CSC 339

SYSTEM ANALYSIS AND DESIGN

LECTURE 2

LECTURER

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COURSE OVERVIEW

LECTURE 1	Introduction to System Concepts and SDLC Analysis
LECTURE 2	Systems Analysis and Fact Gathering Techniques
LECTURE 3	Data Flow Diagrams and Process Description
LECTURE 4	Analyzing Processes and Descriptive Techniques
LECTURE 5	Data Modeling and System Design Principles
LECTURE 6	Designing Systems - ERDs and Structure Charts
LECTURE 7	Form Designs, Security, and Automated Tools for Design
LECTURE 8	Scope of Systems Analysis and Investigation
LECTURE 9	Review and Implementation

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Introduction to System Concepts and SDLC Analysis

Software Development Life Cycle.

System development life cycle (SDLC)

- Systems Development Life Cycle (SDLC) is well defined process by which the system can be conceived, developed & implemented. It can be performed in two stages. Each stage involves three steps. Two phases are
  - System Analysis
  - System Design

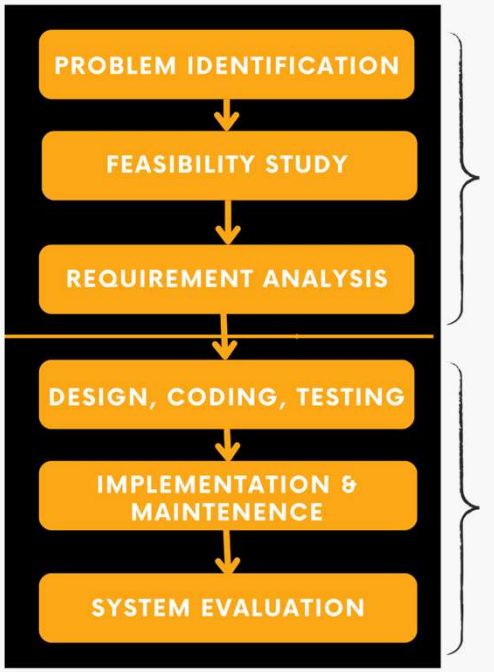

Figure 1: SDLC Diagram

System Analysis

- **Systems Analysis** involves the thorough examination and assessment of a system and its subsystems to achieve overarching goals.
- This process includes modifying components, adjusting interrelationships, and potentially upgrading the entire system.
- The importance of system analysis lies in its ability to.
  - Simplify complex structures for better comprehension.
  - Specify functional requirements for subsystems within the larger system.
  - Understand and compare the functional impacts of subsystems on the overall system.
  - Ensure inter-compatibility and alignment of subsystems towards common goals.
  - Place each subsystem in its proper perspective, optimizing resource usage to effectively achieve central objectives.

System Analysis

- **Systems Analysis** Problem identification: Problem identification is the most difficult but important task in system analysis .Because, if the problem is not properly identified it may lead to wastage of time & energy in later stage. For problem identification the focus is on three aspects. 1. Source (cause) of the problem 2. Type of the problem 3. Nature of the problem

System Analysis

- In order to analyze the system properly it is performed in three steps,
  - Problem identification
  - Feasibility study & cost benefit analysis
  - System requirement analysis

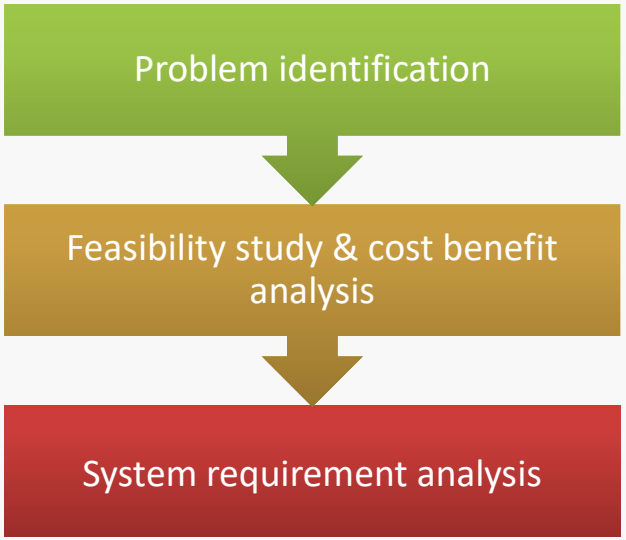

Figure 2: System Analysis Flow

System Analysis

Problem Identification

- Problem identification is crucial in system analysis.
- Proper identification prevents wastage of time and energy in later stages.
- Focus is on three aspects:
  - Source (cause) of the problem.
  - Type of the problem.
  - Nature of the problem.

