions:

Processing functions are the second way to describe an information system as the physical components do not give any explanation of what the sysyem does, and hardware does not explain why it is configured that way.

These processing functions are shown in the following figures. The diagram for the process transactions is shown in the following figure.

Process transactions:



Here the master file is to be updated.

A transaction is an activity which takes place in the organization. For example, making purchases or sales, etc.

Example:

- making a purchase,
- making a sale, etc.

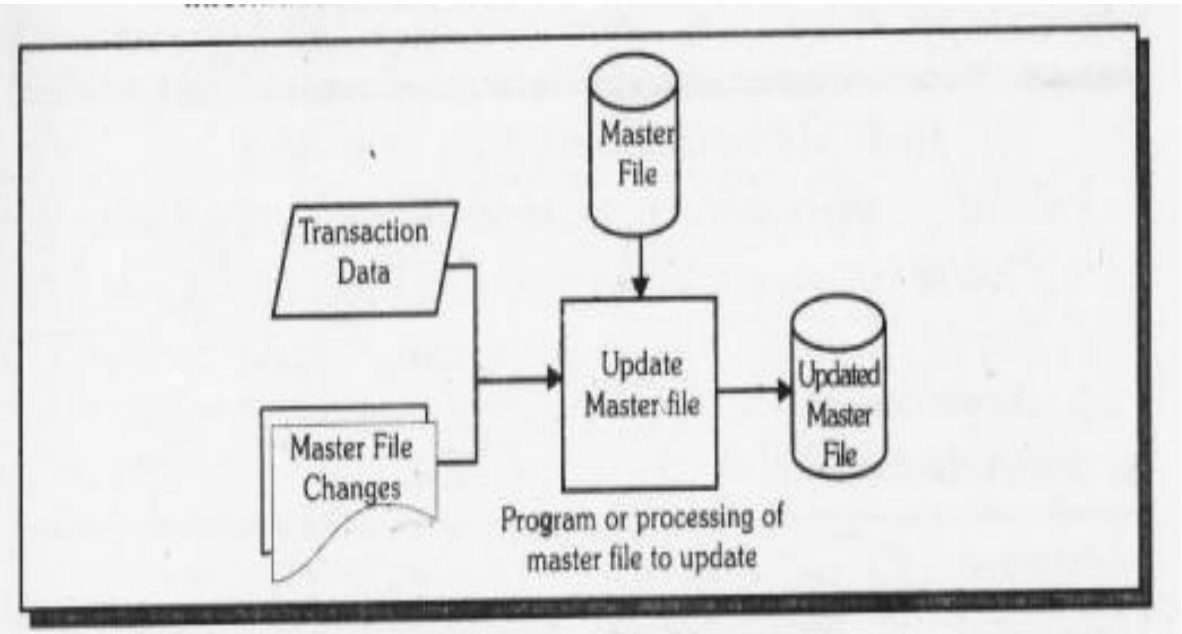
Performance of a transaction requires:

- To direct a transaction to takes place,
- To Report, confirm or explain its performance
- To communicate the transaction to those needing a record for the background information or reference.

- So, the old master file data is to be processed so as to make it an updated master file using the followings as input:
  * transaction data and
  * master file changes.

This is shown in the following figure(i.e.) about maintaining Master file.

Maintaining Master File:



Meaning of Master file:

Master file is a file which holds the latest data. It is subjected to frequent changes and updates.

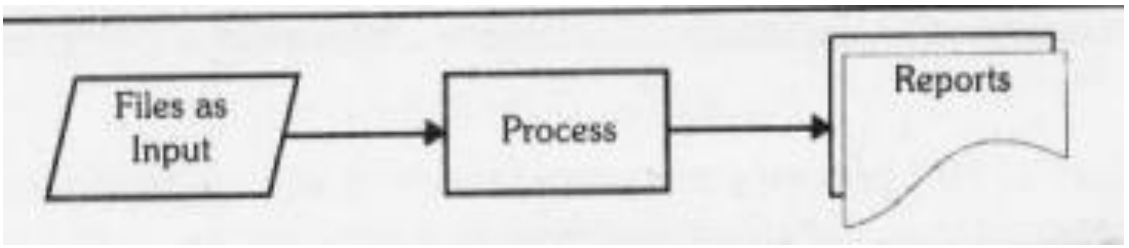
About the reports:

Reports are the significant products of an Information System(IS). Here, the reports produced are;

1. Scheduled reports(on a regular basis)
2. Adhoc reports(on an unscheduled basis)
3. Exception reports(a special report)

The following diagram shows about producing reports:

Producing reports:



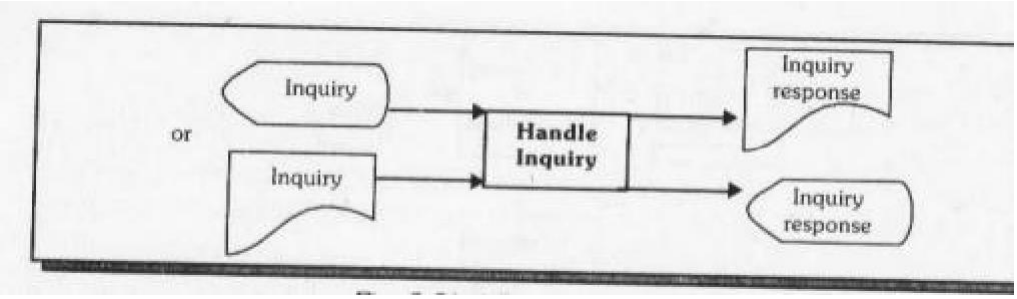
Users inquiries are processed to receive the responses. These may be regular inquiries with a present format or adhoc inquiries.

Inquiry: Inquiry is a request for information, from the storage or another system.

Inquiry response: Inquiry response is a reply, to the request for information(i.e.) inquiry.

The following diagram is for processing the inquiries:

Processing the inquiries:

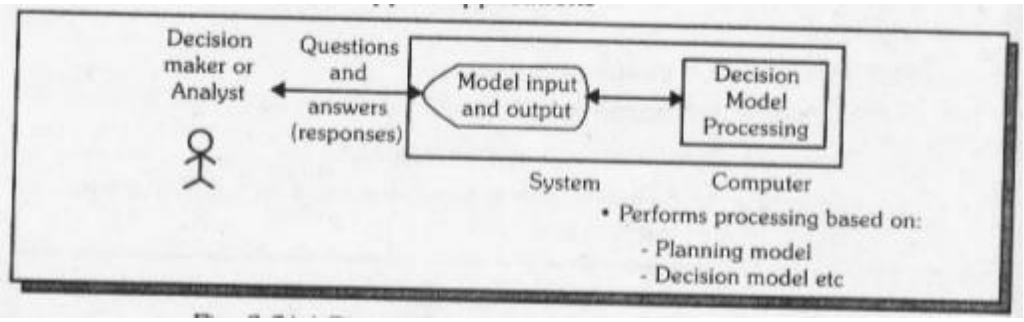


Information Systems(IS) contains the applications which are designed to support the systems for

- Planning,
- Analysis
- Decision making

The following diagram shows this:

- **Process interactive support applications:**

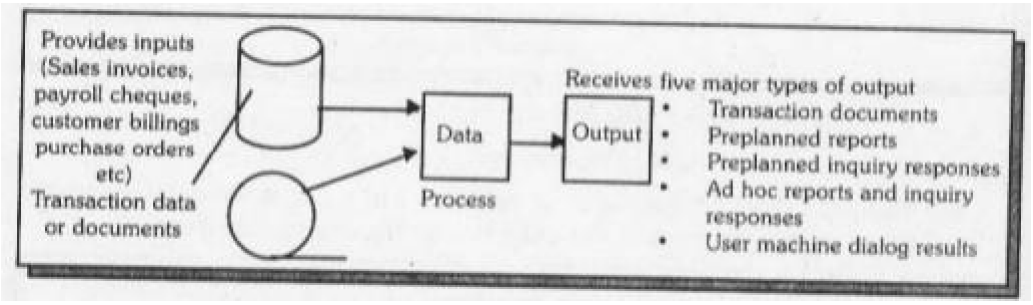


Interactive support is a support given to accept the inquiry and to provide the answer by the system.

(c) Outputs for the users:

The user of MIS provides inputs and receives the uotputs in five major types as shown below.

Outputs for the users:



So, these reports, inquiry responses and machine user dialogue results provides 4 types of information as follows:

- **Monitoring information:** This information confirm that the actions have been taken on the report status, on the financial or the other terms.
- **Problem finding information:** Here, information is presented in the format that promotes the identification of the problems.
- **Action information:** Here, the information presented with the action specified or implied.
- **Decision support:** The report, document, inquiry, result or the user machine dialog result is oriented in performing the planning, analysis and decision making.

Decision support services:

These are the services which assist the human in the decision making.

Preplanned reports:

These have a regular content and format, usualy run on a regularly scheduled basis. They describe the status or a condition at a point of time.

They summarised what has occured during a particular period such as a week, month, or year.

They present the results upto date and present the project upto the end of the period.

Preplanned inquiries - responses:

These are generally asociated with the limited output. Inquiries are handled online(i.e.) the inquiry is entered and the response is received immediately through terminals.

Exception reports:

Exception reports are those reports which are reproduced only when the exceptional conditions are arising, or, exception reports are those reports which are produced periodically and will contain those information about the exceptional conditions only.

In some cases, reports are automatically generated.

Examples:

(a) A report is required to be printed in advance, so as to state the names of the participants of a seminar and its location, where a minimum of 10 participants are not participating, is required 2 weeks prior to the start of that seminar. Such reports are called exceptional reports.

(b) A Credit manager is provided with a report which contains, only the information about those customers, who exceed their credit limits. So, such exceptional reporting promotes Management by Exception(MBE), instead of overwhelming the managers with a periodic detailed report.

Adhoc reports and inquiry responses:

Adhoc reports are the unique, unscheduled, situation specific and information reports. Adhoc reports occur at regular intervals and require data and analysis, whose format has not been pre planned.

User machine dialogue results: User machine dialogue differs from the reports or the inquiries. It is essentially a way, the user can interact with a model to arrive at an analysis or a solution.

Example:

Site planned models, capital investment analysis models, and portfolio mangement models.

(2) Management information support for Decision making:

Decision making:

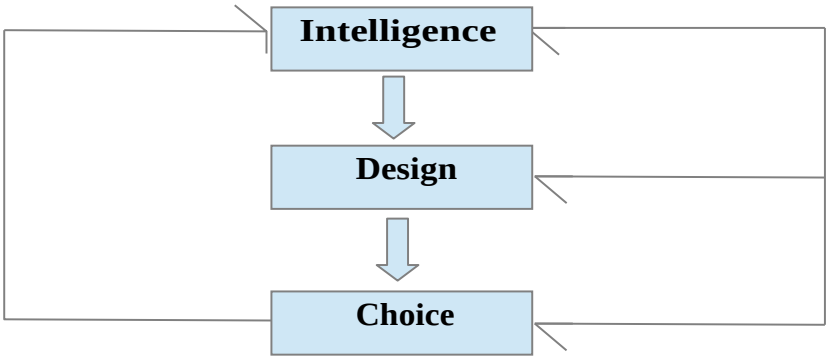
Decision making means to select a course of action from two or more alternatives. It is a determination to do something in a stated way and it breaks the deadlocks.

Information is the key resource for decision making. The information system is designed to meet the information needs in an organization. Decision making involves setting of premises about the future events. It is the information which makes the decision maker to do the right action and hence, the information system focuses on the organizational decision making. The following points show the phases of the decion making process.

Phases of decision making process:

- Intelligence,
- Design,
- Choice

They have been depicted in the diagram as follows:



Its brief explanation is as follows:

Phases of decision making process	**Explanation**
Intelligence	Searching the environment for the conditions calling for the decisions. Data inputs are obtained, processed, and examined for the clues, which may **identify the problems or the oppurtunities.**
Design	Inventing, developing and analysing the possible courses of action. **This involves the processes to understand the problem, to generate the solutions, and to test those solutions for feasibility.**
Choice	**Selecting an alternative course of action** from those available alternatives. Finally, a choice is made and implemented.

(a) Intelligence phase of Simon's model:

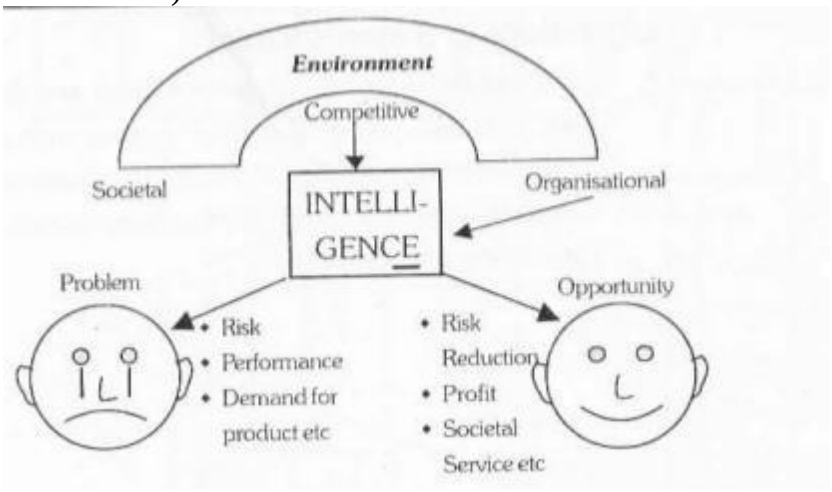
The problem finding activities related to the searching of that operating business environment, for the purpose of identifying those conditions which are calling for the decisions (searching the environment for the conditions calling for the decisions) are found out. Data inputs are obtained, processed, and examined for the clues, which may **identify the problems or the oppurtunities.** So, under this intelligence phase three environments are needed to be studied.

- Societal environment,
- Competitive environment, and
- Organisational environment.

The following diagram shows about the Intelligence Phase:

Intelligence Phase of Herbert Simon's Model :

- Support in understanding the problem,
- Support for generating the solutions by means of manipulating the model to develop insights, creating/using the database retrieval system(so as to help in generating the solution)
- Support for testing the feasibility of the solutions(analyse in terms of the three environments it affects)



(b) Design phase of Simon's model:

Design phase involves the inventing, developing and analysing the possible courses of action. **This involves the processes to understand the problem, to generate the solutions, and to test those solutions for feasibility.**

Iterative steps are followed:

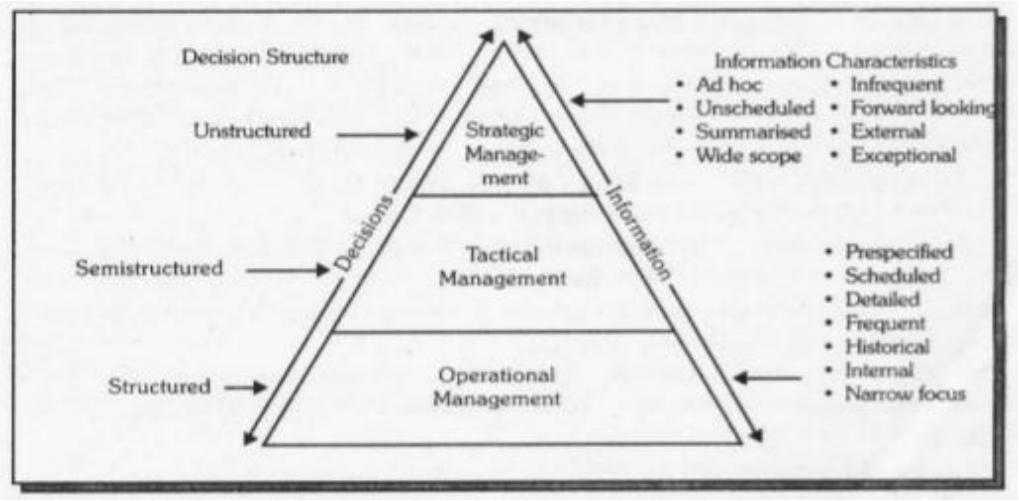
(3) Management Information System Structure based on the Management Activities:

The three levels in the organization are

- Strategic management
- Tactical management, and
- Opeartional management.

Information requirements and their characteristics vary with the level of the management activity supported. The following diagram shows about the –Information characteristics at different levels‖.

The information characteristics at different levels of decision-makers:



On the basis of its intrinsic nature and organizational use, information is classified as

(a) Planning information

- Strategic information,
- Tactical information, and
- Operational information

(b) Control information

Its brief explanation is as follows:

(a) Planning information:

The strategic level of management is mostly concerned with this –planning information‖, and its requirement for the control information is very limited, as most of the control function is excercised at the lower levels.

The planning information is further classified depending upon the user, who uses it and also based upon its impact on its usage, and they as follows:

(i) Strategic information:

Strategic information pertains mostly to the organization as a whole, and the information about its various external environments like population changes, natural resources, new technologies, new products, competitors, political changes, legal and economic changes, etc.

Top management needs strategic information for its long term planning which affects the entire organization, or, a significant part of the organization over a fairly longer period of time.

(ii) Tactical information:

Tactical information is required for the short term planning by the middle level managers.

Examples of tactical information:

- Sales analysts and forecasts,
- Cash flow projections, etc.

Tactical information arises mostly from the current internal activities and some arises externally like the competitor information. Its impact is short-term and it affects only a department.

(iii) Operational information:

Operational information relates to a very few period, which may be a few hours to few weeks. It may be about

- Current stock levels of inventory,
- Outstanding orders from the customers,
- Work schedule for the night shifts, etc.

This information can be generated from the current activity data arising from the internal sources. It is of immediate use and is of interested only to a few people. Such information covers only a limited area of operation of the organization, for example, a shift of production.

(b) Control information:

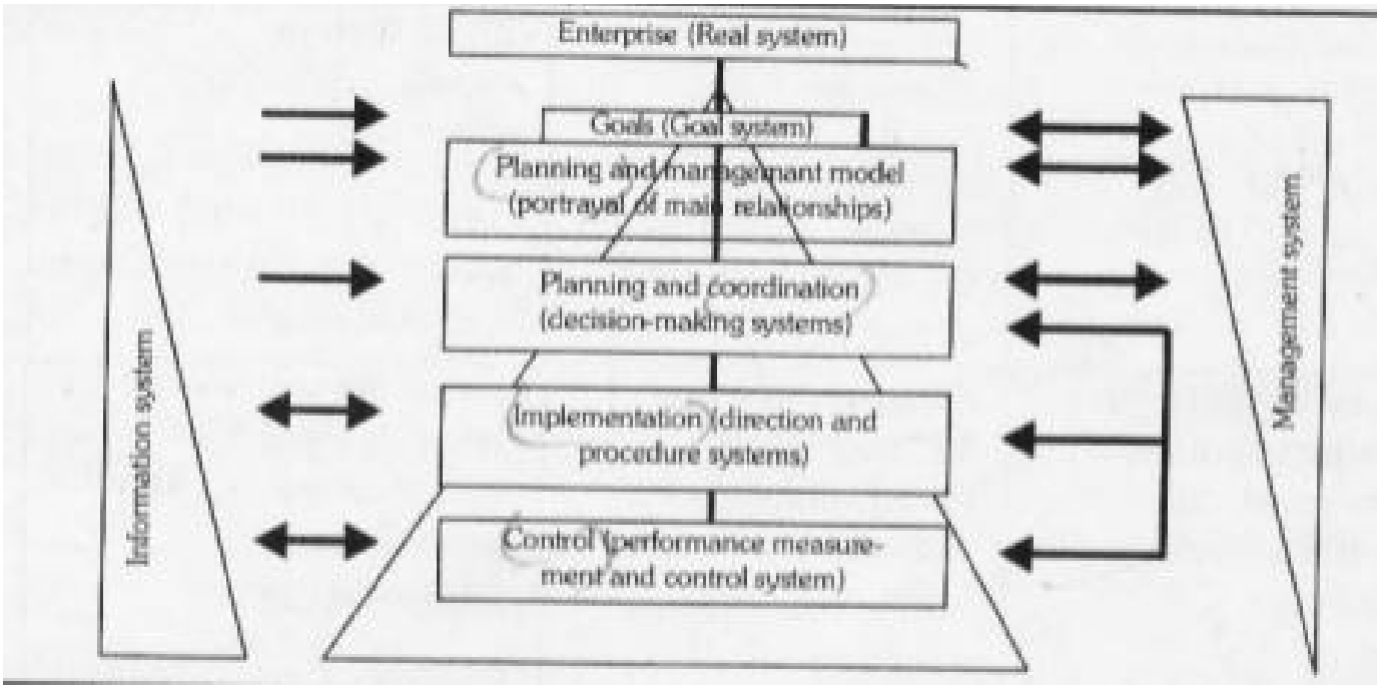
Control information relates to a short time span, say a shift to a few months at the most. The operational level of management requires a large amount of control information, and a small amount of planing information.

Differences between Planning information and Control information:

Planning information	Control information
(1) Planning information cuts across all the organizational divisions and provides information about a few divisions or the entire organization.	Control information relates to the functions of divisions or such small area of responsibility.
(2) Planning information covers a wider time span.	Control information relates to a short time span, say, a shift, to a few months at the most.
(3) Trends and patterns are more important in the planning information.	Finer details are more important in the control information.
(4) In case of the planning information, the purpose is to guide the planning by projecting the trends and patterns.	In case of the control information, the purpose is to invite the managerial interventions so as to correct the deviations.

The following diagram shows about ―the information, its planning and control in case of the Management system‖.

The information, planning and control in the Management system:



Hierarchy of Management Activity:

The three levels of management activity are as follows:

Its brief explanation is as follows:

(a) Strategic planning: Strategic planning is the process of deciding on

(a) the objectives of the organization

(b) the resources used to attain these objectives, and

(c) the policies that are to govern the acquisition use and disposition of these resources.

Activities:

Definition of goals, policies and general guidelines charting course for the organization, determination of the organizational objectives, choice of the business direction, market strategy, product mix, etc.

(b) **Management control:** Management control is the process by which the managers assure that these resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives.

Activities:

Acquisition of resources, acquisition tactics, plant location, new products establishment and monitoring of budgets, structuring of work, training of personnel, etc.

(c) **Operational control:** Operational control is the process of assuring that the specific tasks are carried out efficiently and effectively.

Activities:

Effective and efficient use of the existing facilities and resources to carry out the activities within the budget constraints, etc.

(i) Information systems for strategic planning:

Strategic Information System(SIS):

Strategic Information System(SIS) is a computer based information system which provides a firm with the application of IT to a firm's competitive products and services to help to achieve their strategic advantage over its competitors in the marketplace.

Example:

- Online stock trading,
- Shipment tracking, etc.

Also, information system promotes the business inovation, improve the operational efficiency and build strategic information resources for a firm. Strategic planning deals with the development of an organization's mission, goals, policies and strategies so as to develop its Objectives.

Corporations may begin the process by developing a shared vision using a variety of techniques, including team building, scenario modelling, and consensus creating excercises. Companies adopting this strategic IS planning have four main objectives as follows:

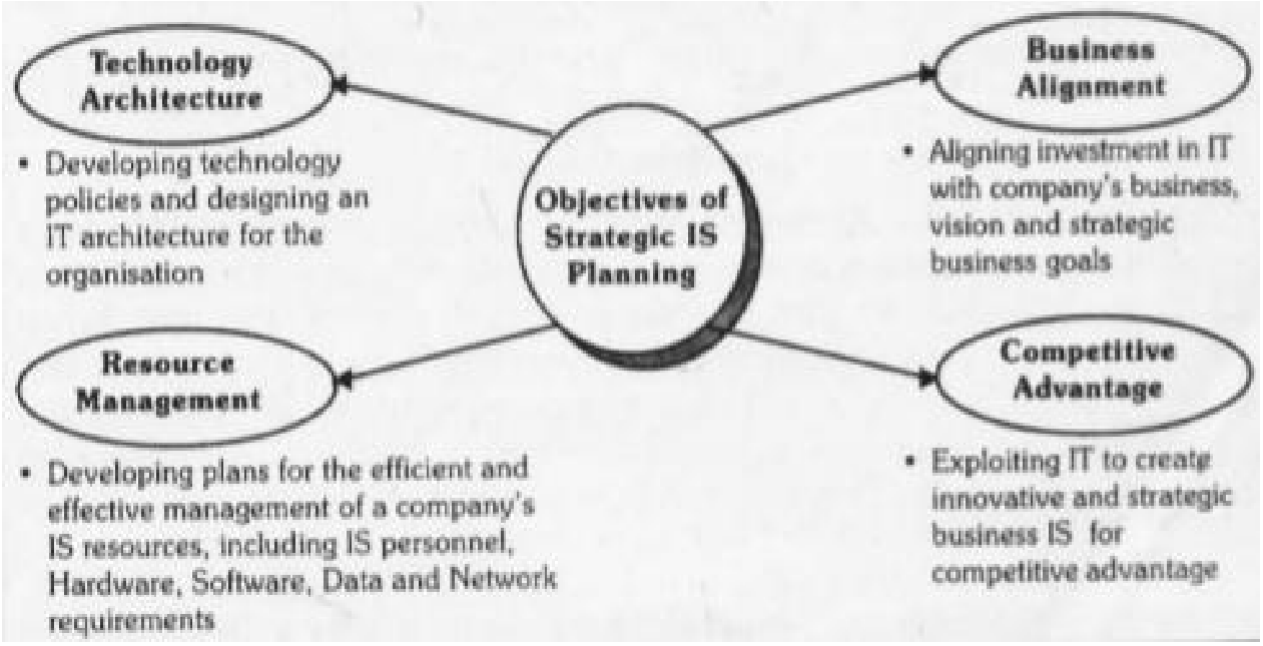
Objectives of Strategic IS Planning:

Strategic planning activities do not have to occur on a periodic regular cycle as do the management control activities.

Data requirements for the strategic planning are generally ‒processed and summarised data from a variety of sources‖. There is also the need for the considerable external data.

SIS should be distinguished from the ‒strategic level systems for the senior managers‖ which focus on the long term, decision making.

So, SIS are more far reaching and deep routed, than the other kinds of systems.



(ii) Information systems for tactical planning and management control:

Management control information is required by(whom?) the managers of the various departments, profit centres, etc. for the purposes of

- Measuring the performances,
- Decide on the control activites,
- Formulate new decision rules to be applied by tha operating personnel,
- Allocate resources.

Summary information is required and processed, so that the trends may be observed, reasons for the performance variances may be understood and the solutions and the solutions for that may be suggested.

Information system for the management control needs the following information like,

- Planned performance(standard, expected, budgeted, etc.)
- Variance from the planned performance
- Reasons for the variance
- Further analysis for the possible decisions inorder to make improvements or for the possible courses of action.

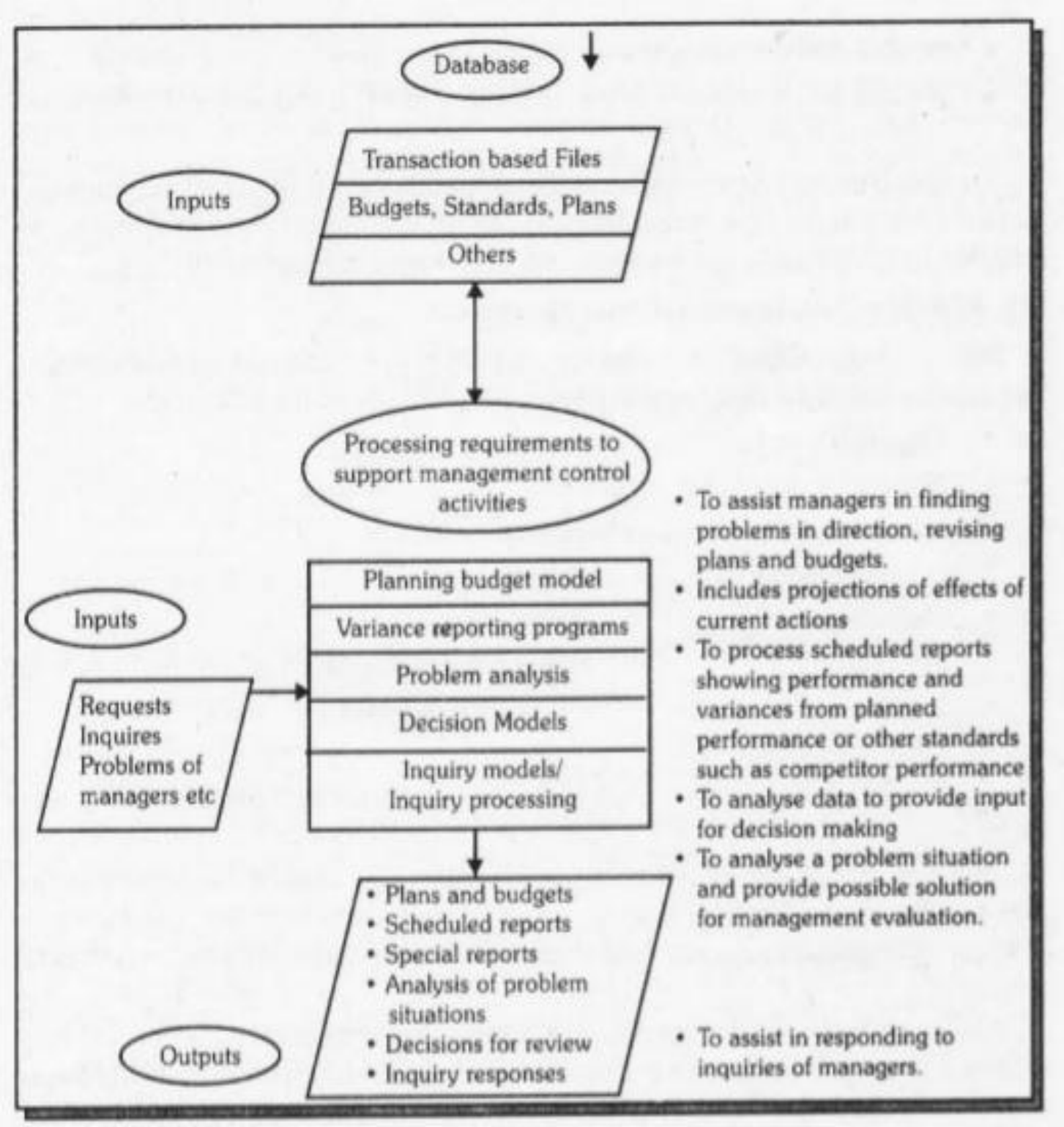
This level is called tactical planning, because, it involves the design of the tactics, the setting up of objectives, and the development of the procedures, rules, schedules and budgets.

Hence, the database needed for the mangement control has 2 major elements as follows:

- The databse provided by the operations
- The plans, standards, budgets, etc. which define the mangement expectations about the performances.

These may include some external data for comparison with the other industries and the cost indices. The following diagram shows the management control inputs, processing requirements and outputs.

The management control inputs, processing requirements and outputs:



(ii) Information systems for Operation control:

(c) **Operational control:** Operational control is the process of assuring that the specific tasks are carried out efficiently and effectively.

Activities:

Effective and efficient use of the existing facilities and resources to carry out the activities within the budget constraints, etc.

It makes use of pre-established procedures, and decision rules. It may be noted that a large percentage of decisions are programmable decisions, and the procedures folowed by them are quite stable.

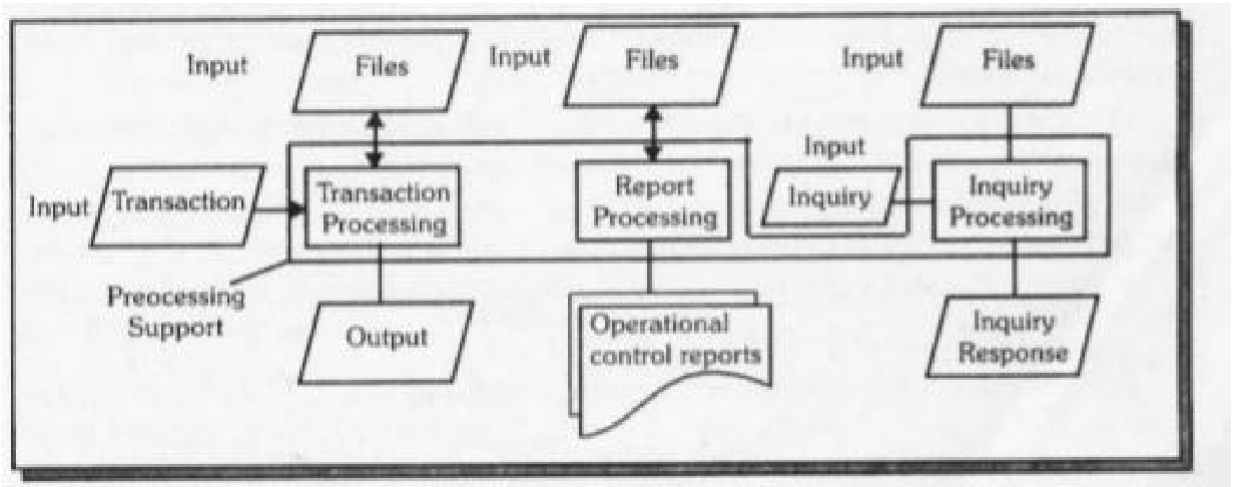
The implementation may involve anyone of the following:

- Transaction processing,
- Operational control reports,
- Inquiry processing.

This will give the

- Pre-specified decision rules
- Provides output describing the decision which will be taken(unless the user who is responsible overrides it).

The database for the operational control and operational decision making contains primarily the internal data, which is generated by the transactions. It is important to interpret those



data which are recorded from those operations, since the sequence of processing is very significant.

(3) Management Information System Structure based on the Organizational Functions:

MIS is introduced as a broad concept referring to as a –Federation of subsystems‖. Two approaches to define the subsystems of MIS are as follows:

- Organizational functions subsystems,
- Managerial activities subsystems.

Its brief explanation is as follows:

(a) Organizational functions subsystems:

The major subsystems of the organizational functions are as follows:

* Marketing,
* Manufacturing,
* Personnel,
* Finance and Accounting,
* Logistics(organization of supplies and services)
* Information processing, etc.

MIS may be viewed as a –Federation of Information Systems‖ - one for each major organizational function. There may be common support systems used by more than one sub system, but each functional subsystem is unique in its procedures, programmes, models, etc.

Organizational functions are somewhat separable interms of activities and are defined managerially as separate responsibilities. Marketing information systems gather data about

- marketing and sales like
  - Sales forecasting,
  - Sales planning,
  - Customer analysis,
  - Sales analysis, etc.
- stock,
- distribution costs,
- promotion costs, etc.

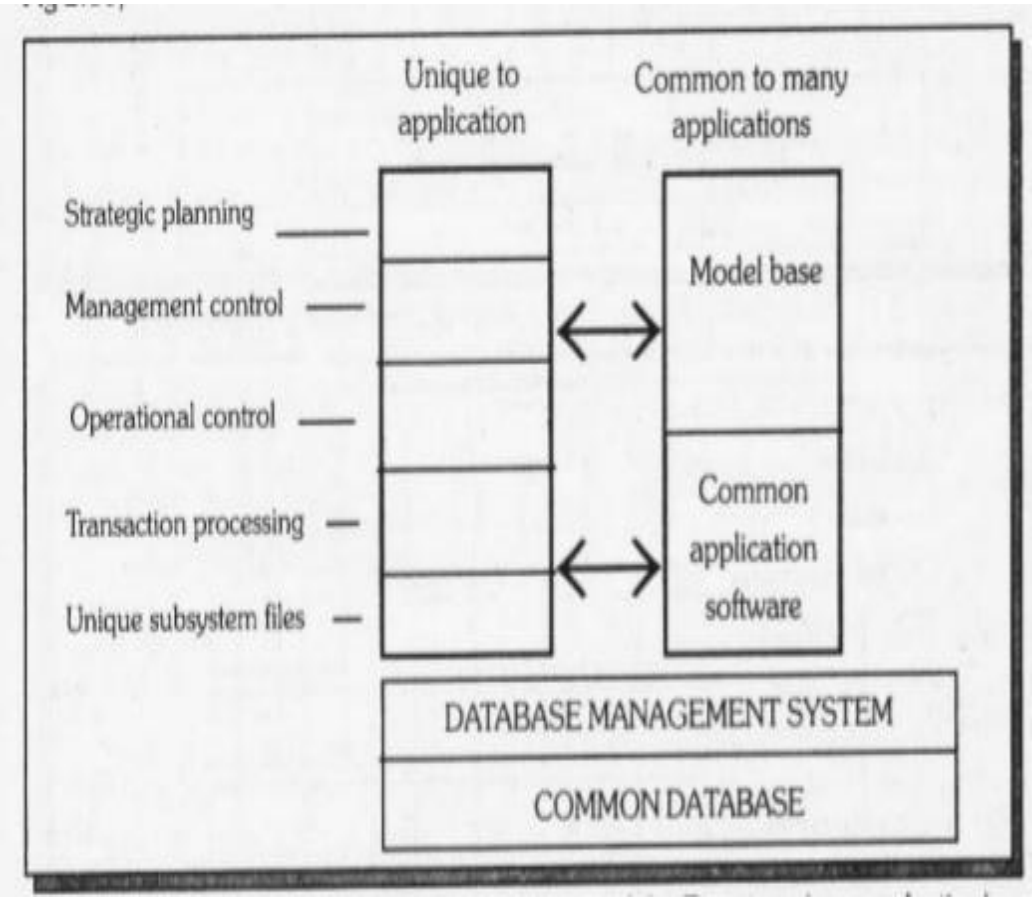
Those data will meet the information requirements of the marketing mangers primarily, and, provides access for the other managers also to its databases.

Example: This sales and inventory information used by the marketing subsystem is supplied through the logistics sub system, and the same data is used by the manufacturing subsystem for the production planning and scheduling.

Again, the production information system tracks the production data, generates the production related reports, and provides them to the target users. The database shown in the following 2 figures is the primary means of integration of the various subsystems like

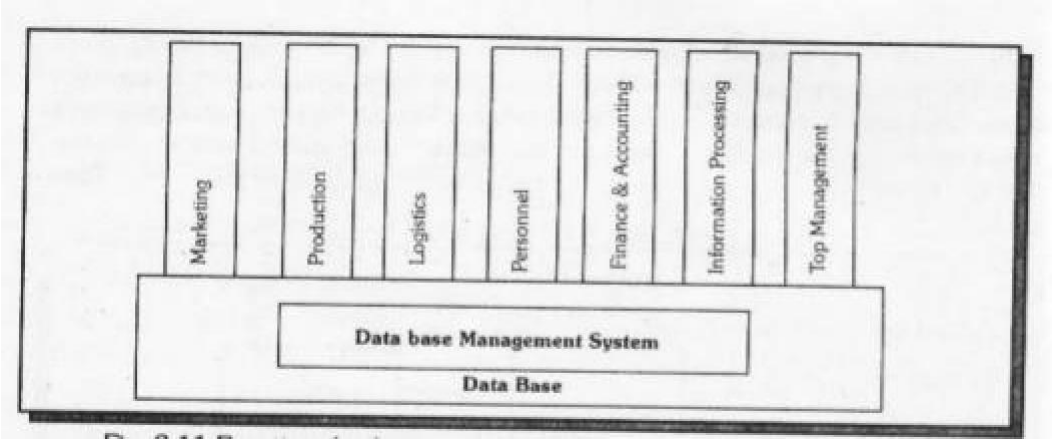
1. Transaction processing,
2. Operational control information system support,
3. Managerial control information system support,
4. Strategic planning information system support

Information subsystem for one of the organizational functions(say production):



Here, this diagram shows that, the data items which is stored or updated by one subsystem is available to the other subsystems. The following diagram shows the –Functional subsystem in the MIS of a manufacturing concern‖ .

Functional subsystem in the MIS of a manufacturing concern



Each of the functional subsystem of the information system has some unique data files, which are used only by that system. There are also some files which need to be accessed by more than one application and need to be available for the general retrieval.

All these files are arranged into a general database managed by a Database Management System. Each subsystem has linkage to the common applications, which serve multiple functions.

There are also many analytical and decision models which can be used by many applications. All these form the model base for an MIS.

(b) Managerial activities subsystems:

The second approach to understand the structure of an Information System is in terms of the subsystems which performs the various managerial activities, and will be useful for more than one organisation function subsystem like,

- Strategic planning,
- Management control,

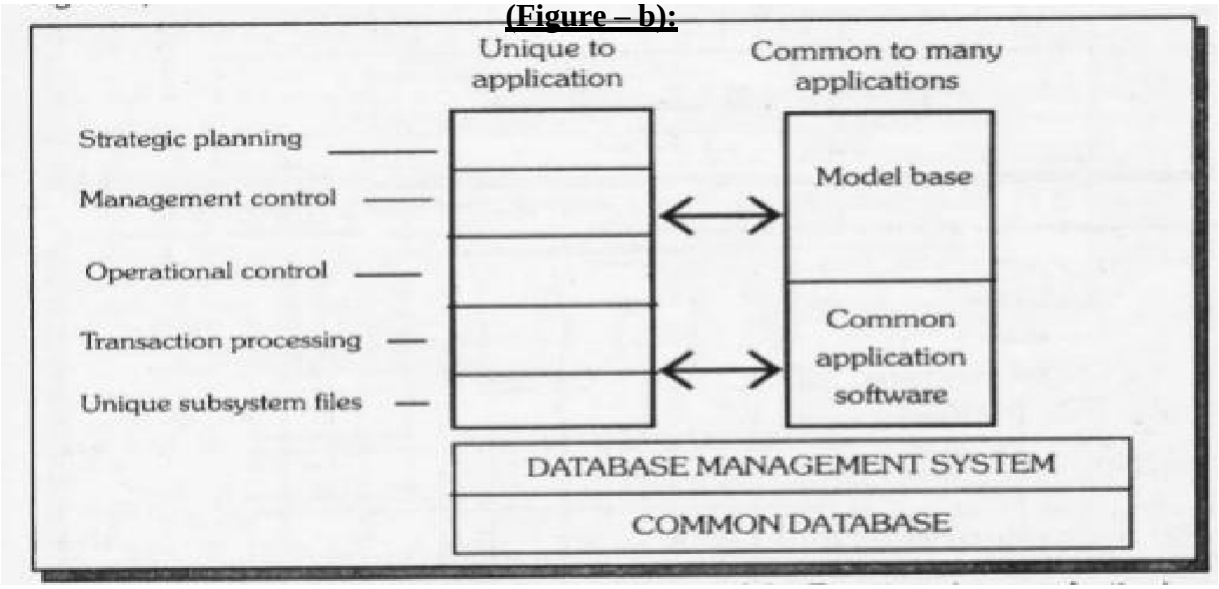
- Operational control,
- Tranasction processing.

The above activities subsystems corresponds to the various levels of the management. The relation of all the activities to the functional subsystems are shown in the following figures a, b and c.

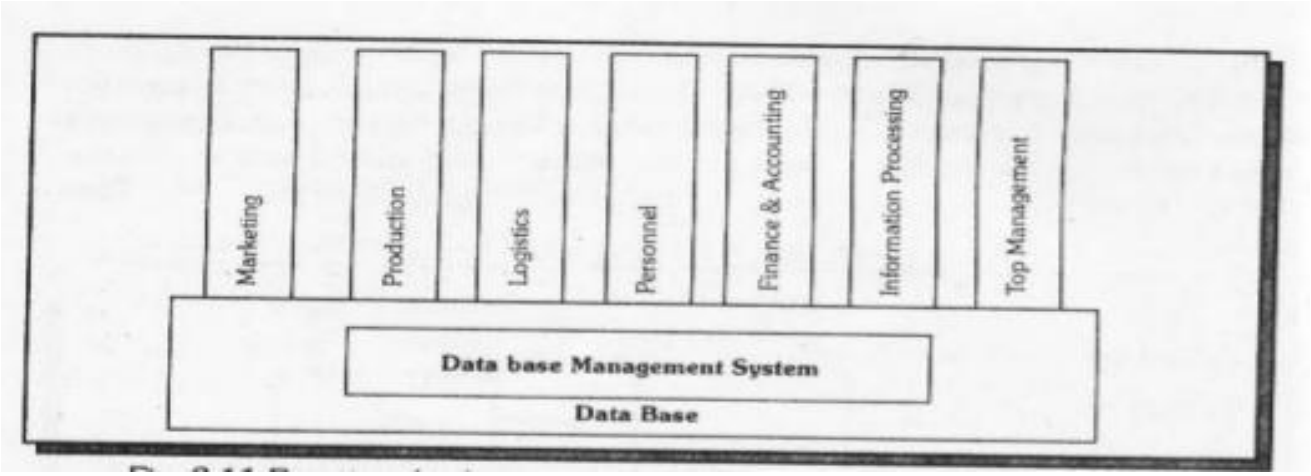
Information subsystem for one of the organizational functions(say production):

(Figure – a):

(Figure – b):



Functional subsystem in the MIS of a manufacturing concern



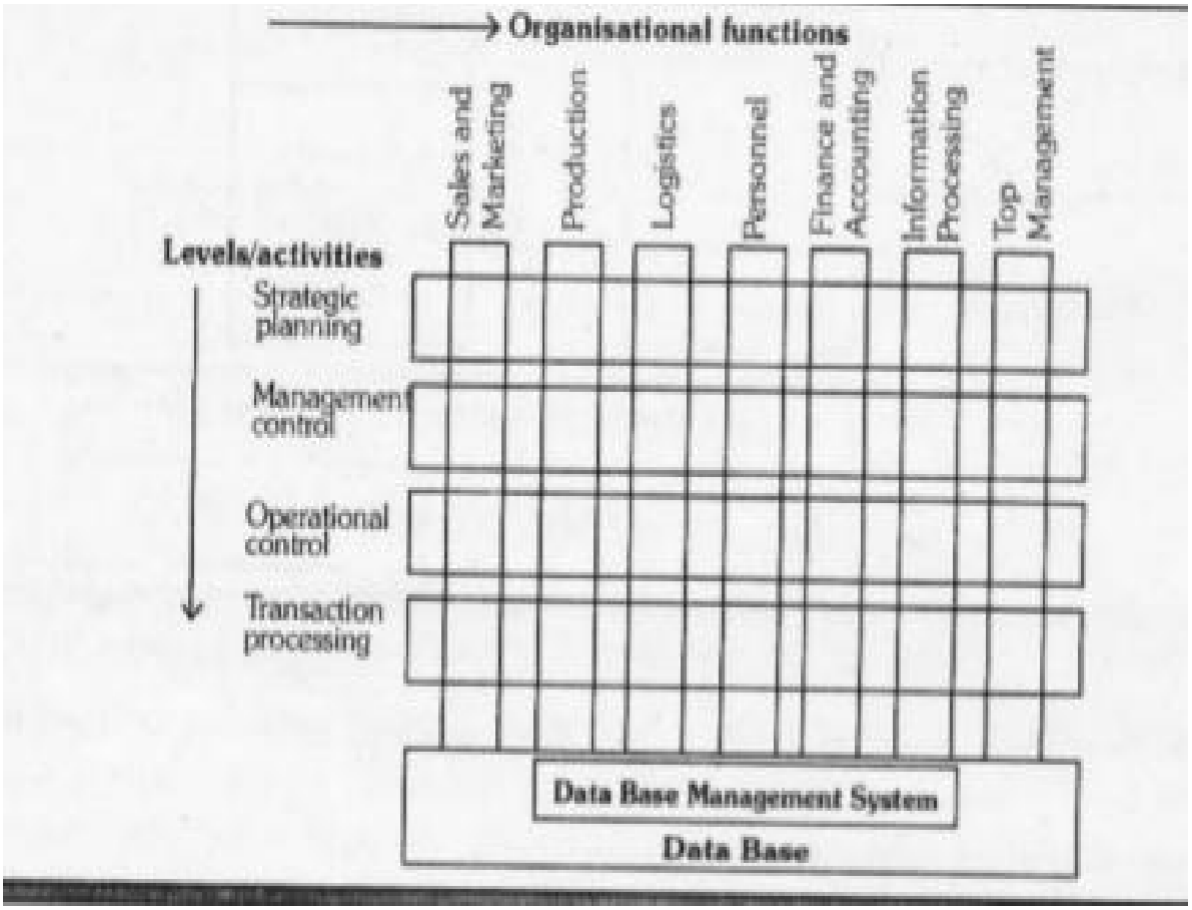
Relation of activities to the functional subsystems:

Figure-(c):

MIS is essentially a federation of information systems, which are designed to support the functional subsystem of an organisation. Each functional subsystem requires the applications to perform all the information processing related to the function, although, this may involve calling upon a database, a model base and some other computer programs, which are common to all the functional subsystems.

Within each functional subsystem, there will be some applications for

- Transaction processing,
- Operational control,
- Management control, and
- Strategic control.



Synthesis of Management Information Structure:

Here, synthesis refers to the mixing of several things to make another, whole, new thing.

MIS structure is essentially a conceptual framework which allows us to describe about an existing information system or a planned information system.

The MIS structure has been described in terms of

- Operating elements,
- Support for decision making,
- Management activity, and
- Organisational functions.

These will now be synthesised into a MIS structure. MIS structure has 2 categories, namely,

(1) Physical structure, and

(2) Conceptual structure.

Its brief explanation is as follows:

(1) Physical structure of organisational MIS:

Physical structure of organisational MIS defines the way an MIS is implemented.

The Physical structure of organisational MIS would be identical to the conceptual structure, if all the applications consisted of completely separate programs, which are used by only one function. But, however, this is not the case. Substantial economies can be achieved from,

- Integrated processing, and
- Use of common modules.

Integrated processing is achieved by designing several related applications as a simple system inorder to simplify the interconnections and reduce the duplication of input. Consider the following example.

Example: Let us consider **an order entry system.** The recording of an order initiates a sequence of processing, each step using new data, but also much of the data from the prior processing.The following table shows the related applications as single system.

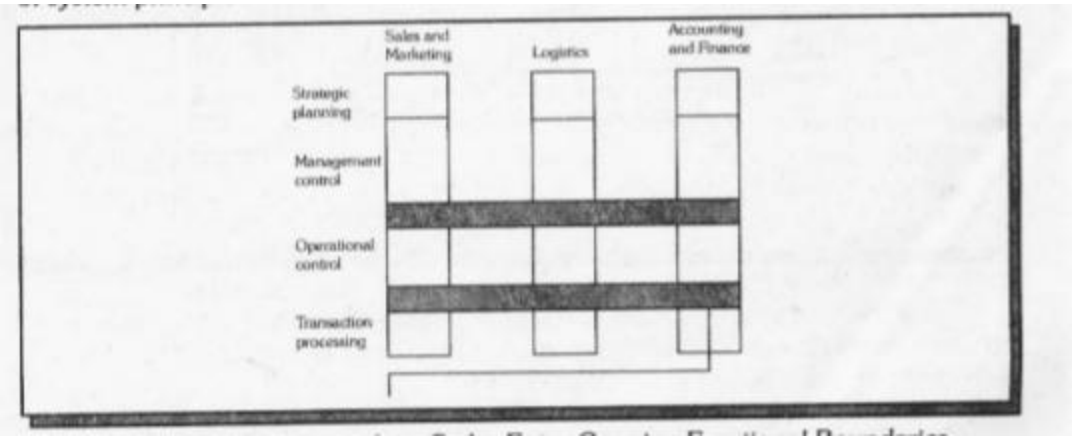
Table showing the related applications as single system:

STEPS	NEW DATA ENTERED	DOCUMENTS PRODUCED
(1)Order entry	Sales representative identification, Customer identification, Items ordered, Quantity of each item	Order acknowledgement, Credit exception notice, Order register,
(2)Shipping invoicing	Actual quantity shipped, Frieght cost	Shipping document, Invoice register, Sales journal, Back order register
(3)Collection	Amounts received, Returns and allowances.	Customer statements, Returns and allowances register, Cash receipts
(4)Analysis		Inventory status, Sales by representative, district, customer or other category.

A large number of documents and reports are prepared from ―the initial entry of the order‖ plus ―the later entry of the actual quantity shipped, frieght, amounts received on account and returns, and allowances‖. The assumption is made that the customer name, address and credit status, and plus the price of each item are contained the customer's files and

billing files. The documents and reports are not associated with a single function but with many departments like sales and marketing, logistics, accounting and finance function. An integrated order system crosses the functional boundaries, as shown in the following figure.