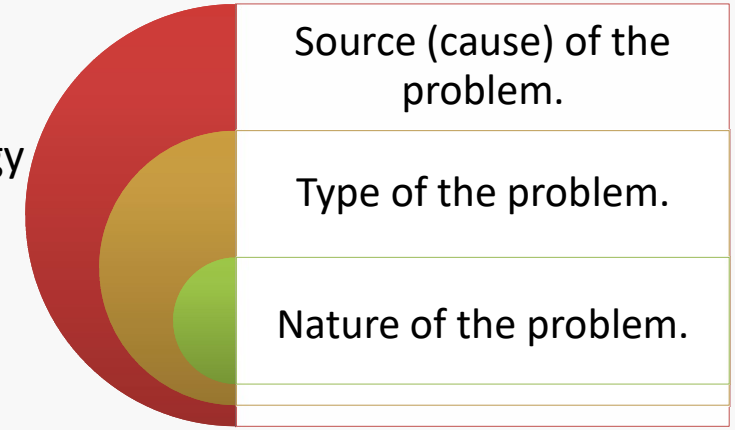

Figure 2: System Analysis Flow

System Analysis – Problem Identification

Source of the Problem

- The root cause may stem from internal or external factors, which can vary across different environments.

Internal	External
Company Management	Customer
Employs of different department	Consultancy services
Internal auditors	External auditors
Financial services	Government Policies

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System Analysis – Problem Identification

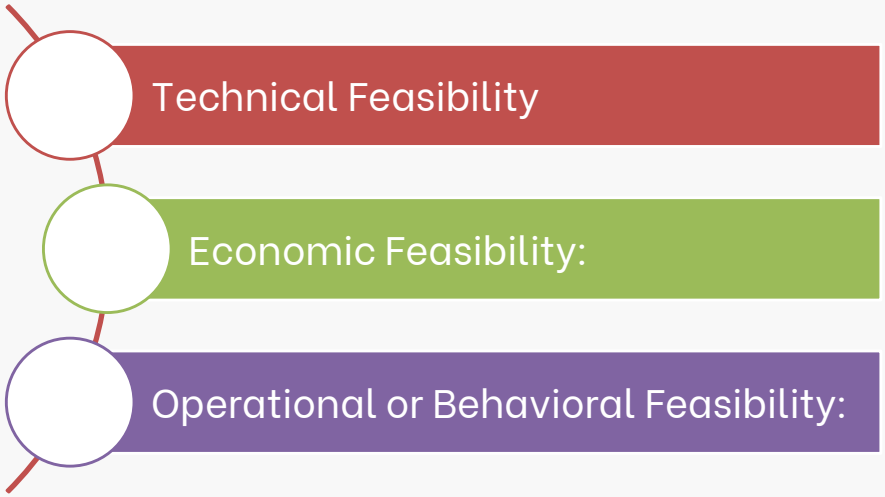
Types of the Problem

- RELIABILITY OF THE SYSTEM.
- VALIDITY
- ACCURACY
- ECONOMY
- TIMELINESS
- CAPACITY
- THROUGHPUT

System Analysis

Feasibility study

- Feasibility study is useful to evaluate the cost & benefits of the system requested
- There are three major aspects of feasibility study



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System Analysis – Feasibility Study

Technical feasibility

- Technical feasibility delves into the evaluation of current computer hardware, software infrastructure, and personnel capabilities.
- It involves a thorough verification process to determine the necessity of these elements and subsequent procurement or installation as per requirements.

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System Analysis – Feasibility Study

Economic feasibility

- Economic feasibility involves a comprehensive examination of the cost and benefit analysis associated with the proposed system.
- Project approval is contingent upon a favorable comparison where benefits surpass costs.
- This assessment aids in identifying various development expenses:
  - One-time costs encompassing investigation or survey expenditures, as well as conversion expenses.
  - Recurring costs include personnel salaries, staff training, and ongoing equipment maintenance.

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System Analysis – Feasibility Study

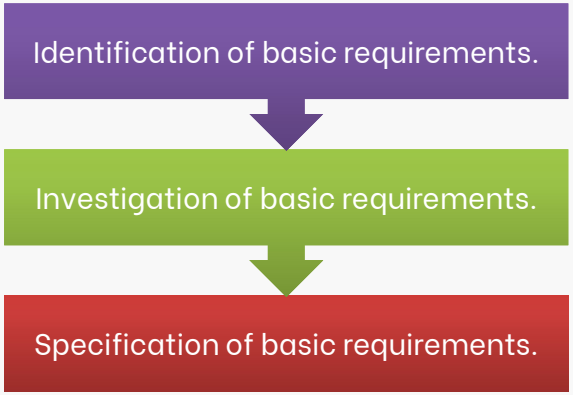
Operational or Behavioral feasibility

- Operational or Behavioral feasibility explores the acceptance level of the proposed system within the operational environment.
- It involves a thorough assessment of pre- and post-implementation procedures to pinpoint potential troubleshooting areas.
- System implementation efforts entail:
  - Convincing users of the system's acceptability and benefits.
  - Educating staff about the system's functionalities and advantages.
  - Training staff to acquire the necessary skill set to effectively utilize the system.