Application such as Order Enter crossing the functional boundaries:



Use of common modules:

Module is the

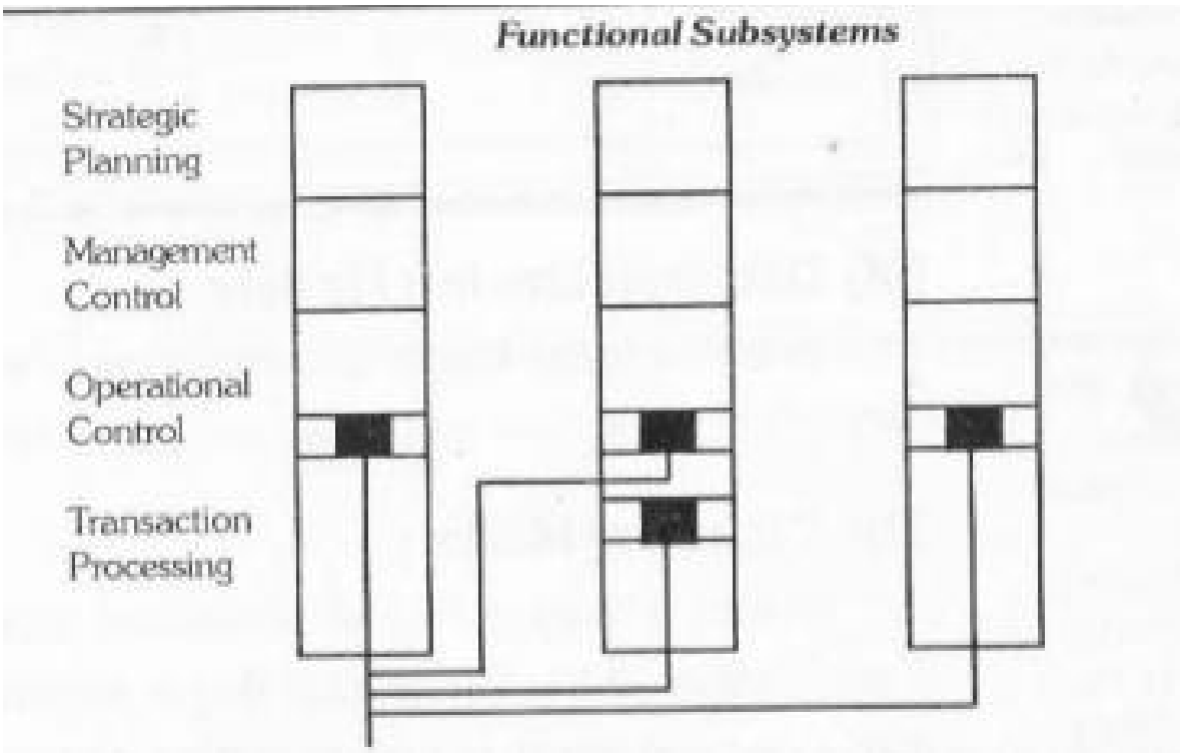
small sets of processing instructions. Modules can be written and tested separately, allowing more efficient maintenance by the identification of the boundaries of the modules which are being changed.

Modularity is the design of an information system as a number of small modules.

Some modules are used only once in a single application, others are used in a large number of applications.

The use of modules is thus an application of system principles. The following diagram shows about the –Use of common modules in the Physical Structure of MIS‖:

Use of common modules in the Physical Structure of MIS:



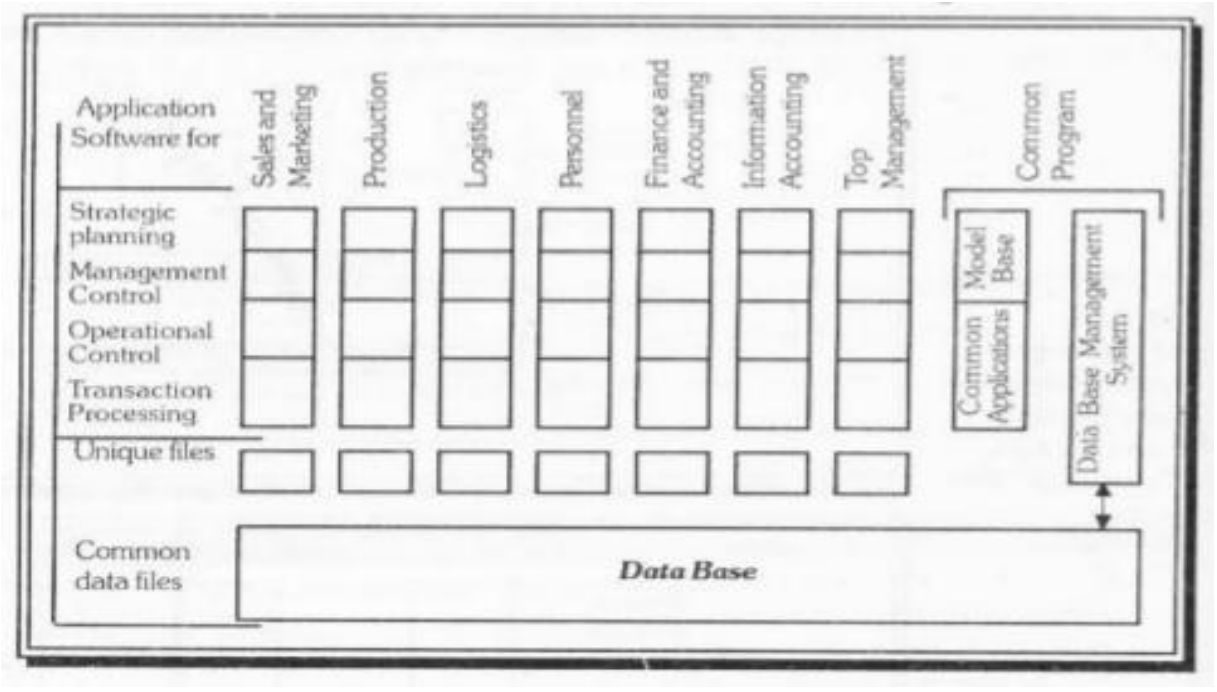
(2) Conceptual structure of organisational MIS:

The Conceptual structure of organisational MIS is defined as a federation of functional subsystems, each of which is divided into four major information processing components like

- transaction processing,
- operational control information system support,
- management control information system support, and
- strategic planning information system support.

Each of the functional subsystem of the Information System(IS) has some unique data files, which are used only by that sub system. There are also files which need to be available for the general retrieval. These files are organised into a general database managed by a database management system. There is also a common software in addition to the application programs written specially to each sub system. Each sub system has linkage to the common applications which serve miltiple functions. There also many analytical and decision models that can be used by many applications. These form the model base for MIS. The conceptual structure of organisational MIS is shown in the following diagram:

The conceptual structure of organisational MIS:



Decision making models:

Every manager has to take decisions at sometime and , at sometimes he is the model of decision also he is a model of decision making himself. Three types of decision making models are there.

1. The Classical model,
2. The Administrative model,
3. The Herbert Simon model.

Its brief explanation is as follows:

(1) The Classical model:

In this classical model, when a manager is confronted(to bring face to face) with a decision making situation, **he would collect all the information which is required for that activity, and, he would take a decision which would be in the best interests of the organisation.**

(2) The Administrative model:

In this model, **the manager is more concerned about himself**. To solve a decision making situation, the manager would collect **whatever information is available**,(and not all the information) and finally takes a decision, which may **not** be to suit the interests of the organisation, **but would certainly be in his interest.** Expediency(advantageous) and oppurtunisms are involved here.

(3) The Herbert Simon model:

In this Herbert Simon model three inter-related phases namely

- Intelligence phase,
- Design phase, and
- Choice phase

have been explained as follows:

Phases of decision making process	**Explanation**
Intelligence	Searching the environment for the conditions calling for the decisions. Data inputs are obtained, processed, and examined for the clues, which may **identify the problems or the oppurtunities.**
Design	Inventing, developing and analysing the possible courses of action. **This involves the processes to understand the problem, to generate the solutions, and to test those solutions for feasibility.**
Choice	**Selecting an alternative course of action** from those available alternatives. Finally, a choice is made and implemented.

This has been already discussed.

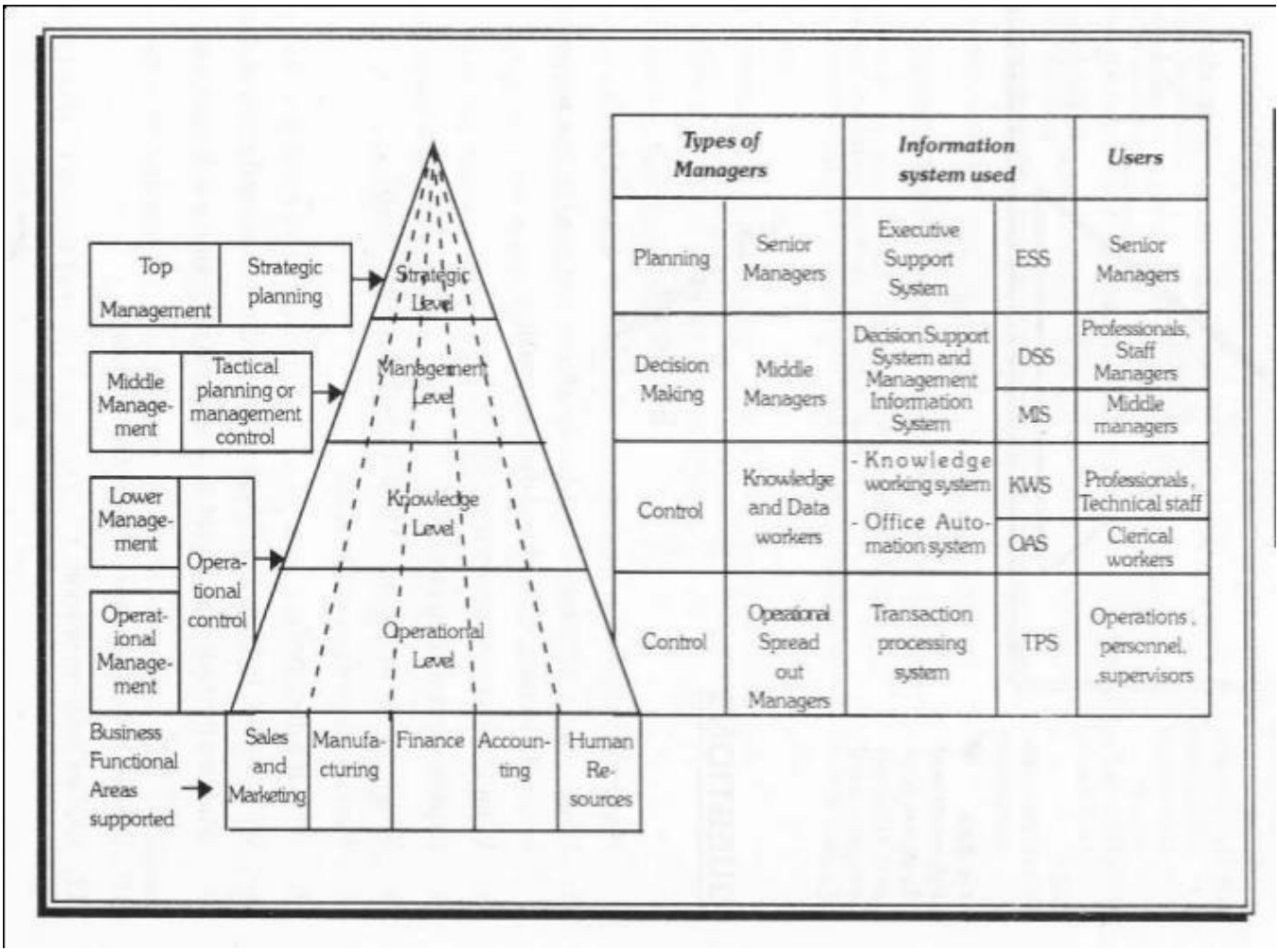
Limitations of Herbert Simon's Model:

It does not talk about the implementation and feedback aspects. It ends at the chice phase. The other aspects like communication and the implementation of design and follow up/feedback of the results of the decision under the decision making process and this has been suggested by the other experts like Rubenstein and Hebertson.

SUPPORT SYSTEMS FOR MANAGEMENT ACTIVITIES LIKE PLANNING, CONTROL AND DECISION MAKING:

The following figure shows about the specific types of information systems that correspond to each organisational level and the management activities such as planning, control and decision making:

Types of Information system at different levels:



The followings figure shows the specific types of information systems that correspond to each organisational level and management activities like planning, control and decision- making.

Informational system to support Different Organisational Levels:

IMPORTANT QUESTIONS TAKEN FROM THE VARIOUS QUESTION PAPERS:

Section – A:

1) What is Batch processing system?
2) What is meant by system approach?
3) What is meant by Open system?
4) What is meant by closed System?
5) What are programmable decision?
6) What are non-programmable decision?
7) What is MIS planning and implementation

Section – B:

1) Explain about the various types of decisions.
2) Explain the structure of MIS based upon management activities.
3) Explain Herbert Simon's model of decision making.
4) Differentiate between Batch processing and real time processing.

Section – C:

1) Explain about systems approach to problem solving
2) Write about manual information system and computer based information system.
3) Explain the structure of MIS based upon the operating elements of an IS.
4) Explain the structure of MIS based upon decision support for decision making.

UNIT – 3:

TECHNICAL FOUNDATIONS OF IS:

INTRODUCTION:

The word computer is derived from the word –compute‖. Compute means –to calculate‖.

Computer:

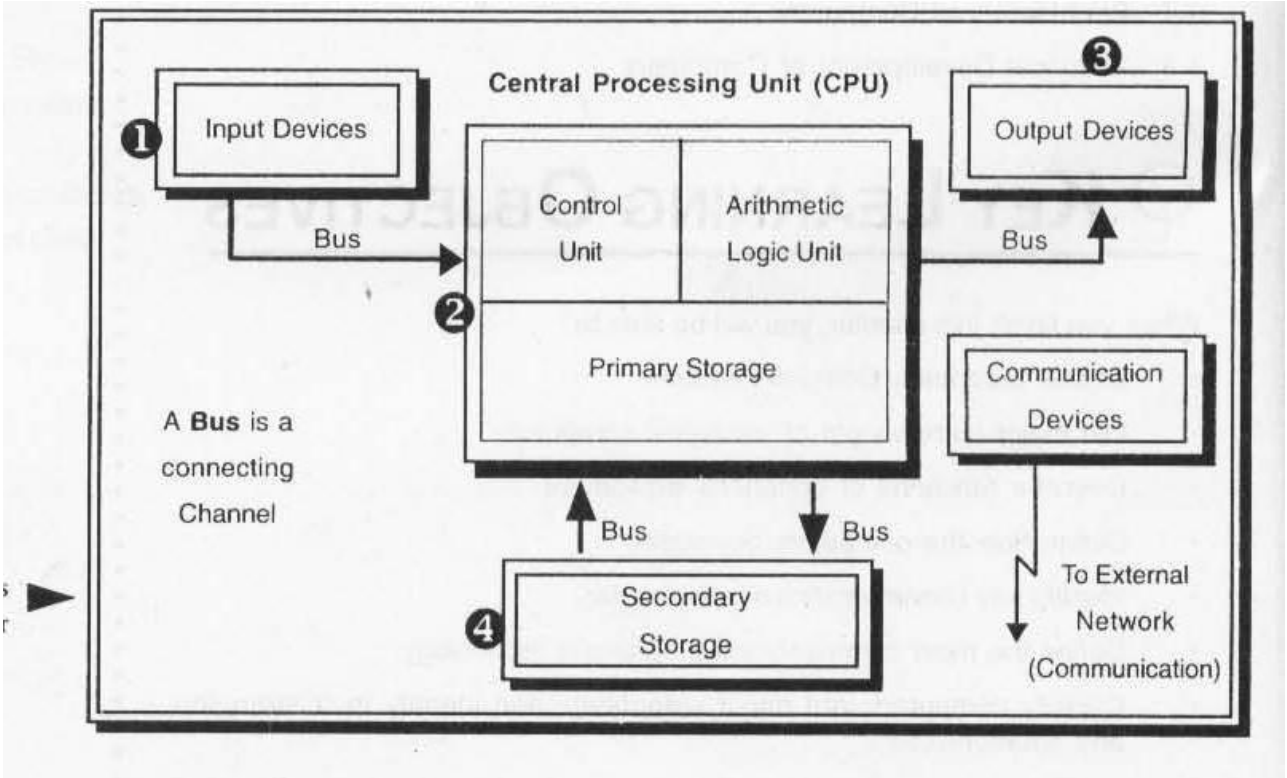
A Computer is an electronic device capable of storing and manipulating data and instructions.

Definition:

The Oxford Dictionary defines computer as –an electronic apparatus for making calaculations or controlling operations that are expressible in numerical or logical terms‖.

The following diagram shows about the –computer system concept‖:

The Computer System concept:



Computer is a system of hardware components and functions.

Input devices	*Central processing unit*		*Out put devices*	*Primary Storage Devices*	*Secondary Storage Devices*
	Control	*Arithmetic*			
For Entering Data and instructions into the CPU	Interprets instructions and directs processing	Performs arithmetic operations and makes comparisons	Communicate and record information	Stores data and program instructions during processing	Stores data and programs for processing
• Keyboard • Mouse • Touch Screen • Optical Scanner • Voice Recog-nition etc.			• Visual Display unit • Printer • Audio Response devices etc.	Also known as Memory	• Magnetize Disk • Tape units • Optical Disk etc.

COMPUTER HARDWARE:

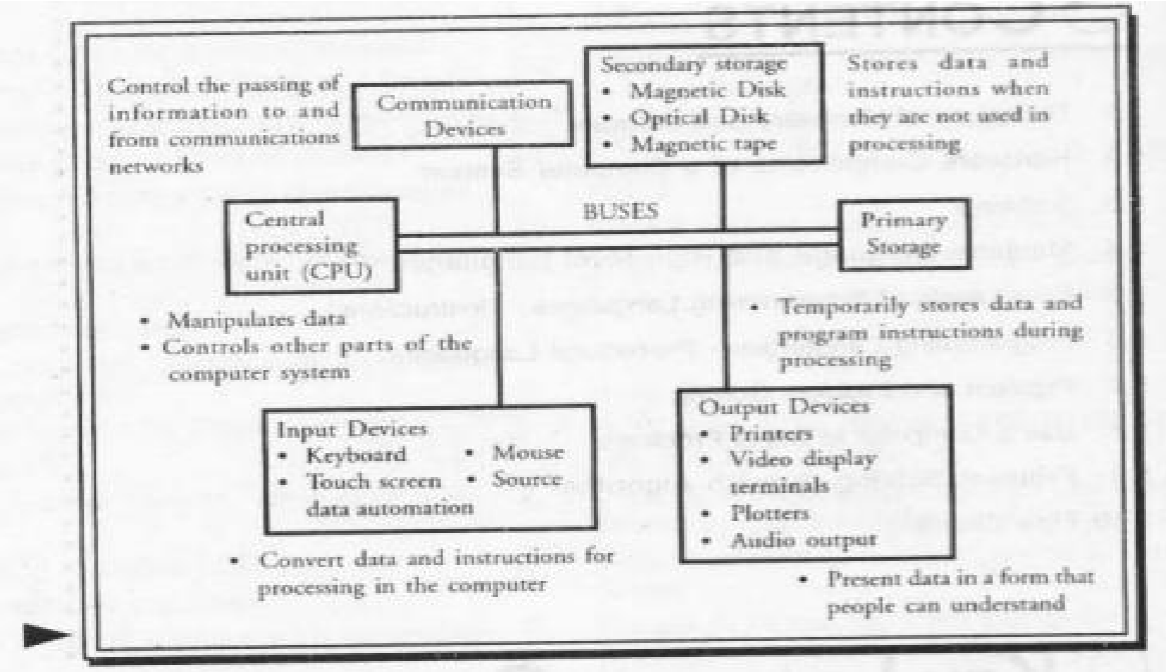
Computer Hardware is a physical equipment used for input, processing and output activity in an information system.

All the parts and peripherals of the computer system, or parts which you can see, touch and feel are termed as hardware computer.

Example: Keyboard, mouse, monitor , CPU , Network Interface Card(NIC).

The following diagram shows about the hardware components of a computer system:

The hardware components of a computer system:



Computer hardware has the following components:

1. Input Devices
2. Central Processing Unit(CPU)
3. Primary Storage
4. Secondary Storage
5. Communication Devices
6. Output Devices

Its brief explanation is as follows:

(1) Input Devices:

An input device is a piece of hardware that is used to enter the data into a computer. Input devices are usually categorised as manual and automatic. Examples of manual input devices are keyboard, mouse, touchpad, joystick, touch screen, graphics tablet, scanner, digital camera, microphone, etc. Examples of automatic input devices are barcode readers, Optical mark reader(OMR), Magnetic Ink Character Recognition(MICR), Optical Character Recognition(OCR), Magnetic stripe readers, sensors, biometric devices, etc. They convert data into an electronic form for data entry or through a telecommunications nework, into a computer system.

(2) Central Processing Unit(CPU):

Central Processing Unit(CPU) is the main processing component of a computer system. Conceptually, the circuitary of a CPU can be subdivided into 2 major subunits, namely, the arithmetic logic unit (ALU) and control unit(CU).

Arithmetic Logic Unit (ALU): The electronic circuits, known as registers, of the ALU performs the arithmetic and logic functions, which are required to execute the software instructions.

Control unit(CU): This control unit(CU) of the CPU is the control component of the entire computer system, which interprets the software instructions and directs processing(i.e.) its registers and the other circuits interpret the software instructions and transmit the directions which controls the activities of the other components of the computer system.

(2) Primary Storage:

Primary storage is a storage or memory which stores the data and programming instructions or software instructions that are necessary for processing. It is a fast memory. Primary memory is a volatile memoryThis main memory is directly addressed by the CPU. Semi conductor memories, RAM(Random Access Memory) are used as main memory. It possess random access property and has smaller access time, about 50ns(nano second).

(3) Secondary Storage:

Secondary storage is a mass storage or memory which stores the data and programming instructions or software instructions when they are **not** used in processing, and is supporting the primary storage. Secondary memory stores the operating sytem, data files, compilers, assemblers, application programs, etc. It is slow, but cheap. Secondary memory is a permanent memory.

CPU does not read the information residing in the secondary memory directly, and, if they are needed by the CPU, are first transferred from the secondary memory to the main memory, and then only, the CPU reads those information from the main memory. The results are stored in the secondary memory. Hard disks are used as secondary memory and their access time is about 5 -10 ms(milli second).

(4) **Communication Devices:** A communication device is a piece of equipment or hardware designed to move the information or data from one place to another or allowing one computer device to communicate with the another. They control the passing of information to and from the communication network. Some examples are Network interface card(NIC) or Network connector, Wi-fi cards, router, modem, etc.

(6) Output Devices:

An output device is a piece of hardware that is used to output the data that has been previously entered into a computer. The output devices of a computer system include video display unit(VDU), printers, plotter, projector, speaker, headphones, etc. They convert those

electronic information which are produced by the computer system, into human – intelligible form for the purpose of presentation towards the end-users.

Categories of Computer Systems:

Computers can be classified, or typed, many ways. Some common classifications are summarized below.

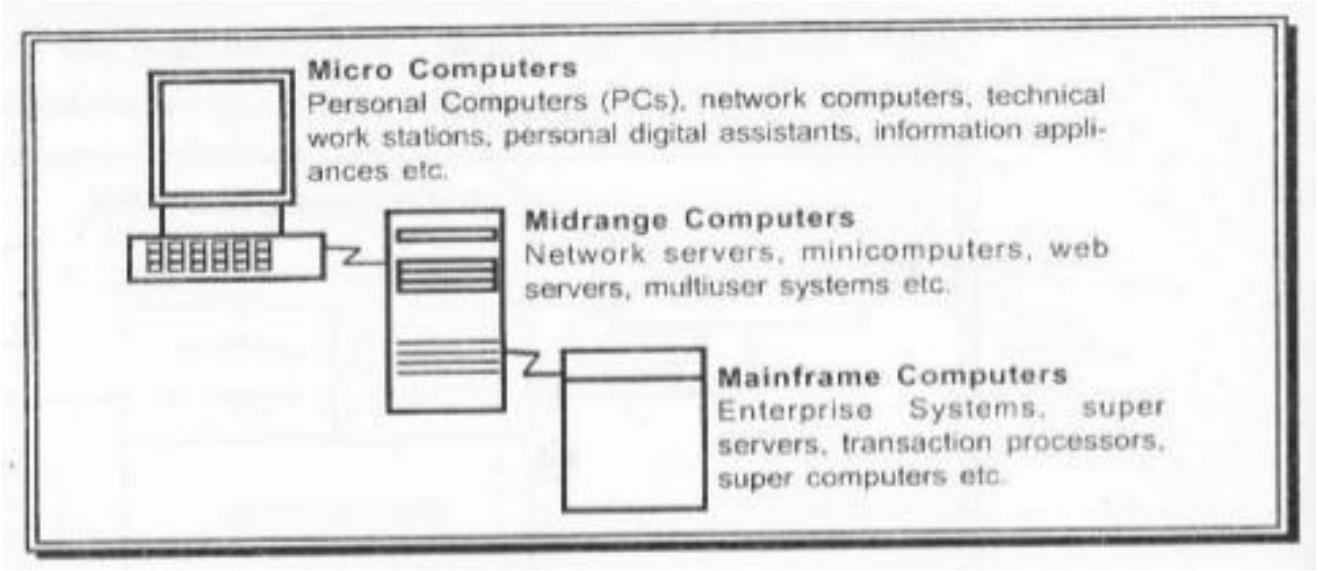
* 1 Classes by Size

1. Microcomputers (Personal computers)
2. Minicomputers (Midrange computers)
3. Mainframe computers
4. Supercomputer

* 2 Classes by function

1. Servers
2. Workstations
3. Information appliances
4. Embedded computers

Its classification is shown digrammatically as follows:



Categories of Computer Systems:

(I) Classes by Size:

(1) Microcomputers (Personal computers)

A **microcomputer** is a small, relatively inexpensive computer with a microprocessor as its Central Processing Unit (CPU).It includes a microprocessor, memory, and input/output (I/O) facilities. Microcomputers became popular in the 1970s and 80s with the advent of increasingly powerful microprocessors.

Microcomputers are the most common type of computers used by people today, whether in a workplace, at school or on the desk at home, by the business people and by the consumers, and are usually called a personal computer(PC). The term ―microcomputer‖ was introduced with the advent of **single chip microprocessors.** The term "microcomputer" itself is now practically an anachronism.

A microcomputer has many advantages as follows:

(a) It is small and portable,
(b) They are relatively inexpensive,
(c) They will start working as soon as they switched on,
(d) They are having excellent graphic capabilities,
(e) They do not occupy much space,
(f) They do not occupy much power.

For the corporate buyers, three top criteria are

(a) Solid performance at a reasonable price: The users of the corporate buyers are doing - Word processing, Order entry, Sales contact management, and other essential business tasks. So, they need a solid, competent machine at a reasonable price, and not the latest whiz-bang.

(b) Operating system ready: A change in the operating system of a computer is the most disruptive upgrade an enterprise has to face. That is why, many corporate buyers want their machines to be able to handle the current operating systems and also the anticipated new operating system, as the versions of OS are expected to be out, for 3 to 5 years.

(c) Secured connectivity: Networked machines and Internet-ready machines are a must in the corporate life. So, the corporate buyers need those machines, which are equipped with a reliable network interface cards or even wireless LAN capabilities . With fewer cables to worry about, wireless LANs, especially when combined with the laptop PCs, contribute to the flexibility of the work place and the simplicity of the PC deployment. Many organizations are planning for the Internet – based applications and so, need machines to make fast, reliable, and secure connections.

Disadvantages :

(a) Limited storage capacity.
(b) Limited relatively slow power, when compared to the mini-computers.

Examples of popular microcomputers:

- IBM system 123,
- Texas Instruments System 200,
- Hewlett Packards HP – 85,
- Apple II and III Commodores PET,
- CBM and VIC IBM personal computer,
- Radio shacks TRS 80,
- Osborne Uptrone S – 800,
- PSI Action Station,
- HCL Work horse, etc.

Categories of Microcomputers based upon the size, shape and purpose:

Hand held, notebook, laptop, portable, desktop floor standing models, PDAs, smart card, table computers, information appliances, wearable computers.

Categories of Microcomputers based upon communications:

Network computer, Window based terminals.

Categories of Microcomputers based upon use:

Home, personal, professional, multi user systems.

Categories of Microcomputers based upon convenience:

Desktop computer, laptop computers.

Categories of microcomputers:

Earlier, microcomputers were of 2 types:

(1) Personal Computer's(PC)
(2) Work Stations.

Its brief explanation is as follows:

(1) Personal Computer's(PC):

A **personal computer** (**PC**) is a general-purpose computer, small, relatively inexpensive computer designed for an individual user. All are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip. Businesses use personal computers for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications. At home, the most popular use for personal computers is for playing games.

Software applications for most personal computers include, but are not limited to, word processing, spreadsheets, databases, web browsers, and

e-Mail clients, dogital media playback, games and myriad personal productivity and special-purpose software applications. Modern personal computers often have connections to the internet,

allowing access to the World Wide Web and a wide range of other resources. Personal computers may be connected to a Local Area Network(LAN), either by a cable or a wireless connection. A personal computer may be a desktop computer or a laptop, tablet or a handhels PC.

Personal Computer:

(2) Work Stations:

A workstation is a high-end personal computer designed for technical, mathematical, or scientific applications. Intended primarily to be used by one person at a time, they are commonly connected to a local area network and run multi-user operating systems. Workstations are used for tasks such as Computer-aided design, drafting and modeling, computation-intensive scientific and engineering calculations, image processing, architectural modeling, and computer for animation and motion picture visual effects.

Supermicros are the powerful workstation. For example, Sun, Apple, HP, IBM work stations, etc.

Other categories of microcomputers:

Portable computer:

A **portable computer** is a computer that is designed to be moved from one place to another and includes a display and keyboard. Portable computers, by their nature, are generally microcomputers. Portable computers, because of their size, are also commonly known as 'Lunchbox' or 'Luggable' computers. They can also be called a 'Portable Workstation' or 'Portable PC'.

Portable types of microcomputers are as follows:

(1) Laptops,
(2) Notebook computers,
(3) Sub notebooks,
(4) Hand held computers,
(5) Personal Digital Assistants(PDAs),
(6) Information Appliances,
(7) Network Computer's(NCs),
(8) Computer Terminals,
(9) Window based Terminals,
(10) Wearable computers.

Its brief explanation is as follows:

(1) Laptops:

A laptop computer or simply laptop, also called a notebook computer, is a small personal computer designed for portability. Usually all of the interface hardware needed to operate the laptop, such as USB ports (previously parallel and serial ports), graphics card, sound channel, etc., are built into a single unit. Laptops contain high capacity batteries that can power the device for extensive periods of time, enhancing portability. Once the battery charge is depleted, it will have to be recharged through a power outlet. In the interest of saving power, weight and space, they usually share RAM with the video channel, slowing their performance compared to an equivalent desktop machine. For this reason, Desktop or Gaming computers are generally preferred to laptop PCs for gaming purposes.

A modern laptop computer:

(2) Notebook computers:

Notebook computers or **notebooks** is a portable lightweight personal computer, and are small enough to fit easily in a briefcase Aside from size and portability, the principal difference between a notebook computer and a personal computer is the display screen. Notebook computers use a variety of techniques, known as *flat-panel technologies*, to produce a lightweight and non-bulky display screen.

.In terms of computing power, modern notebook computers are nearly equivalent to personal computers. They have the same CPUs, memory capacity, and disk drives. However, all this power in a small package is expensive.

Notebook computers come with battery packs that enable us to run them without plugging them in. However, the batteries need to be recharged every few hours.

A modern notebook computer**:**

(3) Sub notebooks:

A subnotebook (also called an ultraportable or mini notebook) is a portable computer that is slightly lighter and smaller than a full-sized notebook computer. Typically, subnotebook computers have a smaller keyboard and screen, but are otherwise equivalent to notebook computers.

Subnotebooks are smaller than full sized laptops but larger than handheld computers. They often have smaller-sized screens, less than 14 inches, and weigh less than typical laptops, usually being less than 2 kg (4.4 lbs). The savings in size and weight are usually achieved partly by omitting ports or having remivable media or optical disc drives. Many can be paired with docking stations to compensate.

Docking station: Docking station is a platform into which you can install a portable computer. The docking station typically contains slots for expansion cards, bays for storage devices, and connectors for peripheral devices, such as printers and monitors. Once inserted in a docking station, the portable computer essentially becomes a desktop model computer. When it is taken out, it becomes a portable computer again. Most importantly, the same data is accessible in both modes,because it resides on the portable computer's drives. The idea behind docking stations is to let you simultaneously enjoy the expansion possibilities of desktop model computers with the portability of notebook computers. In addition, the docking station enables you to use a full-size keyboard and monitor when we are not traveling.

Sizes (smallest to largest): Nintendo DS Lite **(**handheld**),** Asus Eee PC **(**netbook**) and** MacBook **(**laptop**):**

(4) Handheld PC:

A handheld PC, or H/PC is a small portable computer that is small enough to be held in one's hand. Although extremely convenient to carry, handheld computers have not replaced notebook computers because of their small keyboards and screens. The most popular hand-held computers are those that are specifically designed to provide PIM (personal information manager) functions, such as a calendar and address book.

Some manufacturers are trying to solve the small keyboard problem by replacing the keyboard with an electronic pen. However, these pen-based devices rely on handwriting recognition technologies, which are still in their infancy.

Handheld PC:

(5) Personal digital assistant:

A personal digital assistant (PDA), also known as a palmtop computer , or personal data assistant, is a mobile device that functions as a personal information manager. PDAs are largely considered obsolete with the widespread adoption of smartphones.

PDA is a handheld device that combines computing, telephone/ fax, Internet and networking features. A typical PDA can function as a cellular phone, fax sender, Web browser and personal organizer. Unlike portable computers, most PDAs began as pen-based, using a stylus rather than a keyboard for input. This means that they also incorporated handwriting recognition features. Some PDAs can also react to voice input by using voice recognition technologies. PDAs of today are available in either a stylus or keyboard version.

Apple Computer, which introduced the Newton MessagePad in 1993, was one of the first companies to offer PDAs. Shortly thereafter, several other manufacturers offered similar products. Today, one of the most popular brands of PDAs is the series of Palm Pilots from Palm, Inc.

PDAs are also called palmtops, hand-held computers and *pocket computers*.

Nearly all current PDAs have the ability to connect to the Internet. A PDA has an electronic visual display, enabling it to include a web browser, all current models also have audio capabilities enabling use as a portable media player, and also enabling most of them to be used as mobile phones. Most PDAs can access the Internet, intranets or extranets via Wi-Fi or Wireless Wide Area Networks. Most PDAs employ touchscreen technology.

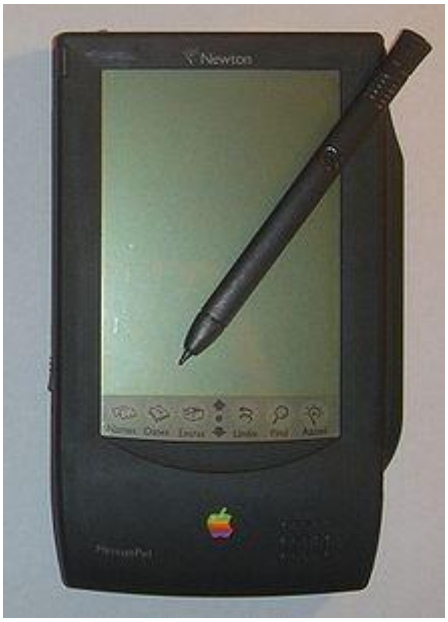
The Palm TX:

(6) Information appliance:

In general terms, an information appliance or information device is any machine or device that is usable for the purposes of computing, telecommunicating, reproducing, and presenting encoded information in myriad forms and applications. The common technical usage of "information appliance" (IA) is more specific — i.e., an appliance that is specially designed to perform a specific user friendly function —such as playing music, photography or editing text.

Typical examples are smartphones and personal digital assistants (PDAs). Information appliances partially overlap in definition with, or are sometimes referred to as smart devices, embedded systems, mobile devices or wireless devices.

A Newton PDA:



(7) Network Computer:

A Network computer is a computer with minimal memory, disk storage and processor power designed to connect to a network, especially the Internet. The idea behind network computers is that many users who are connected to a network don't need all the computer power they get from a typical personal computer. Instead, they can rely on the power of the network servers.

This is really a variation on an old idea --diskless workstations -- which are computers that contain memory and a processor but no disk storage. Instead, they rely on a server to store data. Network computers take this idea one step further by also minimizing the amount of memory and processor power required by the workstation. Network computers designed to connect to the Internet are sometimes called *Internet boxes*, *Net PCs*, and *Internet appliances*.

One of the strongest arguments behind network computers is that they reduce the total cost of ownership (TCO) -- not only because the machines themselves are less expensive than PCs, but also because network computers can be administered and updated from a central network server.

Network Computer (often abbreviated **NC**) is a trademark of Oracle Corporation tthat was used, from approximately 1996 to 2000, to market a range of diskless desktop computer devices. The devices were designed and manufactured by an alliance, which included Sun Microsystems, IBM and others. The devices were designed with minimum specifications, based on the Network Computer Reference Profile. The brand was also employed as a marketing term to try to popularize this design of computer within enterprise and among consumers.

The term, today, is also used somewhat interchangeably to describe a diskless desktop computer or a thin client.

The NC brand was mainly intended to denote and forecast a range of desktop computers from various suppliers that, by virtue of their diskless design and use of inexpensive components and software, were cheaper and easier to manage than standard fat client desktops. However, due to the commoditization of standard desktop components, and due to the increasing availability and popularity of various software options for using full desktops as diskless nodes, thin clients, and hybrid clients, the Network Computer brand never achieved the popularity hoped for by Oracle and was eventually mothballed.

An Acorn NetStation NC:

(8): A computer terminal:

(1) A computer terminal is an electronic or electromechanical hardware *device that is used for entering data into, and displaying data from, a* computer *or a* computing *system.(i.e.)* it is

a device that enables you to communicate with a computer. Generally, a terminal is a combination of keyboard and display screen. Terminals are sometimes divided into three classes based on how much processing power they contain:

- intelligent terminal: a stand-alone device that containsmain memory and a CPU.
- smart terminal: contains some processing power, but not as much as an intelligent terminal.
- dumb terminal: has no processing capabilities. It relies entirely on the computer's processor.

(2) In networking, a terminal is a personal computer or workstation connected to a mainframe. The personal computer usually runs terminal emulation software that makes the mainframe think it is like any other mainframe terminal.

(3) In VoIP terminology, a network endpoint which may provide audio only, audio and video, audio and data, or audio, video, and data communications with another H.323terminal. The most common VoIP terminal is a phone.

Dumb terminal: Dumb terminal is a display monitor that has no processing capabilities, and, it must rely entirely on the central computer. A dumb terminal is simply an output device that accepts data from theCPU. Dumb terminals are not as fast as smart terminals, and they do not support as many display features, but they are adequate for most applications.

Intelligent terminal: Intelligent terminal is a stand-alone device that contains main memory and a CPU. (monitor and keyboard) and also contains processing power. Intelligent terminals include these above memory and a processor , so as to perform special display operations.

Examples:

ATMs – Automated Teller Machines, factory production recorders, and retail point-of- sale(POS) terminals.

These intelligent terminals use keypads, touch screens, bar code scanners, and other input methods to capture the data and interact with the end users during a transaction, while relying on servers or the other computers in the network for further transaction processing.

Smart terminal: Smart terminal is a terminal that has some processing capabilities, but not as many as an intelligent terminal. Smart terminals have built-in logic for performing simple display operations, such as blinking and boldface. Smart terminal is a monitor that has its own processor for special features, such as bold and blinkingcharacters.

The function of a terminal is confined to display and input of data; a device with significant local programmable data processing capability may be called a "smart terminal" or fat client. A terminal that depends on the host computer for its processing power is called a dumb terminal or thin client. A personal computer can run terminal emulator software that replicates the function of a terminal, sometimes allowing concurrent use of local programs and access to a distant *terminal host* system.

The DEC VT100, a widely emulated computer terminal:

(c) Network terminals:

Network terminals may be Windows terminals, which are dependent on the network servers for its Windows software, processing power, and storage. Windows terminal is a dumb terminal especially designed to run Windows applications. Windows terminals are connected to a Windows NT server through a network. All processing and data storage is handled by the server; the terminal does nothing more than send the user's input (keystrokes and mouse movements) to the server and display the results on the display screen. Because Windows NT is not a true multi- user operating system like UNIX, it requires additional software to support Windows terminals. The most popular software for this is called WinFrame.

(d) Internet terminals:

Internet terminals are those which depend on Internet Intranet website servers, for their operating systems and application software.

(9) Windows Based Terminal:

Windows Based Terminal, is a thin client device (sometimes also known as a Windows Interface Device, or WID), generally using Citrix ICA or Remote Desktop Protocol to display a Windows desktop served up by a Citrix server. It is a subset of NC; offers less functionality than PCs. Its advantages are as follows:

Advantages:

- Reduced maintenance and support costs,
- Maintain compatibilities with Windows OS,
- Users can access window applications on the central servers, as if those applications were running locally,
- Savings from the cost of terminals, from the reduced support and maintenance cost.

Disadvantages:

Not so flexible as NC, not so efficient and more expensive to operate than NC.

(10) Wearable computers:

Wearable computers, also known as **body-borne computers** or **wearables** are miniature electronic devices that are worn by the bearer under, with or on top of clothing. This class of wearable technology has been developed for general or special purpose information technologies and media development. Wearable computers are especially useful for applications that require more complex computational support than just hardware coded logics.

One of the main features of a wearable computer is consistency. There is a constant interaction between the computer and user, (i.e). there is no need to turn the device on or off. Another feature is the ability to multi-task. It is not necessary to stop what you are doing to use the device; it is augmented into all other actions. These devices can be incorporated by the user to act like a prosthetic. It can therefore be an extension of the user's mind and/or body.

Many issues are common to the wearables as with mobile computing, ambient intelligence and uiquitous computating research communities, including power management and heat dissipation, software architectures, wireless and personal area networks.

Wearable computing devices can range from providing very specific, limited features like heart rate monitoring and pedometer capabilities to advanced ‒smart‖ functions and features similar to those a smartphone or smartwatch offers.

These more advanced wearable computing devices can typically enable the wearer to take and view pictures or video, read text messages and emails, respond to voice commands, browse the web and more. While wearable computing devices are only just now starting to emerge from the realm of science fiction into reality, rumored devices like Google Glasses and the Apple iWatch may soon bring advanced wearable computing devices into the mainstream.

The WIMM One, an Android powered wearable computer:

Server:

A **server** is a system (software and suitable computer hardware) that responds to requests across a computer network to provide, or help to provide, a network service(i.e.) Server is a computer or device on a network that manages the network resources. There are many different types of servers. Servers are often dedicated, meaning that they perform no other tasks besides their server tasks. Servers can be run on a dedicated computer, which is also often referred to as "the server", but many networked computers are capable of hosting servers. In many cases, a computer can provide several services and have several servers running.

Servers operate within a Client server architecture. Servers are computer programs running to serve the requests of other programs, the clients. Thus, the server performs some tasks on behalf of clients. The clients typically connect to the server through the network but may run on the same computer.

A client is an application that runs on a personal computer or workstation and relies on a server to perform some operations. A **client** is a piece of computer hardware or software that accesses a service made available by a server. The server is often (but not always) on another computer system, in which case the client accesses the service by way of a network. The term applies to programs or devices that are part of a client server model.

A computer network diagram of client computers communicating with a server computer via the Internet:

Servers often provide essential services across a network, either to private users inside a large organization or to public users via the Internet. Typical computing servers are database server, file server, mail server, print server, web server, gaming server, application server, or some other kind of server.

Numerous systems use this client / server networking model including Web sites and email services. An alternative model, peer-to-peer networking enables all computers to act as either a server or client as needed.

There are many different types of servers. For example:

- File server: a computer and storage device dedicated to storing files. Any user on the network can store files on the server.
- Print server: a computer that manages one or more printers, and a network server is a computer that manages network traffic.
- Database server: a computer system that processes database queries.
- **Mail server:** Often referred to as simply "mail server", an E-Mail server is a computer within your network that works as your virtual post office. A mail server usually consists of a storage area where where e-mail is stored for local users, a set of user definable rules which

determine how the mail server should react to the destination of a specific message, a database of user accounts that the mail server recognizes and will deal with locally, and communications modules which are the components that actually handle the transfer of messages to and from other mail servers and email clients.

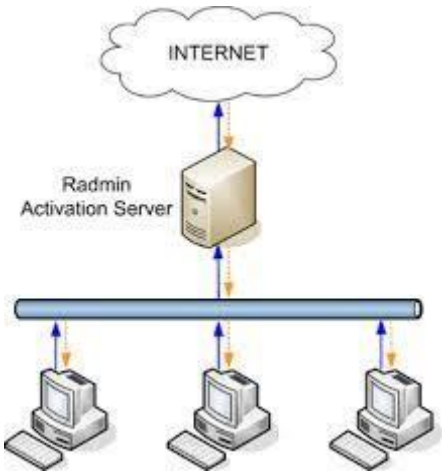
- Web servers are computer that deliver (*serves up*) Web Pages.
  - **An application server:** Also called an *appserver*, and application server is a program that handles all application operations between users and an organization's backend business applications or databases.

    An application server is typically used for complex transaction-based applications. To support high-end needs, an application server has to have built-in redundancy, monitor for high-availability, high-performance distributed application services and support for complex database access.

Servers are often dedicated, meaning that they perform no other tasks besides their server tasks. On multiprocessing operating systems, however, a single computer can execute several programs at once. A server in this case could refer to the program that is managing resources rather than the entire computer.

Servers in a data center. Several servers are mounted on a rack and connected to a KVM switch:

Another diagram:



Midrange computer:

Minicomputer: Midrange computer, or midrange system, is a midsized computer which fall in between mainframe computers and microcomputers. But in general, a minicomputer is a multiprocessing system capable of supporting from 4 to about 200 users simultaneously. **Minicomputers consists of a CPU, several disk drives and printer.**

Individual departments of a large company or organizations use Mini-computers for specific purposes. For example, a production department can use Mini-computers for monitoring certain production process.

The Fujitsu Server PRIMERGY TX100 S3p:

Popular Minicomputers

- K-202
- Texas Instrument TI-990
- SDS-92
- IBM Midrange computers

In the past decade, the distinction between large minicomputers and small mainframes has blurred, however, as has the distinction between small minicomputers and workstations.

The class emerged in the 1960s and machines were generally known at the time as minicomputers - especially models from Digital Equipment Corporation (PDP line), Data General, Hewlett Packard(HP 3000 line and successors), Sun Microsystems (SPARC Enterprise). These were widely used in science and research as well as for business.

IBM favored the term 'midrange computer' for their comparable more business-oriented System/3, System/34, System/32, System/36, System/38, and AS/400 ranges.

Since the 1990s, when the client server model of computing became predominant, computers of the comparable class are instead universally known as servers to recognize that they usually "serve" end users at their "client" computers.

Minis were designed for control, instrumentation, human interaction, and communication switching as distinct from calculation and record keeping. Many were sold indirectly to Original Equipment Manufacturers (OEMs) for final end use application. During the two decade lifetime of the minicomputer class (1965-1985), almost 100 companies formed and only a half dozen remained.

Midrange systems are primarily high-end network servers and other types of servers that can handle the large-scale processing of many business applications. Although not as powerful as mainframe computers, they are less costly to buy, operate, and maintain than mainframe systems and thus meet the computing needs of many organizations. Midrange systems have become popular as powerful network servers to help manage large Internet Web sites, corporate intranets and extranets, and other networks.

Today, midrange systems include servers used in industrial process-control and manufacturing plants and play major roles in computer-aided manufacturing (CAM). They can also take the form of powerful technical workstations for computer-aided design (CAD) and other computation and graphics-intensive applications. Midrange system are also used as front-end servers to assist mainframe computers in telecommunications processing and network management.

List of some notable Minicomputers

- Control Data's CDC 160A and CDC 1700
- DEC PDP and VAX series
- Data General Nova
- Hewlett-Packard HP 3000 series, HP 2100 series, HP1000 series.
- Honeywell-Bull Level 6/DPS 6/DPS 6000 series
- IBM midrange computers
- Varian 620 100 series
- Norsk Data Nord-1, Nord-10, and Nord-100
- Prime Computer Prime 50 series

- SDS SDS-92
- SEL, one of the first 32-bit real-time computer system manufacturers
- Texas Instruments TI-990
- Wang Laboratories 2200 and VS series
- K-202, first Polish minicomputer

7 inch Mini Computer:

MINI-COMPUTER. These are also a general purpose computer, smaller than mainframe computer. Medium sized computer, occupying very less area:

Minicomputer:

Super minicomputer:

A **super minicomputer**, or **supermini**, is –a minicomputer with high performance compared to ordinary minicomputers.‖ The term was an invention used from the mid-1970s mainly to distinguish the emerging 32-bit minis from the classical 16-bit minicomputers. The term is now largely obsolete but still remains of interest for students/researchers of computer history.

Significant superminis

- Norsk Data NORD-5, first supermini, 1972
- Norsk Data Nord-50, 1975
- Interdata 7/32 and 8/32 later taken over by PerkinElmer
- Systems Engineering Laboratories 32/55, 1976
- DEC VAX-11/780, shipped February 1978
- Data General Eclipse MV/8000, 1980
- MAI Basic Four MAI 8000, 1983 [1] and MPx [2]
- Gould Electronics Powernode 9080
- Gould Electronics NP-1
- Norsk Data ND-500, 1981
- Norsk Data ND-570/CX, fastest supermini, 1983, at 7.1 Whetstone MIPS
- Prime Computer 750

Mainframe computer: is a A very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously. In the hierarchy that starts with a simple microprocessor (in watches, for example) at the bottom and moves to supercomputers at the top, mainframes are just below supercomputers. In some ways, mainframes are more powerful than supercomputers because they support more simultaneous programs. But supercomputers can execute a single program faster than a mainframe. The distinction between small mainframes and minicomputers is vague, depending really on how the manufacturer wants to market its machines.

Mainframe computer:

Although Mainframes are not as powerful as supercomputers, but certainly they are quite expensive nonetheless, and many large firms & government organizations uses Mainframes to run their business operations. The Mainframe computers can be accommodated in large air-conditioned rooms because of its size. Super-computers are the fastest computers with large data storage capacity, Mainframes can also process & store large amount of data. Banks educational institutions & insurance companies use mainframe computers to store data about their customers, students & insurance policy holders.

Popular Mainframe computers

- Fujitsu's ICL VME
- Hitachi's Z800

Mainframe computers (colloquially referred to as "big iron") are computers used primarily by corporate and governmental organizations for critical applications, bulk data processing such as census, industry and consumer statistics, Enterprise Resource Planning and Transaction processing.

The term originally referred to the large cabinets called "main frames" that housed the Central Processing Unit and main memory of early computers. Later, the term was used to distinguish high-end commercial machines from less powerful units. Most large-scale computer system architectures were established in the 1960s, but continue to evolve.

An IBM System z9 mainframe:

execute many programs concurrently.

In 2007, an amalgamation of the different technologies and architectures for Super-computers and mainframes has led to the so-called gameframe.

Supercomputer is a fastest type of computer. Supercomputers are very expensive and are employed for specialized applications that require immense amounts of mathematical calculations. For example, weather forecasting requires a supercomputer. Other uses of supercomputers include animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration. A **supercomputer** is a computer at the frontline of contemporary processing capacity – particularly

The chief difference between a supercomputer and a mainframe is that a supercomputer channels all its power into executing a few programs as fast as possible, whereas a mainframe uses its power to speed of calculation which can happen at speeds of nanoseconds.

The ***most powerful computers*** in terms of performance and data processing are the supercomputers. These are specialized and task specific computer used by large organizations. These computers are used for research and exploration purposes, like NASA uses supercomputers for launching space shuttles, controlling them and for space exploration purpose.

The supercomputers are very expensive and very large in size. It can be accommodated in large air-conditioned rooms; some super computers can span an entire building.

In 1964, Seymour Cray designed the first Super-computers `"CDC 6600"`.

Uses of Supercomputer:

In Pakistan and other countries Supercomputers are used by Educational Institutes like NUST (Pakistan) for research purposes. Pakistan Atomic Energy commission & Heavy Industry Taxila uses supercomputers for Research purposes.

Space Exploration:

Supercomputers are used to study the origin of the universe, the dark-matters. For these studies scientist use IBM's powerful supercomputer ‒Roadrunner‖ at National Laboratory Los Alamos.

Earthquake studies

Supercomputers are used to study the Earthquakes phenomenon. Besides that supercomputers are used for natural resources exploration, like natural gas, petroleum, coal, etc.

Weather Forecasting

Supercomputers are used for weather forecasting, and to study the nature and extent of Hurricanes, Rainfalls, windstorms, etc.

Nuclear weapons testing

Supercomputers are used to run weapon simulation that can test the Range, accuracy & impact of Nuclear weapons.

Popular Supercomputers

- IBM's Sequoia, in United States
- Fujitsu's K Computer in Japan
- IBM's Mira in United States
- IBM's SuperMUC in Germany
- NUDT Tianhe-1A in China

Supercomputers were introduced in the 1960s, made initially and, for decades, primarily by Seymour Cray at Control Data Corporation (CDC), Cray Research and subsequent companies bearing his name or monogram. While the supercomputers of the 1970s used only a few processors, in the 1990s machines with thousands of processors began to appear and, by the end of the 20th century, massively parallel supercomputers with tens of thousands of "off-the-shelf" processors were the norm. As of November 2013, China's Tianhe-2 supercomputer is the fastest in the world at 33.86 petaFLOPS, or 33.86 quadrillion floating point operations per second.

The use of multicore processors combined with centralization is an emerging trend; one can think of this as a small cluster (the multicore processor in a Smartphone, tablet, laptop, etc.) that both depends upon and contributes to the cloud.

The Blue Gene/P supercomputer at Argonne National Lab runs over 250,000 processors using normal data center air conditioning, grouped in 72 racks/cabinets connected by a high-speed optical network:

Super computer:

Parallel computers: Parallel computers are the advanced computers using many instruction processors organised in clusters or networks.

Parallel processing is also called *parallel computing.*

Parallel processing is the simultaneous use of more than one CPU to execute a program. Ideally, parallel processing makes a program run faster because there are more engines (CPUs) running it. In practice, it is often difficult to divide a program in such a way that separate CPUs can execute different portions without interfering with each other.

Most computers have just one CPU, but some models have several. There are even computers with thousands of CPUs. With single-CPU computers, it is possible to perform parallel processing by connecting the computers in a network. However, this type of parallel processing requires very sophisticated software called distributed processing software.

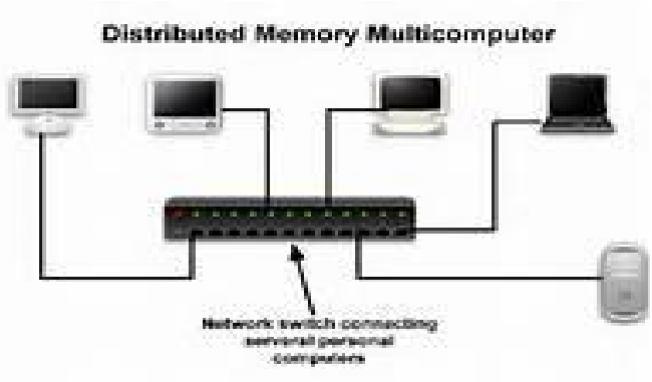
Note that parallel processing differs from multitasking, in which a single CPU executes several programs at once.

Parallel processing is also called *parallel computing.*

Shared memory parallel computers:

Shared memory parallel computers are the computer with a number of processing elements connected to a common main memory by a communication network. Shared memory parallel computers are not scalable beyond 16 processors (all the processors share a common memory) and is accessible only through a single communication network. This gets saturated when many processors read or write from memory.

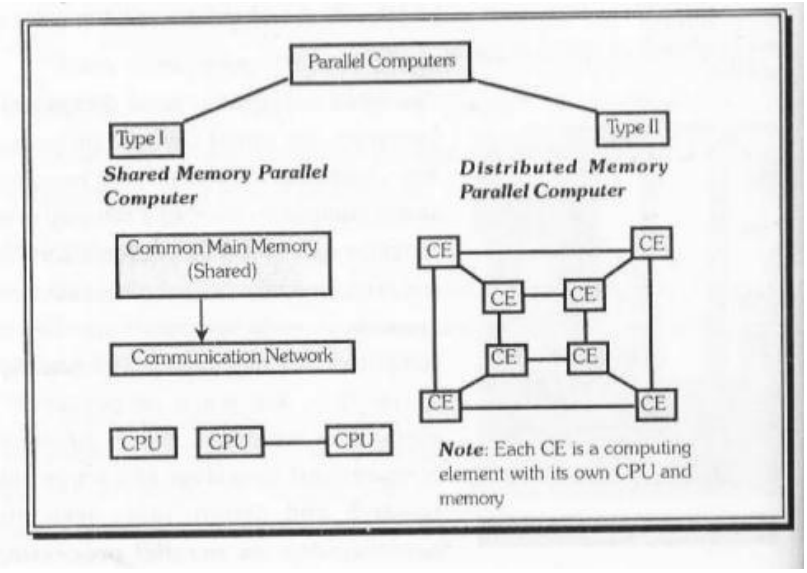
Distributed memory parallel computers:



Distributed memory parallel computers: Distributed memory parallel computers are the computers with a number of processors each within its own memory and are interconnected by a communication network. Each computer works independently.

Distributed memory parallel computers are scalable to over 1000 processors (each computer works reasonably independently) and also multiple communication paths exist. The following diagram shows about this:

Parallel memory computers(Shared and Distributed):



HERE, CE Is the Computing Element With its Own CPU and memory

Message passing multicomputers: When the processors need to exchange data to continue with computation, it will be done by sending message to one another through communication network.

Palm PCs:

The reason for the emergence of this type of PCs are:

- miniaturisation as the main; can be held in our palm
- high density packing of transistors on a chip
- capabilities nearly that of PCs
- accepts handwritten inputs using an electronic pen (can be used to write on a Palm screen)
- as a Fax and E-mail machine
- have a small disk storage, tiny keyboard, connected to a wireless network.

Simputer: **Simputer** is a mobile hand held computer with the input through icons on a touch sensitive overlay on the LCD display panel; use of free open source called GNU/Linux. In Simputer, a smart card reader/writer increases the functionality.

Speciality of this Simputer are;

- Cost of ownership is low(no software cost for OS)
- Indian initiative is to meet the needs of this computer to the rural population of developing countries.

Some new hand hold computers: There are also several new hand held computer which replaces the keyboard with a touch sensitive screen on which we write with a stylus. In these computers, there is a program, which recognise our handwriting, character by character, converts our written characters into a neatly typed text.

Brief history of computers:

The development of electronic computers can be divided into five generations depending upon the technologies used. The following are the five generations of computers.

First Generation of Computers (1942-1955)
The beginning of commercial computer age is from UNIVAC (Universal Automatic Computer). It was developed by two scientists Mauchly and Echert at the Census Department of United States in 1947. *The first generation computers were used during 1942-1955*. They were based on Vacuum tubes. Examples of first generation computers are ENIVAC and UNIVAC-1.

Advantages

- Vacuum tubes were the only electronic component available during those days.
- Vacuum tube technology made possible to make electronic digital computers.
- These computers could calculate data in millisecond.

Disadvantages

- The computers were very large in size.
- They consumed a large amount of energy.
- They heated very soon due to thousands of vacuum tubes.
- They were not very reliable.
- Air conditioning was required.
- Constant maintenance was required.
- Non-portable.
- Costly commercial production.
- Limited commercial use.
- Very slow speed.
- Limited programming capabilities.
- Used machine language only.
- Used magnetic drums which provide very less data storage.
- Used punch cards for input.
- Not versatile and very faulty.

Second Generation Computers (1955-1964)
The second generation computers used transistors. The scientists at Bell laboratories developed transistor in 1947. These scientists include John Barden, William Brattain and William Shockley. The size of the computers was decreased by replacing vacuum tubes with transistors. The examples of second generation computers are IBM 7094 series, IBM 1400 series and CDC 164 etc.

Advantages:

- Smaller in size as compared to the first generation computers.
- The 2nd generation Computers were more reliable
- Used less energy and were not heated.
- Wider commercial use
- Better portability as compared to the first generation computers.
- Better speed and could calculate data in microseconds

- Used faster peripherals like tape drives, magnetic disks, printer etc.
- Used Assembly language instead of Machine language.
- Accuracy improved.

Disadvantages

- Cooling system was required
- Constant maintenance was required
- Commercial production was difficult
- Only used for specific purposes
- Costly and not versatile
- Puch cards were used for input.

Third Generation Computers (1964-1975)

The Third generation computers used the integrated Circuits(IC). Jack Kilby developed the concept of integrated circuit in 1958. It was an important invention in the computer field. The first IC was invented and used in 1961. The size of an IC is about ¼ square inch. A single IC chip may contain thousands of transistors. The computer became smaller in size, faster, more reliable and less expensive. The examples of third generation computers are IBM 370, IBM System/360, UNIVAC 1108 and UNIVAC AC 9000 etc.

Advantages

- Smaller in size as compared to previous generations.
- More reliable.
- Used less energy
- Produced less heat as compared to the previous two generations of computers.
- Better speed and could calculate data in nanoseconds.
- Used fan for heat discharge to prevent damage.
- Maintenance cost was low because hardware failure is reare.
- Totally general purpose
- Could be used for high-level languages.
- Good storage
- Versatile to an extent
- Less expensive
- Better accuracy
- Commercial production increased.
- Used mouse and keyboard for input.

Disadvantages

- Air conditioning was required.
- Highly sophisticated technology required for the manufacturing of IC chips.

Fourth Generation Computers (1975-Present)

The fourth generation computers started with the invention of Microprocessor. The Microprocessor contains thousands of ICs. Ted Hoff produced the first microprocessor in 1971 for Intel. It was known as Intel 4004. The technology of integrated circuits improved rapidly. The LSI (Large Scale

Integration) circuit and VLSI (Very Large Scale Integration) circuit was designed. It greatly reduced the size of computer. The size of modern Microprocessors is usually one square inch. It can contain millions of electronic circuits. The examples of fourth generation computers are Apple Macintosh & IBM PC.

Advantages

- More powerful and reliable than previous generations.
- Small in size
- Fast processing power with less power consumption
- Fan for heat discharging and thus to keep cold.
- No air conditioning required.
- Totally general purpose
- Commercial production
- Less need of repair.
- Cheapest among all generations
- All types of High level languages can be used in this type of computers

Disadvantages

- The latest technology is required for manufacturing of Microprocessors.

Fifth Generation Computers (Present & Beyond)

Scientists are working hard on the 5th generation computers with quite a few breakthroughs. It is based on the technique of Artificial Intelligence (AI). Computers can understand spoken words & imitate human reasoning. Can respond to its surroundings using different types of sensors. Scientists are constantly working to increase the processing power of computers. They are trying to create a computer with real IQ with the help of advanced programming and technologies. IBM Watson computeris one example that outsmarts Harvard University Students. The advancement in modern technologies will revolutionize the computer in future.

(2) Minicomputers (Midrange computers):

A minicomputer (colloquially, mini) is a class of multi-user computers that lies in the middle range of the computing spectrum, in between the smallest multi-user systems (mainframe computers) and the largest single-user systems (microcomputers or personal computers). The contemporary term for this class of system is midrange computer, such as the higher-end SPARC, POWER and Itanium -based systems from Oracle Corporation, IBM and Hewlett-Packard.

Example: Laboratory computers

(3) Mainframe computers:

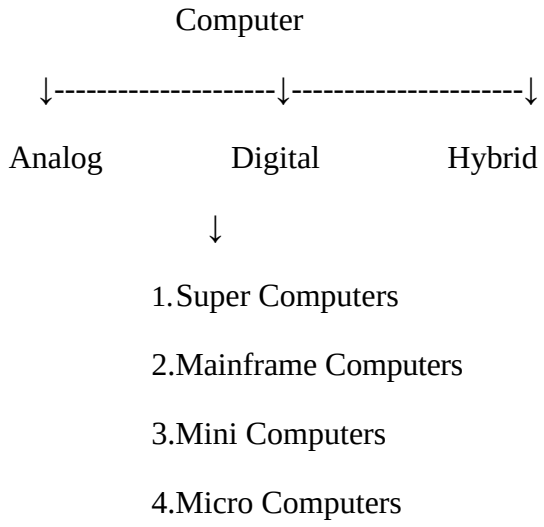
The term mainframe computer **was created to distinguish the traditional, large, institutional computer intended to service multiple users from the smaller, single user machines. These computers are capable of handling and processing very large amounts of data quickly.** Mainframe computers are used in large institutions such as government, banks and large corporations. They are measured in MIPS (million instructions per second) and respond to up to 100s of millions of users at a time.

(4) Supercomputer:

A supercomputer is focused on performing tasks involving intense numerical calculations such as weather forecasting, fluid dynamics, nuclear simulations, theoretical astrophysics, and complex scientific computations. **A supercomputer is a computer that is at the frontline of current processing capacity, particularly speed of calculation. The term supercomputer itself is rather fluid, and the speed of today's supercomputers tends to become typical of tomorrow's ordinary computer.** Supercomputer processing speeds are measured in **floating point operations per second or FLOPS**.

Example: An example of a floating point operation is the calculation of mathematical equations in real numbers.

In terms of computational capability, memory size and speed, I/O technology, and topological issues such as bandwidth and latency, **supercomputers are the most powerful, are very expensive, and not cost-effective just to perform batch or transaction processing. Transaction processing is handled by less powerful computers such as server computers or mainframes.**



(II) Classes by function:

(1) Servers:

Server usually refers to a computer that is dedicated to provide a service.

Example:

1. A computer dedicated to a database may be called a "database server".
2. "File servers" manage a large collection of computer files.
3. "Web servers" process web pages and web applications.

4. Many smaller servers are actually personal computers that have been dedicated to provide services for other computers.

(2) Workstations:

Workstations are computers that are intended to serve one user and may contain special hardware enhancements not found on a personal computer.

(3) Information appliances:

Information appliances are computers specially designed to perform a specific user-friendly function —such as playing music, photography, or editing text. The term is most commonly applied to mobile devices, though there are also portable and desktop devices of this class.

(4) Embedded computers:

Embedded computers are computers that are a part of a machine or device. Embedded computers generally execute a program that is stored in non-volatile memory and is only intended to operate a specific machine or device. Embedded computers are very common. Embedded computers are typically required to operate continuously without being reset or rebooted, and once employed in their task the software usually cannot be modified. **An automobile may contain a number of embedded computers; however, a washing machine and a DVD player would contain only one.** The central processing units (CPUs) used in embedded computers are often sufficient only for the computational requirements of the specific application and may be slower and cheaper than CPUs found in a personal computer.

Secondary Storage:

Storage : Storage is the capacity of a device to hold and retain data, and it is the short for mass storage.

Secondary storage is a mass storage or memory which stores the data and programming instructions or software instructions when they are not used in processing, and is supporting the primary storage. Secondary memory stores the operating sytem, data files, compilers, assemblers, application programs, etc. It is slow, but cheap. Secondary memory is a permanent memory.

CPU does not read the information residing in the secondary memory directly, and, if they are needed by the CPU, are first transferred from the secondary memory to the main memory, and then only, the CPU reads those information from the main memory. The results are stored in the secondary memory. Hard disks are used as secondary memory and their access time is about 5 -10 ms(milli second).

Progress in VLSI – Very Large Scale Integration packs millions of memory circuit elements on the tiny semiconductor memory chips, and is responsible for the continuing increases in the main memory capacity of the computer's. Secondary storage capacities are also escalating into the billions and trillions of characters, due to the advances in the magnetic

and optical media.

There are many types of storage media and devices. The following figure illustrates the speed, capacity and cost relationships of several alternative primary and secondary storage media.

Speed, Capacity and Cost Relationship:

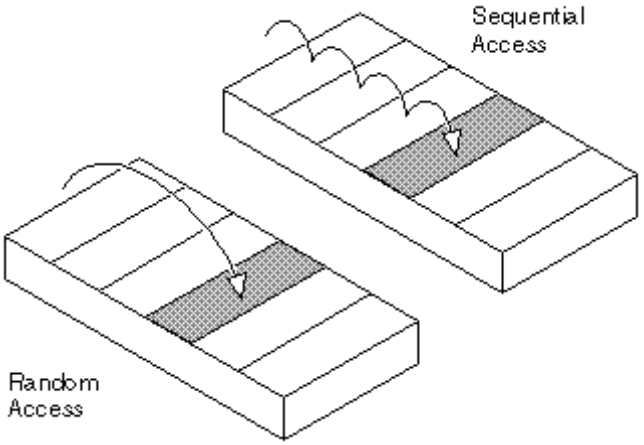
Here, in this diagram, the cost/speed/capacity trade – offs, as one moves from the semiconductor memories to the magnetic disks, to the optical disks, and to the magnetic tape. High speed storage media will cost more per byte, and also provide lower capacities. Large capacity storage media will cost less per byte, but, at the sametime, they are slower. That is why, we have different kinds of storage media.

However, all the storage media, especially memory chips and magnetic disks, continue to increase in both speed and capacity, and decrease in the cost. Developments like automated high speed cartridge assemblies have given the faster access times to the magnetic tape, and the speed of the optical disk drives continues to increase.

As per this diagram, the semiconductor memories are used mainly for the primary storage, though they are sometimes used as a high speed secondary storage device. Magnetic disk, magnetic tapes, and optical disk devices are used as secondary storage devices, so as to greatly enlarge the storage capacity of the computer systems. Since, most of the primary storage circuits use RAM(Random Access Memory) chips, which loose their contents whenever their electric power is interrupted(volatile memory), secondary storage devices provide a more permanent type of storage media.

The primary storage media like semiconductor memory chips are called ‑Direct access‖ or ‑Random Access Memory(RAM)‖. On the other hand, media like magnetic tape cartridges are known as ―sequencial access‖.

Now, we will see about ‑Direct access‖ and ‑sequencial access‖.



Direct access‖ or —Random Access Memory(RAM)‖:

Random Access refers to the ability to access data at random. The opposite of random access is sequential access. To go from point A to point Z in a sequential-access system, you must pass through all intervening points. In a random-access system, you can jump directly to point Z. Disks are random access media, whereas tapes are sequential access media.

The terms random access and sequential access are often used to describe data files. A random- access data file enables you to read or write information anywhere in the file. In a sequential-access file, you can only read and write information sequentially, starting from the beginning of the file.

Both types of files have advantages and disadvantages. If you are always accessing information in the same order, a sequential-access file is faster. If you tend to access information randomly, random access is better.

Random access is sometimes called direct access.

RAM (*pronounced ramm*) is an acronym for **r***andom* **a***ccess* **m***emory*, a type of computer memory that can be accessed randomly; that is, any byte of memory can be accessed without touching the preceding bytes. RAM is the most common type of memory found in computers and other devices, such as printers.

Sequencial access:

Sequencial access refers to reading or writing data records in sequential order, that is, one record after the other. To read record 10, for example, you would first need to read records 1 through 9. This differs from random access, in which you can read and write records in any order.

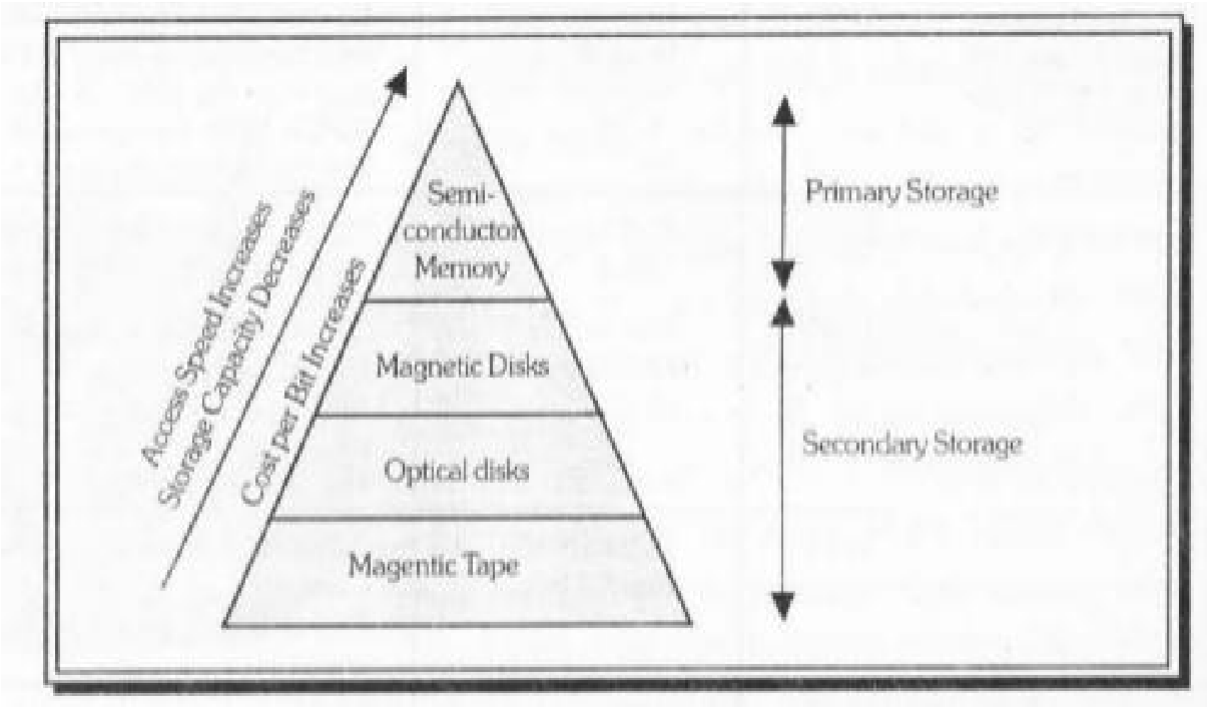
Some programming languages and operating systems distinguish between sequential-access data files and random-access data files, allowing you to choose between the two types. Sequential-access files are faster if you always access records in the same order. Random-access files are faster if you need to read or write records in a random order.

Devices can also be classified as sequential access or random access. For example, a tape drive is a sequential-access device because to get to point q on the tape, the drive needs to pass through points athrough p. A disk drive, on the other hand, is a random-access device because the drive can access any point on the disk without passing through all intervening points.

The followings are about the direct-access and sequential access.

Sequential Access	Direct access
(1) Slow access	Fast access.
(2) Less storage capacity	High storage capacity.
(3) It is cheap Example: Magnetic Tape	It is of reasonable cost. Example: Magnetic Disk
(4) Easily portable	More sturdier(strong), less vulnerable(liable to be wounded) to damage from dust.
(5) Data is more secure than the magnetic disk.	It requires special care during transportation.
(6) A conventional media for the secondary storage.	More used because of Random-access.

The following diagram shows about the ―Sequential access storage device‖ and ―Direct access storage device‖:



See in pg.no.-88(Fig—3.8) in C.S.V.MURTHY

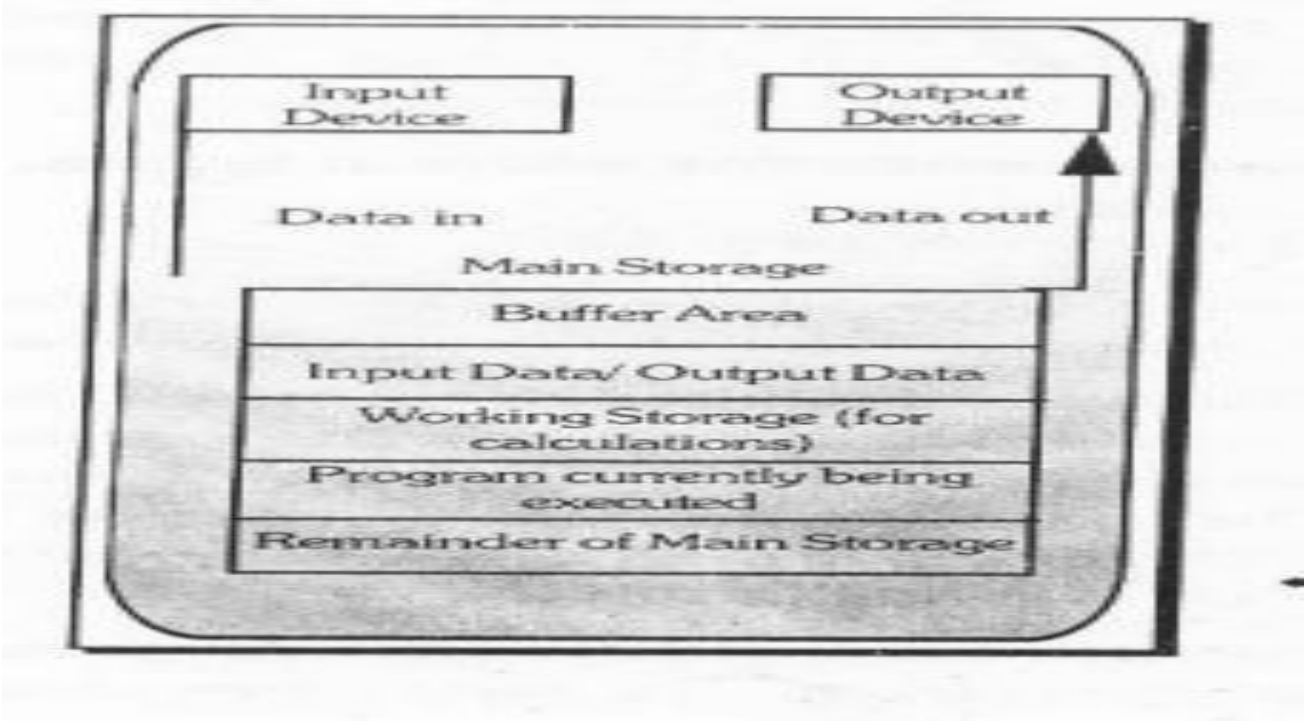
Semi-conductor Memories(For Primary storage):

Semi-conductor Memories are used mainly for the primary storage, but, sometimes, the semi-conductors are used as high speed secondary storage devices also. Most of the primary circuits use RAM(Random-access Memory), which lose the contents when their electrical

power is interrupted. Primary memories provides very fast access, and so, it is used for storing frequently used programs and data.

The main storage location areas are shown in the following diagram:

Main Storage location Areas:



Main memory is being divided into various compartments inorder to store the different types of data, as shown in the above figure.

Working storage area: The data which is being currently used will be in the ―working storage area‖ or ―scratch pad storage area‖.

Buffer area: The data which is awaiting for the processing will be in the ―buffer area‖.

Location in the main storage: The data are stored in a set of boxes along with their numbers and are called ―location in the main storage‖. Here, the number of a box corresponds to the ―location address‖.

Example:

1	2	3	4	5	6 etc,

Here, the data stored will remain in the same location until it is replaced by the another data.

Secondary Storage Devices:

Secondary storage:

Secondary storage is the storage which is provided for the mass storage of program and files. It provides the extra storage area, which increases the computer's extra-ordinary capabilities.

Secondary Storage Devices provide a more permanent type of storage media. The manner in which each storage type is used depends upon the speed with which data is needed. The data held in the secondary storage files is reusable until it is updated or destroyed. It

had to be online to the CPU and allow the ready access to that data during processing.

1) The secondary storage gives a computer system to process with greater processing potential, by expanding the CPU's ability to handle the data.
2) Data cannot be retained in the primary storage as it is an integral part of processing and can only be stored in the secondary storage. These data are available in thousands of a second.
Some other examples of secondary storage technologies are: flash memory (e.g. USB flash drives or keys), floppy disks, magnetic tape, paper tape, punched cards, standalone RAM disks, and Iomega Zip drives.

(a) Magnetic storage (or magnetic recording):

Magnetic storage (or magnetic recording) is the storage of data on a magnetized medium. Magnetic storage uses different patterns of magnetization in a magnetizable material to store data and is a form of non-volatile memory. The information is accessed using one or more read/write heads.

As of 2013 , magnetic storage media, primarily hard disks, are widely used to store computer data as well as audio and video signals. I

In the field of computing, the term magnetic storage is preferred and in the field of audio and video production, the term magnetic recording is more commonly used. The distinction is less technical and more a matter of preference.

Other examples of magnetic storage media include floppy disks, magnetic recording tape, and magnetic stripes on credit cards.

(I) Magnetic disks:

Magnetic Disk: A magnetic disk is a circular plate constructed of metal or plastic coated with magnetized material. Both sides of the disk are used and several disks may be stacked on one spindle with read/write heads available on each surface.

Bits are stored in magnetized surface in spots along concentric circles called tracks. Tracks are commonly divided into sections called sectors. Electromagnetic read/write heads are positioned by the access arms between the slightly separated disks to read and write the data on concentric, circular tracks. Data are recorded on the tracks in the pin of tiny magnetised spots to form the binary digits of common computer codes. Thousands of bytes can be recorded on each track, and there are several hundred data tracks on each disk surface, thus providing us with billions of the storage positions for our software and data.

Types of Magnetic disks:

(l) Disks that are permanently attached and cannot removed by occasional user are called ***hard disks***. (In general, hard disks are less portable than the floppies.)

(2) A disk drive with removable disks is called a ***floppy disk drive.***

Its brief explanation is as follows:

(1) Hard disk drive:

A hard disk drive (HDD) is a data storage device used for storing and retrieving digital information using rapidly rotating disks (platters) coated with magnetic material.An HDD retains its data even when powered off. Data is read in a random-access manner, meaning individual blocks of data can be stored or retrieved in any order rather than sequentially. An HDD consists of one or more rigid ("hard") rapidly rotating disks (platters) with magnetic heads arranged on a moving actuator arm to read and write data to the surfaces.

Introduced by IBM in 1956,HDDs became the dominant secondary storage device for general purpose computers by the early 1960s. Continuously improved, HDDs have maintained this position into the modern era of servers and personal computers. More than 200 companies have produced HDD units, though most current units are manufactured by Seagate, Toshiba and Western Digital. Worldwide revenues for HDD shipments are expected to reach $33 billion in 2013, a decrease of approximately 12% from $37.8 billion in 2012.

The primary characteristics of an HDD are its capacity and performance. Capacity is specified in unit prefixes corresponding to powers of 1000: a 1-terabyte (TB) drive has a capacity of 1,000 gigabytes (GB; where 1 gigabyte = 1 billion bytes). Typically, some of an HDD's capacity is unavailable to the user because it is used by the file system and the computer operating system, and possibly inbuilt redundancy for error correction and recovery. Performance is specified by the time to move the heads to a file (Average Access Time) plus the time it takes for the file to move under its head (average

latency, a function of the physical rotational speed in revolutions per minute) and the speed at which the file is transmitted (data rate).

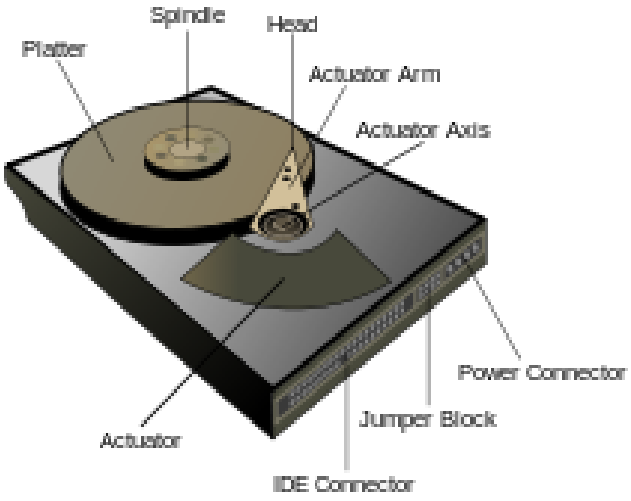
The two most common form factors for modern HDDs are 3.5-inch in desktop computers and 2.5- inch in laptops. HDDs are connected to systems by standard interface cables such as SATA (Serial ATA), USB or SAS (Serial attached SCSI) cables.

As of 2012, the primary competing technology for secondary storage is flash memory in the form of solid-state drives (SSDs). HDDs are expected to remain the dominant medium for secondary storage due to predicted continuing advantages in recording capacity and price per unit of storage; but SSDs are replacing HDDs where speed, power consumption and durability are more important considerations than price and capacity.

Hard disk drive:

A 2.5" SATA hard drive:

Diagram labeling the major components of a computer HDD:



(1) Hard disk:

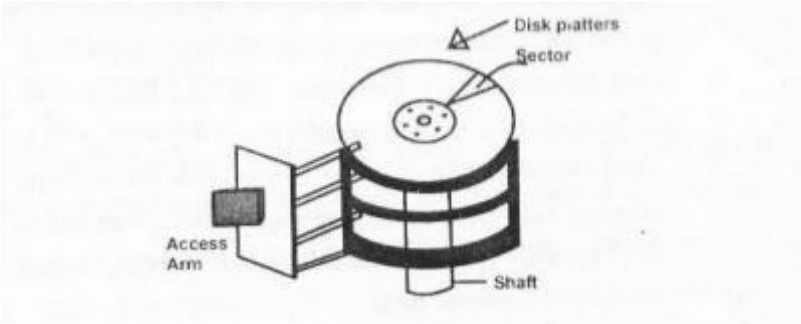
Hard disk is a magnetic disk on which we can store the computer data, and it is a metal platter with the magnetic coating on both the sides. It combines magnetic disk, access arms, and read/write heads into a sealed module. Hard disks are highly reliable and also accessing the data from the hard disk is faster and more efficient than that of the floppies.

This allows higher speeds, greater data recording density and closer tolerances within a sealed, more stable environment. Capacities of hard drives range from several hundred megabytes to many gigabytes of storage in the recent days.

A single hard disk usually consists of several ―platters‖. Each requires 2 read/write heads, one for each side. These heads are attached to a single access arm. No independent move of heads are allowed. Each platter has some number of tracks. A cylinder is the one where in the track location cuts all the platters. In general, hard disks are less portable than the floppies.

The following diagram shows about the Disk platters and Access arms in a Multiple Surface Disk Unit:

Disk platters and Access arms in a Multiple Surface Disk Unit:



The followings diagram shows about the vertical cross section of the hard disk and arm assembly.

The vertical cross section of the hard disk and arm assembly:

draw the diagram in pg. no.44 in P.Mohan Book:

Several hard disks are stacked one on the other, without touching each other, into a disk pack for large storage. A disk pack is a collection of disks stacked vertically one on top of the other and it is mounted on a disk drive. This disk pack which is housed in a metal container with a read/write head assembly unit, is fixed inside a computer permanently.

The disk drive has a head assembly with a read/write arm for each pair of the recording surfaces. Each disk has two surfaces for storage. The top surface of the first disk and the lower surface of the last disk are not used for recording as small dust particles might settle down on them. The disk drive mechanism rotates the disk pack at a constant speed. Each read/write arm has one pair of read/write head, one for each surface. To increase the speed of access, the read/write arm carries as many heads as the number of tracks on the disk.

The access-time is determined by the two factors:

- seek time, and,
- rotational delay.

Seek time:

Seek time is the time required to locate the track on the recording surface.

Rotational delay:

Rotational delay involves positioning the read/write arm at the right track of the surface for reading/writing.

Advantages of hard disks:

- They support direct-access.
- They have quick access rates.
- They have fairly large storage capacities (20 – GB to 80 – GB storage)
- Hard disks are essentially for online systems.

Disadvantages of hard disks:

- Hard disks are expensive.
- Hard disks are not always reliable.
  Example: Hard disks can crash. If they crash, data recovery is difficult and expensive.
- Speed and performance of hard disks are slower than that of CPU. Hence they slow down the overall speed of performance.

(2) Floppy disk:

A floppy disk, or diskette, is a disk storage medium composed of a disk of thin and flexible magnetic storage medium, sealed in a rectangular plastic carrier lined with fabric that removes dust particles. Floppy disks are read and written by a floppy disk drive (FDD). Floppy disks, initially as 8-inch (200 mm) media and later in 5 1⁄4-inch (133 mm) and 3 1⁄2-inch (90 mm) sizes, were a ubiquitous form of data storage and exchange from the mid-1970s well into the 2000s.[1]

By 2010, computer motherboards were rarely manufactured with floppy drive support; 3 1⁄2-inch floppy disks can be used with an external USB floppy disk drive, but USB drives for 5 1⁄4-inch, 8- inch and non-standard diskettes are rare or non-existent, and those formats must usually be handled by old equipment.

While floppy disk drives still have some limited uses, especially with legacy industrial computer equipment, they have been superseded by data storage methods with much greater capacity, such as USB flash drives, portable external hard disk drives, optical discs, memory cards and computer networks. The current trend is towards the optical disks and other small memory devices.

8-inch, 5 1⁄4-inch, and 3 1⁄2-inch floppy disks:

8-inch, 5 1⁄4-inch (full height), and 3 1⁄2-inch drives:

A 3 1⁄2-inch diskette's "floppy" magnetic material, removed from its housing:

&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&7

###333

3 1⁄2-inch, high-density diskettes affixed with adhesive labels:

8-inch floppy disk drive with diskette (3 1⁄2-inch disk for comparison):

A 31⁄2-inch floppy disk drive:

(iii) Removable cartridge:

Removable cartridges are the hard disks encased in a metal or plastic cartridge, so that, we can remove them just like a floppy disk.Removable cartridges are very fast, though, but, usually not as fast as fixed hard disks. So, hard disks are the fastest in case of the magnetic disks.

(II) Optical disk:

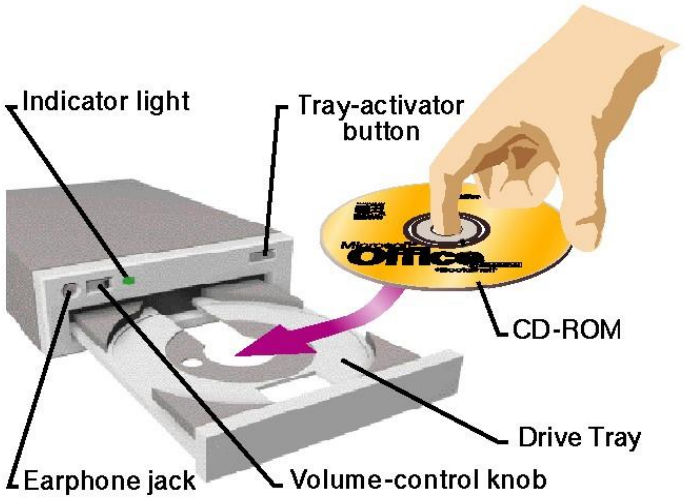
Optical disk is a storage medium from whichdata is read and to which it is written by lasers.

Optical disks can store much more data -- up to 6 gigabytes(6 billion bytes) -- than most portable magnetic media, such as floppies. There are three basic types of optical disks, namely, (i) CD- ROM, (ii) WORM, and (iii) Erasable optical (EO)

Optical disks come in three basic forms:

(i) **CD-ROM:** Most optical disks are read-only. When we purchase them, they are already filled with data. We can only read the data from a CD-ROM, but we cannot modify, delete, or write new data.

Using a CD-ROM drive



(ii) **WORM:** It stands for write-once, read-many. WORM disks can be written on once and then read any number of times; however(while writing), we need a special WORM disk drive so as to write data onto a WORM disk.

(iii) **Erasable optical (EO):** EO disks can be read to, written to, and erased just like magnetic disks.

(iv)

The following is the diagram for the Optical disk drive.

Optical disk drive:

An optical disc drive is a disk drive that utilizes electromagnetic waves or a laser light near the light spectrum in order to read and write data to or from optical discs.

Some drives can only read from discs; however, most recent drives are generally both readers and recorders. Recorders are often times referred to as burners or writers. CDs, DVDs, and Blu-ray discs are familiar examples of optical media.

Winchester disk:

Named after the .30-caliber Winchester rifle, the 3340 Winchester disk drive is a hard drive developed by IBM that had two 30MB capacity and offered a 30 millisecond (ms) access time.

What made this drive significant is the technique where the read/write heads would rise or lift off from the disk while the disk increased and lowered when the disk decelerated. This enabled the heads to not have to move off the disk each time the speed was increased or decreased. Future hard drives after the 3340 began to use this as a standard for hard drive development.

SuperDisk:

Alternatively referred to as a LS-120 and LS-240, the SuperDisk is a type of disk drive and diskette introduced by 3M, which later became Imation. The drive was mostly released in OEM computers such as Compaq and Packard Bell computers.

The original SuperDisk like that shown in the picture above was capable of holding 120 MB on a single disk that was the size of a traditional 1.44MB floppy diskette. Later SuperDisks were capable of holding 240MB on a disk.

Zip drive:

It is a Hardware data storage device developed by Iomega that functions like a Standard 1.44" floppy drive.

The fact that makes the Iomega zip drive unique, is its capability to hold up to 100 MB of data or 250 MB of data on new drives. Iomega Zip Drives became very popular in late 1990s, however, became less popular as users needed larger storage capabilities. This drive was later replaced by larger and cheaper CD- R and CD-RW drives and discs. In the picture to the above, is an example of an Iomega Zip diskette. This diskette is bigger than the standard floppy diskette and is made out of a much harder plastic.

Different types of Disks:

Paste the diagram given in Pg. no. 92 in my C.S.V.Murthy---Fig---3.12

The following diagram shows about the characteristics of storage media:

The characteristics of storage media:

Paste the diagram (table) given in Pg. no. 93 in my C.S.V.Murthy---Fig---3.14

(III) Magnetic tape:

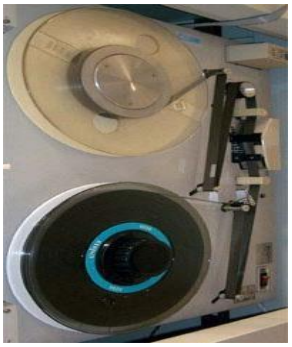
Magnetic tape is a medium for magnetic recording, made of a thin magnetizable coating on a long, narrow strip of plastic film. It was developed in Germany, based on magnetic wire recording. Devices that record and play back audio and video using magnetic tape are tape recorders and video tape recorders. A device that stores computer data on magnetic tape is a tape drive (tape unit, streamer).

Magnetic tape is a serial access storage medium. It can store large volumes of data at low costs. The conventional magnetic tape is in the reels of 3600 feet made of mylar plastic tape; the tape is 1 ½ inch in width and is coated with the magnetic material on one side. The reel of the tape is loaded on a magnetic tape drive unit. During any read/write operation, the tape is moved from one spool to the other in the same way as in the audio-cassette tape recorder.

The conventional tape is replaced by the cartridge tape, which is housed in a small box,(i.e.) Cartridge, which is more convenient to use. Thie eliminates the need to handle manually and to thread the tape for any read/write operation. The magnetic tape is densely packed with the magnetic spots in frames across its width. A frame records 1 byte and each bit in the frame can be read/written by a read/write head, for that bit position. The tape has 9 tracks, out of which 8 tracks are used as data tracks and the nineth track is used for parity bit meant for error detection. The following diagram shows about the magnetic tape:

Draw the diagram in pg. no.-45 -Fig---3.8 in P.Mohan Book

Magnetic tape:

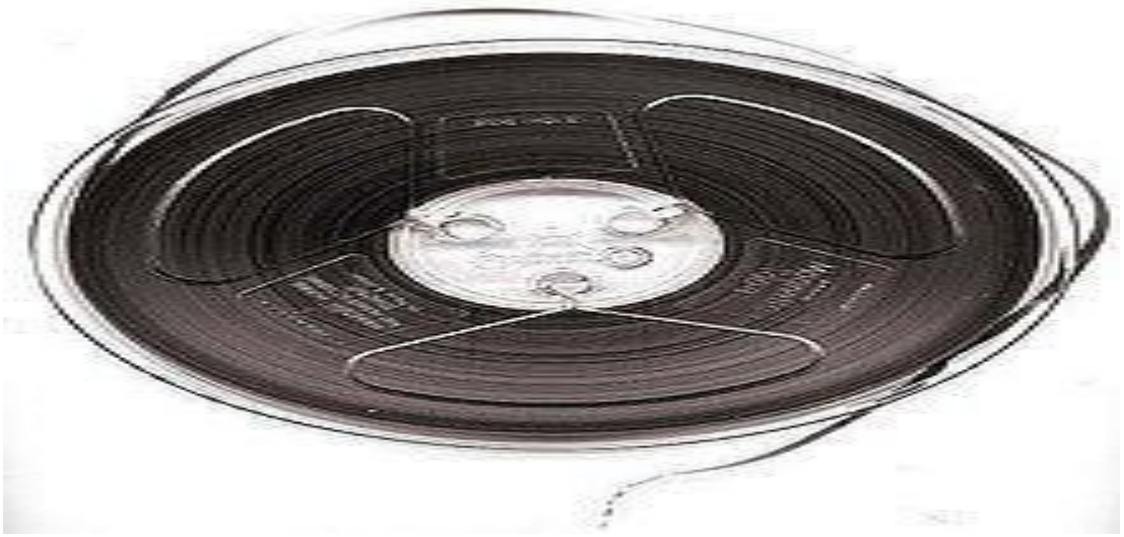


Magnetic tapes are ideally suited for the large storage for serial processing of data. They are generally used for the backing up of large volumes of data, which are required for the serial processing. They are low cost and reliable storage devices. They can store fairly large volumes of data are ideal for the

- batch processing applications,
- storing the historical data, and,
- backing up of important files.

It is also a cheap and effective secondary storage medium for ensuring security of data by backing up the data and keeping it off-the-site. Besides these, tape formats are more standardised than the disk formats, which facilitates the transfer of data between the machines. It can rapidly transfer the data to the CPU. The disadvantage is that it permits only the serial access and hence it is not suitable for many applications requiring the direct-access. With the popularity of the optical disks, storage is not of much in use now.

7-inch reel of ¼-inch-wide audio recording tape, typical of consumer use in the 1950s–70s:



Audio Recording:

Compact Cassette**:**

Video recording:

An assortment of video tapes:

The followings are the differences between the Magnetic tape and Magnetic disk:

The differences between the Magnetic tape and Magnetic disk:

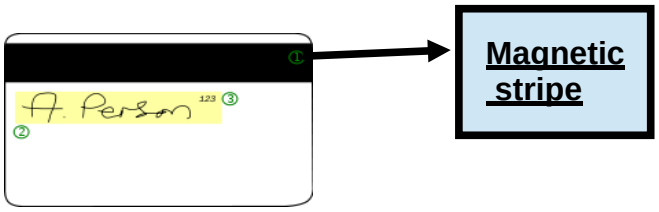
Magnetic Tape	Magnetic Disk
(1) Magnetic Tape supports only the serial access.	Magnetic disk permits the serial and random-access.
(2) Magnetic Tape has a much larger storage capacity.	When compared to the magnetic tape, the magnetic disk has a smaller storage capacity.
(3) Magnetic Tape is divided lengthwise into tracks and the data are recorded in those tracks.	In the magnetic disk, it is divided into circular tracks and sectors. Here, data are recorded in one sector fully before moving into the next sector.
(4) Magnetic Tape takes much more processing time, because of the serial access.	When compared to the magnetic tape, the magnetic disk has a smaller processing time.
(5) Accessing and updating of the online tape files are slower, when compared to the magnetic disks.	Accessing and updating of the online disk files are much faster.
(6) A number of disk files, which are affected by a single transaction have to be updated separately.	A number of disk files, which are affected by a single transaction can be updated simultaneously.
(7) Tape storage is not costlier, when compared to the disk storage.	Disk storage is costlier than the tape storage.

(IV)Magnetic stripe card:

A magnetic stripe card is a type of card capable of storing data (by how?)by modifying the magnetism of tiny iron-based magnetic particles on (on where?) a band of magnetic material on the card. The magnetic stripe, sometimes called swipe card or magstripe, is read by swiping past a magnetic reading head.

Magnetic recording on steel tape and wire was invented during World War II for recording audio. In the 1950s, magnetic recording of digital computer data on plastic tape coated with iron oxide was invented.

An example of the reverse side of a typical credit card: Circle #1 labels the Magnetic stripe:



Input Devices:

Paste the diagram(table) given in Pg. no. 96 in my C.S.V.Murthy---Fig---3.18

(1) Input Devices:

An input device is a piece of hardware that is used to enter the data into a computer.

Input devices are usually categorised as manual and automatic.

Examples of manual input devices are keyboard, mouse, touchpad, joystick, touch screen, graphics tablet, scanner, digital camera, microphone, etc.

Examples of automatic input devices are barcode readers, Optical mark reader(OMR), Magnetic Ink Character Recognition(MICR), Optical Character Recognition(OCR), Magnetic stripe readers, sensors, biometric devices, etc.

They convert data into an electronic form for data entry or through a telecommunications nework, into a computer system.

Software:

Software is a set of instructions which will make the computer to do the desired job(i.e.) controls the operations of a computer system. Software can neither be seen nor touch and feel the software like hardware. There are different types of software available; they are

(1) Application software and
(2) System software.

It is depicted in the form of the following diagram.

Paste the diagram given in pg. no.117 in my book.

Its brief explanation is as follows:

(1) Application software:

Application software, is a software which is used for carrying the specified application of the computers inorder to meet the information needs of the users.

Application software includes a variety of programs and can be subdivided into

(a) General purpose application programs, and

(b) Application specific programs

They are explained as follows:

(a) General purpose application programs:

General purpose application programs perform the common information processing jobs for the end users.

Examples:

Word processing, spreadsheet programs, database management programs and presentation graphics programs.

They significantly increase the productivity of the end users, and are sometimes known as ―productivity packages‖. Other examples include web browsers, E-Mail, and groupware, which help to support communication and collaboration among the workgroups and teams.

(b) Application specific programs:

Application specific programs are those programs which are available to support the specific applications of the end users in business and other fields.

Examples:

Business application software supports the reengineering and automation of the business processes with the strategic E-business applications like customer Relationship Management, Enterprise Resource Planning and Supply Chain Management.

Other examples are the software packages that web-enable the applications in E-Commerce or in the functional areas of the business like Human Resource Management and Accounting and Finance. Still other software, empowers the managers and business professionals with decision support tools like data mining, enterprise information portals, or Knowledge Management Systems.

(2) System software:

System software is a software that manages and supports a computer system and its information processing activities.

Example:

Operating systems and network management programs serve as a vital software interface between the computer networks and hardware and the application programs of the end users.

System software is further sub divided into

(a) System management programs, and

(b) System development programs

(a) System management programs:

System management programs are those programs that manages the hardware, software, network and data resource of the computer system, during the execution of the various information processing jobs of end users.

Examples:

Operating systems, network management programs, database management systems and system utilities. Network management programs support and manage the telecommunications acivities, and network performance telecommunications networks. Database management systems control the development, integration and maintenance of the databases. Utilities are programs that perform the routine computing functions like backing up data or copying the files, as a part of an operating system or as a separate package.

About Operating systems:

An Operating system is an integrated system of programs that manages the operations of the CPU, controls the input/output and storage resources and activities of the computer system, and also provides support services as the computer executes the application programms of the users.

The primary purpose of an operating system is to maximise the productivity of the computer system by operating it in the most efficient manner. So, an operating system minimizes the amount of human intervention during processing. It helps the application programs to perform the common operations like accessing a network, entering the data, saving and retrieving the files, and printing or displaying the output.

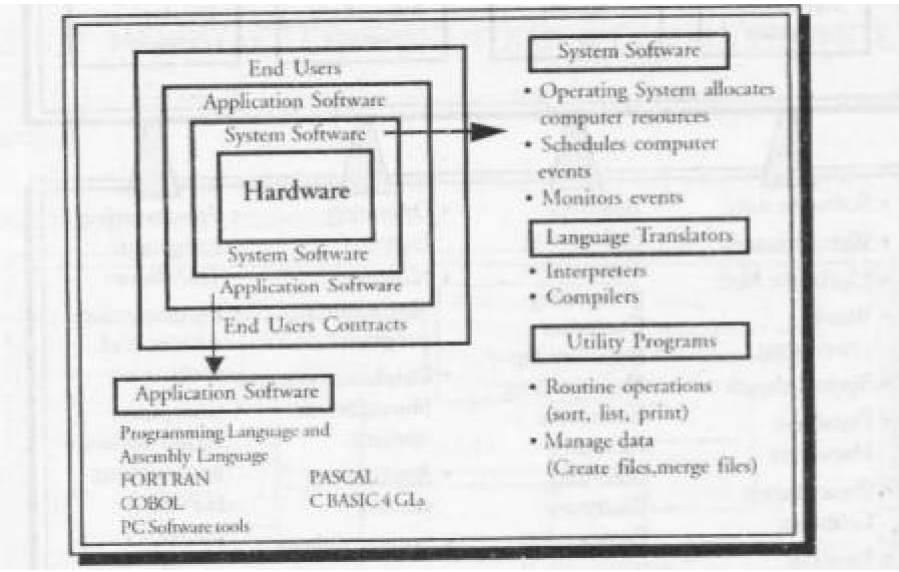
(b) System development programs:

System development programs are those programs that help the users to develop information system programs and procedures, and prepare the user programs for computer processing.

Major software development programs are programming language translators and editors, and a variety of CASE(Computer Aided Software Engineering) and other programming tools. They help the IS specialists to develop computer programs, inorder to support the business processes.

Major types of software is shown in the following diagram.

Major types of software :



Application software includes programming languages and 4GLs

To understand the computer software, we have to understand the Programming languages.

Programming languages or Computer Languages:

A language is a means for communication. Computer language is a language useful for the computer to communicate between the user and computer. Computer languages are used to give instructions to the computer about what it has to do.

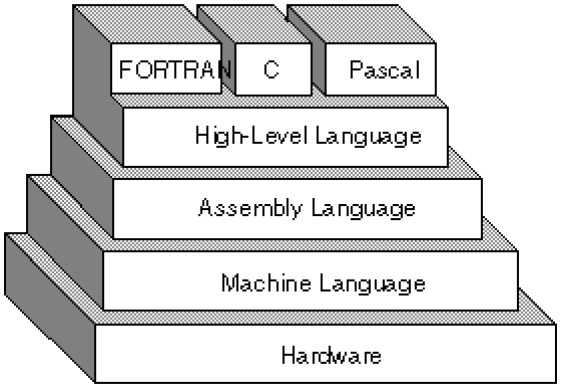
The following diagram tells us about the major types of software. Major

types of software:

Programming language:

A **programming language** is an artificial language designed to communicate instructions to a machine, particularly a computer. Programming languages can be used to create programs that control the behavior of a machine and/or to express algorithms.

Programming language is a vocabulary and set of grammatical rules for instructing a computer to perform specific tasks. It is diagrammatically represented as follows:



Its brief explanation is as follows:

(1) Machine language:

Machine language (or first generation language)is a collection of binary digits or bits that the computer reads and interprets. Machine language is the only language a computer is capable of understanding, and it is the lowest-level programming language(except for computers that utilize programmable microcode) . These are machine dependent and machine specific languages. While easily understood by computers, machine languages are almost impossible for humans to use because they consist entirely of numbers. Programmers, therefore, use either a high-level programming language or an assembly language.

Programs written in high level languages are translated into assembly language or machine language by **a Compiler**. Assembly language programs are translated into machine language by a program called **an assembler**.

(2) Assembler languages:

Assembly language(or second generation language)**)** is a low-level programming language used to interface with computer hardware. Assembly language uses structured commands as substitutions for numbers, allowing the humans to read the code easier than looking at binary. Although easier to read than binary, assembly language is a difficult language and is usually substituted for a higher language such as C. Assembler languages are frequently called "symbolic languages", because symbols are used to represent the operation codes and storage locations.

Each type of CPU has its own machine language and assembly language.. So an assembly language program written for one type of CPU won't run on another. In the early days of programming, all programs were written in assembly language. Now, most programs are written in a high-level language such as FORTRAN or C. Programmers still use assembly language when speed is essential or when they need to perform an operation that isn't possible in a high-level language.

Assembler

Assembler is a program used to convert or translate programs written in assembly code to machine code. Some users may also refer to assembly language or **assembler** language as assembler.

(3) High-level language:

High-level language(or third generation language)) is a programming language such as C, FORTRAN, or Pascal , etc. that utilises the macro instructions and statements that resemble human language. They use instructions, which are called statements, that use brief statements or arithmetic expressions. The syntax(vocabulary, punctuation and grammatical rules) and the semantics(meanings) of such statements do not reflect the internal code of any particular computer. The main advantage of high-level languages over low-level languages is that they are easier to read, write, and maintain. Ultimately, programs written in a high-level language must be translated into machine language by a compiler or interpreter. They are easier to learn and program, than an assember language, because, they have less rigid rules, less forms and less syntaxes.

But, however, high-level language programs are usually less efficient, than the assenbler language programs, and also require a greater amount of computer time for the purpose of translation into machine instructions.

The first high-level programming languages were designed in the 1950s. Now there are dozens of different languages, including Ada, Algol,, BASIC, COBOL, C, C++, FORTRAN, LISP, Pascal, and Prolog.

(3) Fourth-generation language:

Fourth-generation language is Often abbreviated 4GL(fourth-generation language) are programming languages closer to human languagesthan typical high level programming languages, and are more non-procedural and conversational than the other languages. Most n
$GLs are used to access databases. For example, a typical 4GL command is FIND ALL RECORDS WHERE NAME IS "SMITH".

The other four generations of computer languages are

- **first generation: Machine language**
- **second generation: Assembler language**

- **third generation: High-level programming languages, such as C, C++, and Java**

- **fifth generation: languages used for Artificial intelligence and Neural networks**

Some advanced 4GLs help in writing the programs using input and output forms and menus and icons, even, without writing the code. Here, the software creates the Source code((i.e.) a program as originally written), in the background. In today's large data volume environment, 4GLs are widely used and also no longer viewed as a trade off, between ease of use and flexibility.

The following diagram shows about translation to machine language.

About translation to machine language:

Paste the diagram given in pg. no. 123 in my book.

(5) Object Oriented Languages:

Object Oriented Programming(OOP) Languages like Visual Basic, C++, Java, etc. are considered to be fifth generation languages, and also have become major tools of software development. Briefly, while most of the other programming languages, separate the data elements from the procedures or actions, which will be performed upon them, OOP languages tie them together into objects. Thus, an "Object" consists of data and actions, which can be performed upon the data. Orelse, an object could be data in the graphic form such as a video display window plus, the display icons, which might be used upon it.

Object Oriented Languages are easier to use and more efficient for programming the Graphics oriented User Interfaces, required by many applications. So, they are very popular nowadays. Also, once the objects are programmed, they are reusable, and so, reusability is one of the major benefits of the Object Oriented Languages. Most OOPs Packages provide a GUI, which supports a "point and click", "drag and drop", visual assembly of the objects known as "visual programming".

The following figure shows about the "Evolution of Programming Languages".

Evolution of Programming Languages:

Paste the diagram given in pg. no. 119 in my book.

IMPORTANT QUESTIONS TAKEN FROM THE VARIOUS QUESTION PAPERS:

Section – A:

1. Define computer.
2. What is the function of CPU?
3. Distinguish between microcomputers and microprocessor.
4. What is meant by secondary memory?
5. What is System Software?
6. Define database.
7. What is meant by data warehousing?
8. What is Data resource management?
9. What is Distributed database?
10. Expand OOPL.
11. What is DBMS?
12. What is file management?
13. What is a high level language?
14. What is Desk top publishing?
15. What is meant by Primary key?

Section – B:

1. What are the different classes of computer?
2. Explain different types of Application software.
3. What are the different types of languages?
4. What are the objectives of database approach?
5. What are the benefits of DBMS?
6. Discuss the characteristics and functions of DBMS.
7. Discuss the characteristics of data warehouses.
8. What are the differences between an assembler, compiler and interpreter?
9.

Section – C:

1. What is DBMS? Explain RDBMS with suitable example.
2. Mention the various types of databases used in a computer organization.
3. What is network data model? What are its advantages and disadvantages?
4. Explain the hierarchical structure of DBMS with its advantages and disadvantages.
5. Differentiate between File mangement and database management.
6. Explain DBMS with its five models.
7. What is file? Explain the different methods of file organization?

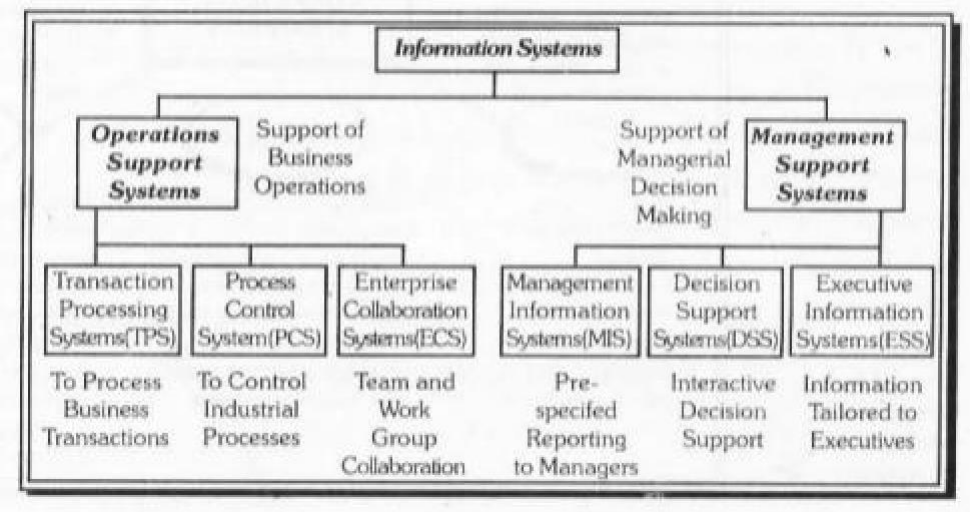
UNIT – 4

SUBSYSTEMS OF MIS:

Information System:

Information System is an organised combination of people, hardware, software, communication networks and data resource technologies.

Conceptual Classification of Information System(IS):



Its brief explanation is as follows:

(i) Operations Support Systems(OSS):

Operations Support Systems(OSS) is an information system necessary to process the data which are generated by, and which are used in, the business operations.

OSS collects, processes, and stores the data generated by the operation systems of an organisation, and produces the data and information for inputting into a Management Information System, or, for the control of an operations system.

Meaning of Operations System: Operations System is a basic sub system of a business firm, that constitutes its input, processing and output components. It is also called a Physical system.

The following are the important roles or examples of OSS.

(1) Transaction Processing System(TPS):

Transaction Processing System(TPS) records or process the data resulting from the business transactions(i.e.) it records and process the business transactions and it supports the day to day operations.

Examples:

3) Order – entry system,
4) Cheque processing system,
5) Accounts receivable system,
6) Accounts payable system,
7) Payroll system,
8) Ticket reservation system, etc.

Transaction Processing System(TPS) is the oldest type of information system and can be called as the ―work horse‖ in the industry of IS, for the last 50 years. Generally, transactions are processed in the following 2 basic ways.

- (a) Online Batch Transaction Processing, and,
- (b) Online Realtime Batch Transaction Processing(OLRTP)

They are explaned as follows:

(a) Online Batch Transaction Processing:

Online involves a direct connection between the operator and the TPS program, and so they provide immediate results.

In case of Batch Processing, transactions are grouped together and processed periodically as a unit.

Example: We can take the case of Cheque processing system in a bank. Here, all the cheques which are received in a particular time frame, say, on a particular day, are first grouped together. Then, they are sorted out by the account number and processed in a batch.

(b) Online Realtime Transaction Processing(OLRTP):

Real time processing means that, not only the input data is processed immediately, but, the output results are available fast enough so as to meet the immediate information needs of the end-user.

Here, data are processed immediately after a transaction occurs.

Example: Airlines enquiry for ticketing, railway ticketing, point-of-sale(POS) systems at many retail stores use electronic cash register terminals to electronically capture and transmit the sales data over the telecommunications links to the regional computer centers for the immediate(real-time) or nightly(batch) processing.

(2) Process Control Systems(PCS):

Process Control Systems(PCS) monitors and controls then physical processes.

Example: In case of petroleum refineries, it uses some electronic sensors linked to the computer monitor of the chemical process and, so, real time(immediate) adjustments are made to control the refinery processes.

(3) Enterprise Collaboration Systems(ECS):

Enterprise Collaboration Systems(ECS) is an information system that creates, processes, stores, modifies, displays and communicates the business correspondence, in the written, verbal or video form, among the individuals, work groups and organisations, so as to enhance team and work group communications and productivity. Enterprise Collaboration Systems(ECS) is sometimes called OAS – Office Automation Systems. The followings are some examples.

Examples:

- Usage of E-Mails to send and receive the electronic messages,
- Video conferencing to hold the electronic meetings, etc.

(ii) Management Support Systems(MSS):

Management Support Systems(MSS) is an information system that provides information and support for the effective managerial decision making by the managers. Providing information and support for the effective decision making by all type of managers and business professionals is a difficult task and all the applications when it is focussed on the above are called Management Support Systems(MSS).

The following roles are played by the major categories of MSS.

(1) Management Information System(MIS):

Management Information System(MIS) provides information in the form of reports and displays them to the managers and business professionals to support business decision making. Management Information System(MIS) is the study of information system focusing on their use in business and management.

Examples: Sales analysis, production performance, cost-trend reporting systems, etc.

(2) Decision Support Systems(DSS):

Decision support system (DSS) is a set of expandable, interactive IT techniques and tools designed for processing and analyzing data and for supporting managers in decision making. To do this, the system matches individual resources of managers with computer resources to improve the quality of the decisions made.

Decision support system (DSS) provides interactive and adhoc support for the decision making process of the managers and the other business professionals

Examples: Product pricing, profitability forecasting, risk analysis systems, etc.

(3) Executive Information Systems(EIS or ESS):

Executive Information Systems(EIS or ESS) provides the critical information from many sources, which are tailored according to the information needs of the top management or senior executives. ESS is the newest.

Examples: Systems for easy access to the analysis of business performance, competitor's actions, economic development to support the strategic planning, etc.

The following table shows about the comparison of OSS and MSS:

Comparison of OSS and MSS:

Information Systems					
Operations Support Systems			*Management Support Systems*		
TPS	***PCS***	***ECS***	***MIS***	***DSS***	***EIS***
Process data resulting fr-om business transactions, update operational databases, produce business documents	Monitor and control industrial process	Support team, workgroup and enterprises. Communi-cation and collaboration	Provide information in the form of pre-sepecified reports and displays to support business decision making	Provide interactive ad hoc support for the decision-making process of managers and other business professionals	Provide critical information from many sources tailored to the needs of executives
Eg:- Sales and Inventory Processing, Accounting Systems	Petroleum refining, power generation, steel production, phama-ceuticals	e-mail, chat, video-conferencing, group ware systems	Sales analysis, production, performance, cost trend reporting systems	Product pricing, profitability forecasting, risk analysis systems	Systems for easy access to analysis of business performance, competitors actions, economic development to support strategic planning

Other classifications of Information Systems:

- Expert System(ES)
- Knowledge Management System(KMS)
- Strategic Information System(SIS)
- Business Information System(BIS)
- Integrated Information System

Its brief explanation is as follows:

(1) Expert System(ES):

Expert System(ES) is a computer based information system in which knowledge is presented in data, in which the processing of that knowledge is directed, primarily by the computer programs. Expert advice for the managerial decision making is provided by the Expert Systems.

An Expert System captures the expertise of an expert or a group of experts in a computer based information system and thus, it can outperform a single human expert in many problem situations. An Expert System can have the knowledge of several experts and does not get tired or distracted by the overwork or stress. An Expert System can preserve and reproduce the knowledge of experts.

They allow a company to preserve the expertise of an expert, before he leaves the organisation, and this expertise can then be shared, by reproducing the software and knowledge base of the expert system. They build a knowledge based database for the organisation.

(2) Knowledge Management System(KMS):

Knowledge Management System(KMS) is a computer based information system for organising and sharing the diverse forms of business information created within an organisation.

Simply, Knowledge Management is the set of processes developed in an organisation to create, gather, store, maintain, and disseminate the firm's knowledge. It includes

(a) managing the project and enterprise document libraries, (b) discussion database,

(c) hypermedia website database, and other types of knowledge bases. Success KMS creates techniques, technologies, systems, rewards, etc. For geeting the employees to share, what they know and to make better use of accumulated work place and enterprise knowledge. Knowledge Based Information Systems (KBIS) adds a knowledge base to the major components found in the other types of computer based information systems(CBIS).

(3) Strategic Information System(SIS):

Strategic Information System(SIS) is a computer based information system which provides a firm with the application of IT to a firm's competitive products ans services to help to achieve their strategic advantage over its competitors in the marketplace.

Example:

- Online stock trading,
- Shipment tracking, etc.

(4) Business Information System(BIS):

Business Information System(BIS) is a computer based information system within a business organisation which support one of the traditional functions of business like marketing, finance or production. This can be either Operations Information System or Management Information System.

(5) Integrated Information System:

Integrated Information System is the integrated combination of several types of information systems mentioned above.

This conceptual classification of Information Systems(IS) are designed to emphasise many different roles of Information Systems(IS). These roles are integrated into composite or cross functional information systems which provide a variety of functions.

Transaction Processing System(TPS):

(1) Transaction Processing System(TPS):

Transaction Processing System(TPS) records or process the data resulting from the business transactions(i.e.) it records and process the business transactions and it supports the day to day operations.

Examples:

9) Order – entry system,
10) Cheque processing system,
11) Accounts receivable system,
12) Accounts payable system,
13) Payroll system,
14) Ticket reservation system, etc.

Transaction Processing System(TPS) is the oldest type of information system and can be called as the ―work horse‖ in the industry of IS, for the last 50 years.

An event occurs in the business world. It can be a request for a ticket to a dance program or a music program or the presentation of a cheque for the payment. This event is recorded by keying it into the computer system as transaction.

Transaction: Transaction is a representation of an event.

Transaction processing program:

Transaction processing program is a computer program, which process a transaction against TPS data.

TPS program generates 2 types of outputs:

- It sends back the messages back to the operator terminal.
- It generates the printed documents.

Example:

A ticket reservation system, displays the message back to the operator terminal indicating the seats sold out to the people. It generates printed document like printed tickets, and perhaps a mailing label for sending them.

The following diagram shows about the architecture of a generic TPS application:

The architecture of a generic TPS application:

(d) Inquiry processing

(e) Database maintenance

Types of TPS:

Two fundamental types of TPS are

- Online transaction processing
- Batch transaction processing

Generally, transactions are processed in the following 2 basic ways.

- (a) Online Batch Transaction Processing, and,
- (b) Online Realtime Batch Transaction Processing(OLRTP)

They are explained as follows:

(a) Online Batch Transaction Processing:

Online involves a direct connection between the operator and the TPS program, and so they provide immediate results.

In case of Batch Processing, transactions are grouped together and processed periodically as a unit. All the data are accumulated into batches and processed periodically. The following diagram shows about the architecture of a Batch Transaction Processing Application.

The architecture of a Batch Transaction Processing Application:

Paste the diagram in pg. no. 194 in my book—Fig-4.4

All the transactions are based into a transaction file. Then the entire batch is read in order, by the TPS program. This program reads the stored data, often called the old master file data, process those transactions and creates the new master file. In this process it generates reports. Inorder to match those transactions with the master file records, the master file record is shown in the same way, that, the transactions are sorted.

Example: We can take the case of Cheque processing system in a bank. Here, all the cheques which are received in a particular time frame, say, on a particular day, are first grouped together. Then, they are sorted out by the account number and processed in a batch.

The old master file, which is also sorted by the account number, contains the customer checking account data from the prior period. This data is updated to create a new customer master file.. Here, the outputs may be overdrawn accounts, monthly summaries, suspicious activity, etc.

Similar characteristics which exist in many of the firms are;

(a) High volume of transaction noticed,

(b) Similar transactions,

(c) Procedures for processing the transactions are well understood and can be described in detailed.

(d) Few exceptions to the normal procedure occurs.

So, routines can be established for handling those transactions.

Online Transaction Processing(OLTP) :

Online Transaction Processing(OLTP) involves a direct connection between the operator and TPS program. They provide immediate results. They are used to process a single transaction at a time.

Example:

An order arrives by a telephone call; it is processed at that moment itself, and the results are produced. TPS program is to read the data about the ticket reservations in the order that the customers are requesting them, and, not in the same order in which they are stored on the file.

(b) Online Realtime Transaction Processing(OLRTP):

Real time processing means that, not only the input data is processed immediately, but, the output results are available fast enough so as to meet the immediate information needs of the end-user. It is often called online processing, since the online capability is required in OLRTP. Advances in the computer software and hardware have made a real time capability applicable to many functions of the modern information systems. Here, data are processed immediately after a transaction occurs.

Example:

Airlines enquiry for ticketing, railway ticketing, point-of-sale(POS) systems at many retail stores use electronic cash register terminals to electronically capture and transmit the sales data over the telecommunications links to the regional computer centers for the immediate(real-time) or nightly(batch) processing.

The following diagram shows about real time processing(for the sales transaction processing).

Real time processing(for the sales transaction processing):

Paste the diagram in pg. no. 196 in my book—fig4.5

Time sharing:

One form of online processing allows the concurrent use of a computer by means of a group of individuals. Here, nany users share the computer resoures at the same time. Schools often adopt time sharing systems, so as to support their school curriculum.It allows many students concurrent access to the same computer.. A student can create on online link to the computer using a device called ― a terminal‖, with a keyboard for inputting the data and a TV screen for the output data. This online use to the computer may use a leased line or a regular telephone line. The students received a set of instructions on, how to use that terminal and create the online link.

Remote Processing Systems:

Remote Processing is processing at a distance. Real time processing is an example of this, as its orientation is remote.

Management Information System(MIS):

Meaning of MIS:

MIS is a Management Support System (MSS – is an information system that provides information to support managerial decision making) that produces prespecified reports, displays and responses on a periodic, exception, demand, or push reporting basis. MIS is the study of information system focusing on their use in business and management.

Definition of MIS:

According to Davis and Olson,‖MIS is an integrated user-machine system for providing information to support the opertions, management and decision making functions in n organisation. This system utilises computer hardware and software, manual procedures, models for analysis, planning, control and decision making, and database‖.

Two contemporary approaches found in MIS are

(a) Technical approach

(b) Behavioural approach

(a) Technical approach:

Technical approach consists of

7. **Computer Science:** Computer Science is for establishing the theories of computability, methods of computation, methods of efficient data storage and access.
8. **Management Science:** Management Science is for the development of models for decision-making and management practices.
9. **Operation Research:** Operation Research is related to the mathematical techniques for optimisation of the selected parameters of organizations covering transportation, inventory control, and transaction costs.

(b) Behavioural approach:

Behavioural approach is concerned with the behavioual issues that arise in the development of long term maintenance of Information System. The issues are raised by Sociology, Economics, and Psychology.

Two approaches found in MIS are shown diagrammatically as follows:

Two approaches found in MIS:

Paste ths diagram in pg. no. 198 in my book.

Four major components of MIS:

- **Data Gathering:**

Data pertinent to the operations of the organization are gathered from both the internal and external sources.

- **Data Entry:**

The above data is inputted and stored in databases as the information processing core of the system.

- **Data Transformation:**

Data is transformed into useful information through the application of computer software programs and also the judgements are made by the technical support staffs and other system users.

- **Information utilization:**

The useful information is retrieved as needed by the management and technical personnel, and also applied to a wide variety of decisions related to the conduct of the organizational operations.

Objectives of MIS:

Goals of an MIS are to implement the organizational structure and dynamics of the enterprise for the purpose of managing the organization in a better way and capturing the potential of the information system for competitive advantage.

Following are the basic objectives of an MIS:

(10) **Capturing Data:** Capturing contextual data, or operational information that will contribute in decision making from various internal and external sources of organization

(11) **Processing Data:**The captured data is processed into information needed for planning, organizing, coordinating, directing and controlling functionalities at strategic, tactical and operational level. Processing data means:
   (1) making calculations with the data
   (2) sorting data
   (3) classifying data and
   (4) summarizing data

(12) **Information Storage:** Information or processed data need to be stored for future use.

(13) **Information Retrieval:** The system should be able to retrieve this information from the storage as and when required by various users.

(14) **Information Propagation: I**nformation or the finished product of the MIS should be circulated to its users periodically using the organizational network.

Characteristics of MIS:

Following are the characteristics of an MIS:

- MIS is management oriented
- Management directed
- Integrated system.

- Avoids redundancy of data storage.
- Common data flow
- Heavy planning element
- Subsystem concepts
- Common data base
- Flexibility and ease of use
- Computerization.

Manual Vs computerized systems:

• **MANUAL**	• **COMPUTERIZED**
• Oldest system	• Uses computer hardware & software to perform its data processing.
• People receive input by seeing or hearing.	• MIS is an integrated user-machine system and utilizes computer hardware software along with manual procedure.
• Data processing and storing are done thro' brain, Brain acts as control and logic unit.	• Computer information system consists of people, data, program, procedures. •
• Output will be oral or written report.	• Computer serves as communication device to obtain data or information from other computers.
• Human process is unreliable process • Human mind is slow in performing calculations.	• Computer can present information by producing tables, reports, chart, graphs and formatted documents. •
• Planning and decisions, data processing is difficult to handle. •	•

Characteristics of Computerized MIS:

Following are the characteristics of a well-designed computerized MIS:

- It should be able to process data accurately and with high speed, using various techniques like operations research, simulation, heuristics etc.

- It should be able to collect, organize, manipulate and update large amount of raw data of both related and unrelated nature, coming from various internal and external sources at different periods of time.
- It should provide real time information on ongoing events without any delay.
- It should support various output formats and follow latest rules and regulations in practice.
- It should provide organized and relevant information for all levels of management: strategic, operational and tactical.
- It should aim at extreme flexibility in data storage and retrieval.

MIS Need for Information Systems:

Managers make decisions. Decision making generally takes a four-fold path:

(6) Understanding the need for decision or the opportunity
(7) Preparing alternative course of actions
(8) Evaluating all alternative course of actions
(9) Deciding the right path for implementation

MIS or Management Information System is an information system that provides information in the form of standardized reports and displays for the managers. MIS is a broad class of information systems designed to provide information needed for effective decision making.

Data and information created from an accounting information system and the reports generated thereon is used to provide accurate, timely and relevant information needed for effective decision making by managers.

Management information systems provide information to support management decision making, with the following goals:

- Pre-specified and preplanned reporting to managers
- Interactive and ad-hoc support for decision making
- Critical information for top management

MIS is of vital importance to any organization, because:

- It emphasizes on the management decision making, not only processing of data generated by business operations
- It emphasizes on the systems framework that should be used for organizing information systems applications.

Evolution of MIS:

Attributes for evolution:

(11) Growth of management theory and techniques.
(12) Growth of management accounting and its application in business.
(13) Change in the production and distribution methods and consequent changes in the organization structure.
(14) Development of management science
(15) Introduction of computer into business data processing and development of information technology.

Evolution of various computer based Information system

Electronic data processing (EDP) - 1950s to 1960s
It includes transaction processing, record keeping, accounting and other EDP applications

Management reporting - 1960s to 1970s:
It deals with Management Information System(MIS)

Decision support - 1970s to 1980s:
It deals with Decision Support System(DSS)

Strategic end user support - 1980s to 1990s:
It includes

End user computing system
Executive information system
Expert system
Strategic information system

- **Enterprise and global internet working - 1990s to 2000s:**

It includes Internet worked information system.

MIS Functions:

paste the diagram in pg. no.--212 in my book--------fig-4.11

Information Generators:

paste the diagram in pg. no.--211 in my book

Information System Support:

Information Systems can improve the product in 2 basc ways as follows:

- Improving the product quality,
- Improving the product delivery.

Supports of IS:

paste the diagram in pg. no.--214 in my book---fig - 4.13

Simply the supports also can be sai at the 3 management levels, namely,

- Support for Strategic Advantage,
- Support for Managerial Decision-making,
- Support for Business Operations.

Difference between TPS and MIS:

- MIS are conceptually a level above transaction processing application. They are not concerned with day to day operations, but rather concerned with activities that do support operations. Examples : TPS : takes orders and print tickets
- Measures and reports the performance of each of the agents who will sell tickets. It keeps track of the number and amount of each agent's sales and it regularly produce reports about gent's effectiveness. Ex. MIS.

Information Resource Management (IRM):

This is an IS management concept that organizes the management and mission of the IS functions into five major dimensions, as follows:

Five major dimensions:

paste the diagram in pg. no.--217 in my book ---fig--4.16

Information Frame work:

3 popular framework are:

- Simon's framework
- Robert Anthony framework
- Gorry and Scott Morton's framework.

Simon's Framework:

Delineated by Robert Anthony

- Different types of planning and control.
- Planning ---deciding what to do?
- Control---assuring desired results are obtained

Three levels:

> Operational control

> Management control

> Strategic planning

Robert Anthony's frameworks:

Robert Anthony has given 3 layers of management as follows:

paste the diagram in pg. no.--220 in my book ---fig--4.18

Strategic planning is the process of deciding on the objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use and disposition of these resources.

Management control is the process by which the managers assure that these resources are obtained and use effectively and efficiently, in the accomplishment of the organization's objectives.

Operational control is the process of assuring that specific tasks are carried out effectively and efficiently.

Robert Anthony's framework of Planning and control:

paste the diagram in pg. no.--221 in my book ---fig--4.19

Gorry & Scott-Morton's Framework:

Classification	Operational control	Management control	Strategic planning
Structured	Order processing , accounts payable	Budgets , personnel reports	Warehouse/location,
Semi structured	Inventory control, production planning.	Analysis of variance.	Introduction of new product.
Unstructured	Cash management	Management of personnel	Planning for R&D

Decision Support System(DSS):

(2) Decision Support Systems(DSS):

Decision support system (DSS) is a set of expandable, interactive IT techniques and tools designed for processing and analyzing data and for supporting managers in decision making. To do this, the system matches individual resources of managers with computer resources to improve the quality of the decisions made.

Decision support system (DSS) provides interactive and adhoc support for the decision making process of the managers and the other business professionals

Examples: Product pricing, profitability forecasting, risk analysis systems, etc.

MANAGERIAL DECISION MAKING PROCESS

Managerial decision making is a process of intelligence, design and choice activities that result in the selection of a particular course of action.

DEFINITION OF DSS:

Scott Morton defined –DSS as an Interactive computer based system, which helps decision makers utilized data and models to solve unstructured problem.

Example of DSS:

A strike is conducted by the Dancer's union and so, this strike forces the **cancellation of dance performances arranged.** So, their **management of the dance association** wants to know the **impact on the revenue because of the cancellation of each performance.** Inorder to get this information, a DSS could be used **to process the data of the ticket agencies.**

ARCHITECTURE OF DSS APPLICATIONS:

paste the diagram in pg. no.--224 in my book ---fig--4.22

Its brief explanation is as follows:

Data from the organization, TPS MIS applications are input to the DSS programs, along with the data from the external sources and DSS model data. DSS may store and later reprocess its own model data as well. The user interacts with the DSS online, requests are made, models are created or adjusted and the data is manipulated etc. The outputs of DSS program can be either text, structured reports or graphics.

DSS uses different types of models as follows:

DSS MODELS

Behavioral Model	Management Silence Model	Operations Research Model (OR)
Focus is on studying/understanding the behaviors trends amongst the variables. Decision could be arrived based on behavior relationship E.g.: trend Analysis, Forecasting, Regress Analysis	Developed based up on the principles of management, Management Accounting and Econometrics etc. Eg: Budgetary system , cost accounting, Inventory management etc	• Basically application of mathematical formula for arriving at optimum solutions. • Mainly mathematical model. • Represent real life problem situations. • Linear programming ABC analysis , MRP etc

Characteristics of decision support system:

- Ability to support the solution of complex problems:
- Fast response to unexpected situations that result in changed inputs:
- Designed to help support decisions that are formulated as semi-structured, complex problem:
- May be constructed to support one time decisions:
- DSS is typically designed for either a particular decision maker or a group of decision makers:
- Allows the decision-maker to interact in a natural manner due to the careful design of the interface.
- DSS generator can be used.
- It is a way to organize information intended for use in decision-making:
- Consistent and objective decision.

(10) Facilities communications.

Component of DSS Programs:

- **Dialogue management :**

It has 3 subsystems.

1st The user interface subs (it control the appearance if the screen accepts input from the user and displays the results.)

2nd Dialogue control subsystem maintains a processing context with the user.

3rd Model management subsystem (the command processor receives the commands from the dialogue management and delivers the commands to either the model base or model execution system).

- **Data Base management:**

(g) Stores and manipulates the data base

(h) It maintains an interface with data sources that are external to DSS , TPS.

(d) **DSS Software System:**

- This permits easy interaction between the users of the system and the DSS data base and DSS model base
- Provides a graphic, easy to use, flexible user interface.

Examples of DSS Application

(c) Airline DSS: (AAIMS) American Analytical Information Management System --- helps managers and analysts decide how much to overbook, and how to set prices for each seat so that a plane is filled up and profits are maximized. Management deal with more than 250 decision variables

(d) Real Estate DSS: To do the complex analysis of investment in commercial real estate (deal with income, expense, and cash flow projections).

Real plan can forecasts of property values up to 40 years into the future.

- **Geographic DSS:**

A geographic information system is a DSS that constructs and displays maps and other graphics displays that support decisions affecting the geographic distribution of people and other resources (to choose new retail store locations, optimize distribution, target audiences).

Four analytical modeling activities:

(3) What-if analysis: an end user make changes to variables, or relationships among variables, and observes the resulting changes in the values of the other variables.

(4) Sensitivity analysis: the value of only one variable is changed repeatedly, and resulting changes on other variables are observed.

(5) Goal seeking analysis: sets a target value for a variable and then repeatedly changes other variables until the target value is achieved

(6) Optimization analysis: the goal is to find the optimum value for one or more target variables, given certain constraints. Then one or more other variables are changed repeatedly, subject to the specified constraints, until the best values for the target variables are discovered. (What the best amount of advertising to have, given out budget and choice of media?)

Limitations of DSS:

- Small memories and limited storage capacities,
- It is slow compared to speed of large mainframes.
- Most of the DSS are designed for individual use

Comparison of DSS with MIS:

POINTS	MIS	DSS
Focus	On structured task and routine decisions	On semi-structured task, requiring managerial judgment
Emphasis	On data storage	On data manipulation
Data Access	Offers indirect access by managers	Direct access by managers
Reliability	On computer expert	On managers own judgments
Access to Data	Possibly requiring a wait for managers turn and data	Direct access to computer
Understanding the nature of decision	MIS manager not understands completely	Manager understand knowing decision environment
Emphasis	On efficiency	On effectiveness

- The hardware
- The user system interface.

Its is diagrammatically shown as follows:

paste the diagram in pg. no.--230 in my book----fig--4.24

type as per pg. no. 230 in my book.

MIS IMPORTANT QUESTIONS:

UNIT – 4:

Section - A:

1) What is DSS?
2) What is meant by GDSS?
3) What is ESS?
4) What is LAN?
5) Define ES.
6) What is meant by Report processing?
7) What is meant by flowchart?
8) What is simulation?

Section – B:

1) What is TPS? Give Examples.
2) What is DSS? What are the various components of DSS?
3) Explain with the help of a suitable diagram the transaction processing cycle.
4) Explain the characteristics of DSS.
5) What is DSS? Differentiate from GDSS?
6) Explain the functions of DSS applications.
7) Distinguish between DSS and MSS.
8) Highlight the importance of GDSS.
9) Write a note on ES?
10) Explain the structure of ES.
11) What is groupware system?
12) What is an ES? How does it differ from the other decision support systems? Explain.
13) What are the advantages and limitations of ES?

Section – C:

1) What is the importance of TPS?
2) What are the advantages and disadvantages of DSS?
3) Explain GDSS and Video conferencing.
4) What is the difference between an Expert system and a Decision Support system(DSS)? Discuss briefly the various classes of DSS?
5) Compare and contrast different types of decisions found in an organization at different levels.
6) Explain system and subsystem concepts? Explain their characteristics.

UNIT – 5

INFORMATION SUBSYSTEMS AND ORGANIZATION

ENTERPRISE RESOURCE PLANNING:

Meaning of enterprise:

Enterprise is a group of people with a common goal, and it has certain resources at its disposal to achieve that goal.

Resources:

Resources are the assets of an enterprise that are assigned to the activities and used in the process of producing an output, products or services.

Example: Men, money, materials, etc.

Enterprise Resource Planning(ERP):

ERP is an integrated cross functional software that reengineers manufacturing, Finance, human resources and the other basic business processes of a company to improve its efficiency, agility, and profitability. Cross functional information systems are the information systems which are the integrated combinations of the business information systems. Sharing the information resources across the functional units of an organization, is the main function of ERP.

The meaning of ERP is diagrammatically shown as follows:

Paste the diagram in pg. no.263 ---fig-5.2 of my book.

Enterprise Systems:

Integrate the key business processes of a firm into a single software, so that the information can flow seamlessly throughout the organization, improving coordination, efficiency and decision making.

ERP software typically consists of:

7) Integrated modules that give a company a real-time cross functional view of its core business processes, like,
8) Production
9) Sales
10) Order processing
11) and its resources like
cash,

raw materials,

production capacity

people.

The following diagram shows about the ―Disparate Information System‖.

Disparate Information System:

Paste the diagram in pg. no.263 fig-5.3 in my book.

Uses of ERP:

- Ideal for manufacturing industry
- All functions for planning managing core businesses like sales management,finace management, accounting and financial affairs
- Eliminating complex, expensive links between computer system.

Application of Enterprise:

- ERP:

- Supply chain (purchasing , manufacturing , shipping and billing)

ERP: ERP is also called Enterprise Application. ERP is an integrated cross functional software that reengineers manufacturing, Finance, human resources and the other basic business processes of a company to improve its efficiency, agility, and profitability. Cross functional information systems are the information systems which are the integrated combinations of the business information systems. Sharing the information resources across the functional units of an organization, is the main function of ERP.

Supply chain (purchasing , manufacturing , shipping and billing)

ERP system designers take a system approach to an enterprise. They regard all the business processes like purchasing, manufacturing, shipping and billing, as a chain consisting of main and support activities

ERP is therefore said to support SCM making it easier to make minor modifications to suit a company's business processes.

Characteristics of ERP:

- Flexible ERP: companies who installed ERP systems pressured software vendors to adopt more open, flexible , standards based software architectures

- Web Enable ERP software: for the reason of internet web enabled ERP was developed

Firm Structure and organization.

- To create more disciplined organization.
- Cross functional coordination and information flowing freely across business functions.

Management Process

- ERP automates many internal business transactions
- Information supplied by an enterprise is structured around cross functional business processes and it can be obtained rapidly.

Technology platform

Business capability

- ERP Can help create the foundation for a customer driven or demand organization. The entire organization efficiently respond to
- Customer requests for products or information.
- Forecast new products.
- Build and deliver them as demand requires.

Disadvantages of ERP:

- **Daunting implementation:**

It requires not only deep seated technological changes but also fundamental changes in the way the business operates.

- **Large initial cost.**

- **Inflexibility**

- **Failure to achieve strategic benefits.**

If the standard ERP software do not allow the firm to use unique business processes needed by the company to gain competitive advantage over competitors.

Objectives of ERP System:

Paste the diagram in pg. no.-276 in my book ------ Fig-5.13

ERP technologies:

Paste the diagram in pg. no.-276 in my book ------ Fig-5.13

Biggest challenges face by ERP vendors from internet are:

- To address the global access issue,
- Development of IS that will cater to both intra and extra organizational needs,
- To deliver the complete best business process,
- Adaptable business systems for easy installation and post implementation mainteanace.

Business Process Engineering:

BPR – Business Process Re-engineering:

Introduction:

Business Process:

Business processes are a related group of steps or activities, that use

People,

Information, and,

Other resources

to create value for the internal or external customers.

Meaning of BPR:

BPR is a methodology for introducing a fundamental change in the specific business processes and usually supported by an Information System. It is a holistic process leading to a complete:

12) Organisation transformation – A process of moving from the traditional to a re – engineered, frequently networked, organisation.

13) Stabilisation.

Information Technology Support to BPR:

Paste the diagram in pg. no.-278 in my book ------ Fig-5.15

15) Severe competition, involving very large corporations

16) Providing quality products at competitive prices

17) Fundamental change in the manner in which business is done

18) Features of re-engineering to be included– for reduce cycle time, mass customization approach in manufacturing and supply chain from, suppliers and buyers

19) Collaborating with other vendors, providing unique services to customers

Explanation of the diagram:

In the above diagram, the need for ERP is shown under 5 points.

Changes in the environmental drivers bring pressures on the organisation for the purpose of rapid intense predictable changes inorder to

- meet the competition, and
- survive better.

These pressures will make the organisation to go immediately fot BPR and Networked organisation, followed by a slow pace of continuous improvements, TQM, traditional strategies. Also, IT support is very much needed as an enabler of bringing the changes.

BPR is nowadays becoming a major issue in the business and the second most issue in the IT management(voted in 1994/1995 study).

In the figure, if we study the A & B portion,

- A involves the continuous improvement programs, which can be used if the pace of the changes is slow. This might include the automation of the existing processes, small structural modifications, quality and productivity improvement programs, modifications in the management procedures, etc.
- B is inevitable and has to be applied quickly, if the pace and the magnitude of the business pressures are high. Changes should accelerate, continuous improvement programs could become effective in many cases as it is time consuming. Old tricks cannot work and a fresh approach is needed which is known as BPR.

Strategic allignment of business and IT:

Paste the diagram in pg. no.-279 in my book ------ Fig-5.16

Business Process:

A business process is a collection of activities that:

- takes one or more kinds of input
- create an output of value to the customer

Example: Bbusiness process in a bank

Bank accepts a Loan application – process it - Approves or rejects

Business Process in an organization:

Paste the diagram in pg. no.-280 in my book-------Fig-5.17

Redesigning:

Redesigning is about further simplification of business processes.

The main objective of BRP is to provide Competitive advantage to the business process.

Old process before BPR:

Paste the diagram in pg. no.-281 in my book ------ Fig-5.18

Process after BPR:

Paste the diagram in pg. no.-282 in my book ------ Fig-5.19

BPR and Restructure of the organization:

1. Redesign of processes
2. From Mass Production to Mass Customization
3. Cycle time reduction
4. Restructuring the organization

Artificial Intelligence:

Meaning: It is a capability of device to perform functions that are normally associated with human intelligence, such as reasoning, learning and self improvement

Some have described that Expert system technology is an outgrowth of a field of study called artificial intelligence .

Areas of Artificial Intelligence:

- Expert system
- Natural language(Concerned with the development of human language, computer interfaces and with the translation of human language.
- Pattern recognition system(attempts to identify patterns in visual auditory and other signals in data)
- Vision system(address the technology required for computer system see)
- Robotics(concerns the development of primarily industrial robots(like welding, painting robots)

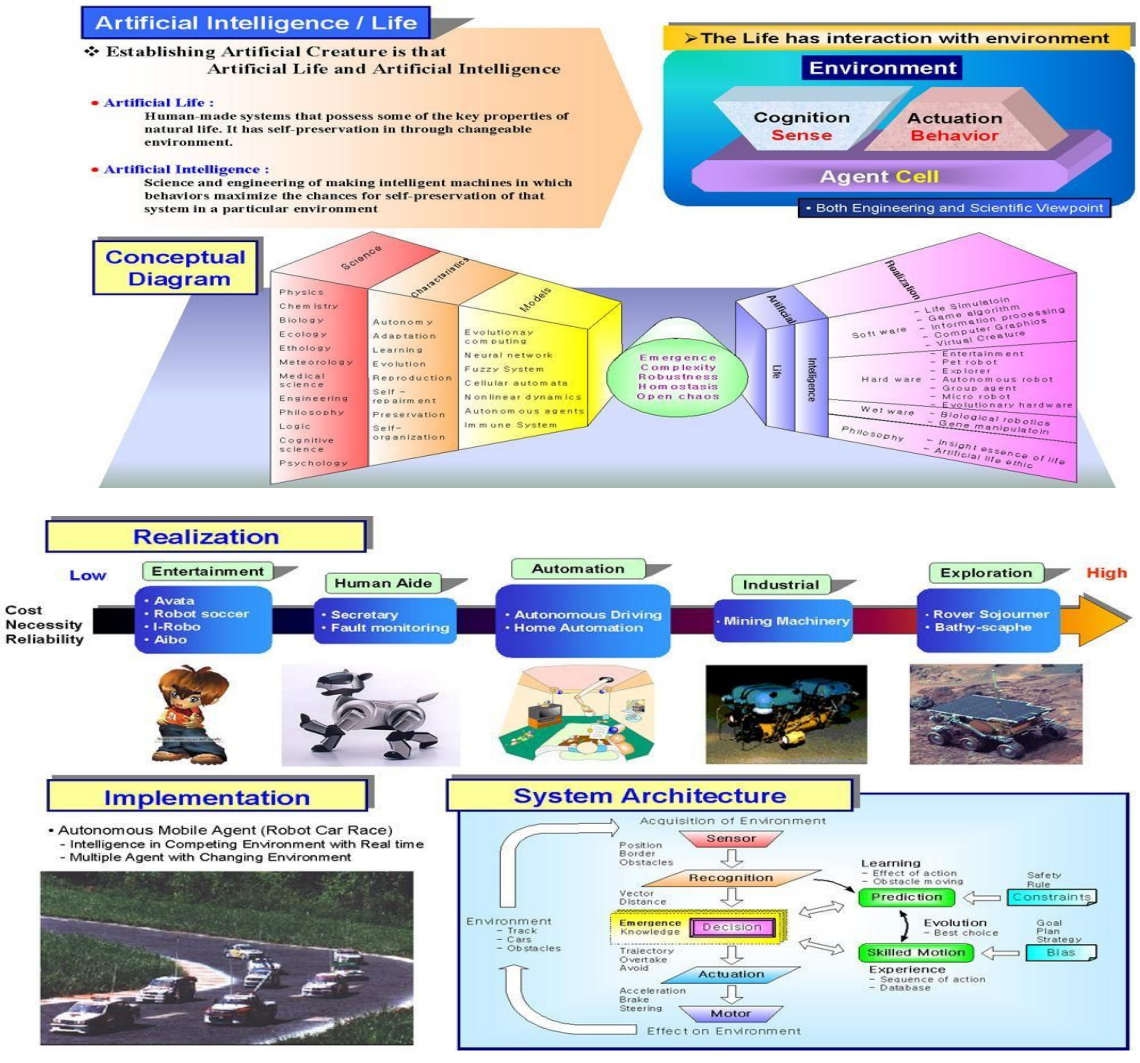
Major branches of AI:

Paste the diagram in pg. no.-287 in my book ------ Fig-5.20

Applications of AI:

- Information distribution and retrieval
- Data base mining
- Product design
- Manufacturing

- Inspection
- Training
- User support
- Surgical planning
- Resource scheduling



Inference Engine:

It is a part of the expert system that controls

- Choice of the rules
- Its application
- Decides the quality of the result

–The Inference engine performs the processing of the result , data, and relationships stored in the knowledge base to provide answers, predictions and suggestions the way a human expert would need‖

Expert Systems(ES):

It is a computer application that performs a task that would otherwise be performed by a human expert. For example, there are expert systems that can diagnose human illnesses, make financial forecasts, and schedule routes for delivery vehicles.

Some expert systems are designed to take the place of human experts, while others are designed to aid them.

Expert systems are part of a general category of computer applications known as artificial intelligence .

To design an expert system, one needs a knowledge engineer, an individual who studies how human experts make decisions and translates the rules into terms that a computer can understand.

Expert systems are used to aid:

Single point decisions. e.g. Planning

Designing. e.g. Design of an irrigation system

Selection. e.g. The most suitable Crop variety or market outlet

Diagnosis or identification. e.g. Of a livestock disorder

Interpretation. e.g. Of a set of financial accounts

Prediction. e.g. of extreme events such as thunderstorms and frost;

A sequence of tactical decisions throughout a production cycle. e.g. plant protection and nutrition decisions, livestock feeding.

Components of an Expert System:

Knowledge

– In various forms: associations, models, etc.

Strategy

– Exhaustive enumeration, on-line, etc.

Implementation

– Programs, pattern matching, rules, etc.
–

The following diagram shows about the Structure of an Expert System:

Structure of an Expert System:

Paste the diagram in pg. no.-294 in my book ------ Fig-5.21

Advantages:

1. Have the ability to imitate human thought and reasoning
2. Make modification of knowledge very convenient
3. Ability of interpretation and transparency makes interaction more user friendly
4. With the machine learning technique knowledge can be acquired automatically and directly from experimental data and real time examples
5. Provide expert level recommendations understandable to users
6. Have the ability to handle uncertain information

Limitations of Expert System:

1. They excel only in solving specific types of problems in a limited domain of knowledge.
2. They perform well with specific types of operational and analytical tasks but latter at subjective decision making
3. They are comparatively costly to develop and maintain
4. They can't maintain themselves that is they don't learn by experience as humans do,

Differences between Expert systems and Decision support system:

Expert System:

Attributes	DSS	ES
Objective	Assist human decision	Duplicate a human adviser and replace him
Recommendation and decision	Made by the user and the system	The system
Major orientation	Decision making	Transfer of expertise and rendering advice
Query direction	Human system	System
Data manipulation	Numerical	Human symbolic

Types of data base and procedures	Factual knowledge	Factual knowledge
Reasoning capability	Absent	Present
Explanation	Limited	Total
Learning capability	Absent	present
Nature of support	Personal , groups and institutional	Personal and groups

Interference engine:
Interference engine applies the knowledge in a systematic way. It is the brain of ES. It applies the rules and other forms of knowledge in an attempt to make the sequences of logical

Knowledge Management System(KMS):

Knowledge acquisition:

This program is used by an individual who has expertise in the problem to create, add to, or exchange the knowledge base. Potential sources of knowledge include human experts, text books, databases, special research reports and the user's own experience.

Knowledge base:

Knowledge is the primary material of the Expert Systems. It can also have the standard problem solving and decision making models. The heuristics express the informal judgemental knowledge of an application area. Global strategies, which can be heuristics and part of the theory of the problem area are usually included in the knowledge base.

The information in the knowledge base is incorporated into a comuter program by a process called —konwlegde representation‖.

Meaning of knowledge

Knowledge is assured belief; that which is known; information; instruction; enlightenment, learning; practical skill; facts or ideas acquired by study, investigation, observation or experience.

1. **Explicit knowledge :** It is the component of knowledge which is formal that can be codified and transmitted in a systematic way and formal language embedded in documents, manuals , information systems and processes

It is data ,data base, electronic mail, document ,web , charts

Things written down or stored on computer

2. **Tacit knowledge : T**his constitutes about 70% of the whole organizational knowledge . In the present competitive world, better knowledge and its efficient management would be the key differentiators for becoming the first among equals

3. **Potential knowledge:** Business knowledges, knowledge that can be extracted from highly structured data stored in data base(ERP systems and business operational applications)
4.

KM is organizing and sharing the diverse forms of business information created within an organization

Knowledge management includes Managing project, enterprise document library, discussion data base, intranet website data bases Successive knowledge management creates : techniques, systems, technologies , rewards.

Forms of Organizational Knowledge:

The components of these forms is the organizational context and the ways in which they are created, is known as knowledge creation cycle

Competitor knowledge, customer knowledge , supplier knowledge , product knowledge, technology knowledge, process knowledge

Benefits of KM:

1. Leads to reduction in training needs of employees
2. Enables an organization to achieve competitive edge
3. Customer would like to interact more with organisationals that have relevant skills and abilities to adopt changing business conditions
4. Enables systematic access to business data, comparative information, market demo graphics that support to decision making process
5. Reduces loss of intellectual capital leaving the organisation

6. Breaks communication barriers within the organization
7. Reduces cost by decreasing and achieving economies of scale in obtaining information from external sources
8. Helps in removal cognitive biases form decision making
9. Increases productivity by providing knowledge available more quickly and easily

Problems in KM:

1. HR POLICIES: The existing HR policies give more weight age to seniority then merit in the promotion process as there is no separate placement policy for knowledge workers. These policies are hindrance in the way of effective knowledge management
2. SKILL MAPPING : most of the organizations do not have centralized data base of the skill profile of their employees.
3. CULTURAL : Employees view information as power and as such avoid sharing it with others. Some organizations are plagued with regional local bias rather than a single organizational cultures
4. GEOGRAPHICAL : collection of data information from remote places is difficult sharing of information with them is difficult
5. TECHNOLOGIES: Many organizations have not yet networked their branches / offices. They have not adopted advanced technology to collect and analyzed data that is generated from day to day operations

Customer Relationship Management(CRM) :

CRM is the process of developing and managing long-term relationships with customers so that they will keep coming back to make repeat purchases

Definition: CRM is a comprehensive strategy and process of acquiring, retaining and partnering with selective customers to create superior value for the company and the customer.

Essentials of a good CRM:

- Identify customer success factors.
- Create a customer-based culture.
- Develop and end-to-end process to serve customers.
- Recommend what questions to ask to help a customer solve a problem.
- Track all aspects of selling to customers and prospects as will as customer support.

Roles of CRM:

Finance:

Increase revenues –by identify which of the current customers.

Lower cost and increase efficiencies-making better use of customer data

Operations:

Deliver an improved customer service.

Monitor activity and gain greater control.

Information technology.

Sales and marketing.

Increase sales and marketing.

Increase productivity.

Increase forecasting and deliver on targets

Advantages of CRM:

1. Provide product information.
2. Identify how each individual customer defines quality.
3. Help to identify potential problems.
4. Use internet cookies to track customer interest and personalize product offerings accordingly.
5. Provide a fast mechanism for managing and scheduling maintenance.

CRM process:

Step 1: Analyze : Conduct detailed customer intelligence to pinpoint your most valuable customers and to learn all you can learn about them, including the life time value to the company

Step 2: Connect and collect : Make contact with your most valuable customer and begin building a customer data base using data mining and data ware house techniques

Step 3 : Learn: Learn from your customers by encouraging feed back from them; develop a thorough customer profile and constantly refine it.

Step 4: Build Relationships : Based on what your have learned, contact customers it an offer designed for them. Make customers feel special and valued

Step 5: Sell , Service and satisfy : Superb customer service is the best way to retain the most valuable customers .

Step 6: Go to step 1.

E-CRM:

E-C RM enables enterprises to understand customer needs and buying habits better to leverage the new/better product or service offering to the customer . Capturing of market depends on cost and competition

The differences between CRM and Transaction Selling is as follows:

Feature	CRM	Transaction Selling
(1)Duration	Ongoing	Distinct beginning and end; One transaction attitude
(2)Key concepts	Collaboration and Cooperation	Negotiation
(3)Driven by	Commitment and trust.	Making profitable short term transactions
(4)style	Mutual dependence	Independence
(5)Business plan implication	Build a network of relationships with the dependable suppliers and customers that will lead to long term profitability.	Maximise short term profits; make the bottom line look good, whatever the long term costs.
(6)Primary advantage	Intimate knowledge of customer's needs, wants and preferences developed overtime.	Cash in hand
(7)Primary Disadvantage	Dependence on other partners in the web of relationships.	Losing the sale if a competitor makes the customer a better offer.
(8)Foundation	Knowledge based	Bottom line oriented
(9)Outlook	Increasing in the popularity	On the decline.

IMPORTANT QUESTIONS TAKEN FROM THE VARIOUS QUESTION PAPERS:

UNIT – 5:

Section – C:

1. **What are the advantages and disadvantages of ERP?**
2. **What is the relevance of ERP in the context of Internet explosion? Explain in detail taking some hypothetic/live business organization you are familiar with.**
3. **What is Artificial Intelligence? What are the major application areas of AI?**
4. **(or) (or) (or)**
5. **Explain the major branches of AI.**
6. **What is HRIS SYSTEM? Explain the procedure followed in HRIS system.**
7. **Explain the merits and demerits of BPRE to the orgnization and customers?**
8. **Explain GDSS and Video conferencing.**
9. **What is the difference between an Expert system and a Decision Support system(DSS)? Discuss briefly the various classes of DSS?**
10. **Compare and contrast different types of decisions found in an organization at different levels.**
11. **Explain system and subsystem concepts? Explain their characteristics.**

Section – B:

1. **What is ERP? Explain the concept, use and importance of ERP in an organization.**
2. **What is BPRE?**
3. **Explain the advantages and disadvantages of EIS?**
4. **Explain the differences between DSS AND EIS.**
5. **Why Knowledge Management has acquired importance in the Cyber Era?**
6. **(or) (or) (or)**
7. **Explain the benefits of KM**
8. **How will you build a knowledge creating company with KMS?**
9. **What is the need for E-CRM?**
10. **Expain CRM and E-CRM.**

Section – C:

1. What are the advantages and disadvantages of ERP?
2. What is AI? Explain its major branches.
3. What is HRIS? Explain the procedure followed in HRIS.
4. What is BPR? Explain its advantages and disadvantages.