System Analysis

Requirement Analysis

- Requirement analysis entails the meticulous process of identifying the essential prerequisites for a new system.
- This involves a comprehensive study of the existing system and gathering pertinent details to discern user requirements.
- Requirement analysis encompasses three key activities:
  - Identification of basic requirements.
  - Investigation of basic requirements.
  - Specification of basic requirements.



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System Analysis - Requirement Analysis

Identification of basic requirements

- To pinpoint the basic requirements, it's imperative to understand the system's functioning and areas necessitating improvement.
- This can be achieved by addressing fundamental questions like:
  I. What are the prevailing issues within the existing system?
  II. What are the expectations of users from the proposed system?
  III. What processes are involved in addressing the problem?
  IV. What data is utilized and generated throughout these processes?
  V. Which controls are presently in use?

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System Analysis - Requirement Analysis

Investigation of requirements

- Requirement investigation employs various fact-finding methods including:

Interviews | Questionnaires | Observations | Record reviews | Brainstorming | Desk research

- These techniques are utilized to gather comprehensive information about the system.
- This activity is crucial, and documentation describing system features is meticulously conducted for future analysis.
- Requirements are documented and presented using specialized tools such as system flowcharts, data flow diagrams, and presentation graphics, aiding designers in system design.

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System Analysis - Requirement Analysis

Specification of requirements

- Requirement specification serves as a negotiation between developers and end users.
- Data collected from end-users may not always be exhaustive, requiring analysis to ensure alignment with organizational demands.
- Users may suggest additional features for inclusion in the new system.
- The process of requirement specification involves identifying:
- I. Data used in various activities.
- II. Different controls required in the system.
- III. User's transactional requirements.
- IV. User's decisional requirements.
- V. User's organization-dependent requirements.

Advantages of System Analysis

- Facilitates the establishment of precise system goals, ensuring alignment with organizational objectives.
- Defines the project boundaries by carefully considering the constraints posed by available resources.
- Emphasizes the delineation and scope of the project, ensuring clarity and focus on objectives.
- Identifies and evaluates the constraints and limitations of available resources, aiding in informed decision-making.

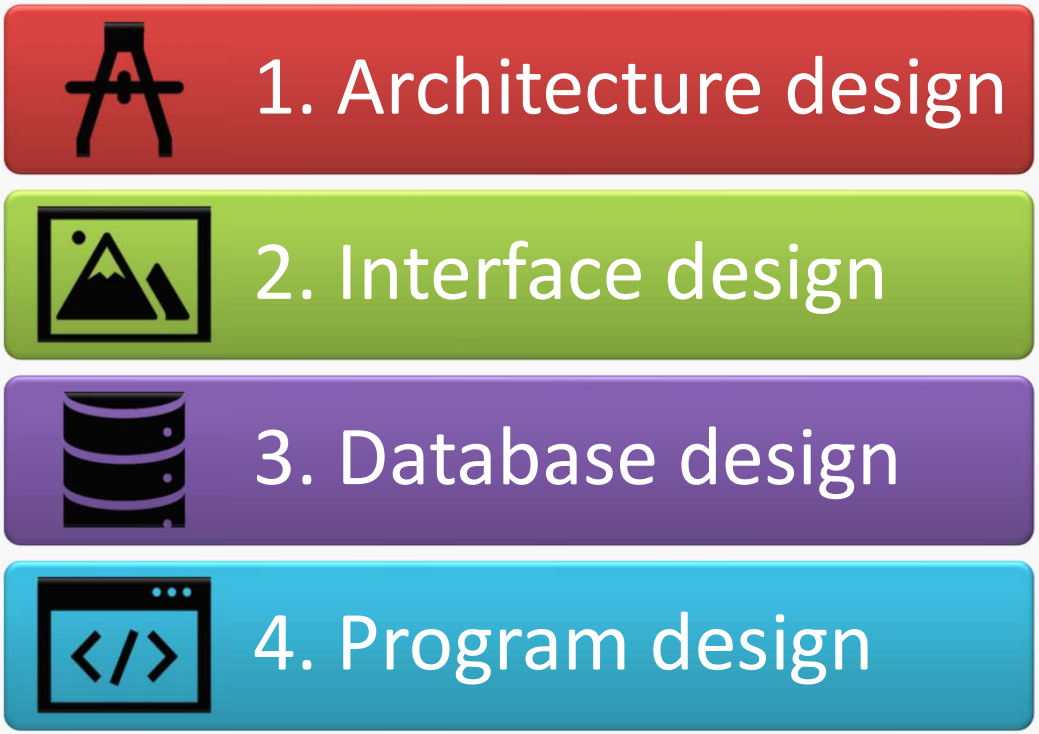
System Design

- System analysis defines 'What is to be done,' while system design defines 'How it is to be done.'
- System design, being the most challenging and creative phase of the SDLC, is pivotal for transforming analysis into a tangible solution.
- System analysis serves as the fundamental process of the system development life cycle (SDLC), while design represents the concluding phase.
- System design progresses through the following three steps:
  - System design specification and programming
  - System testing, implementation, and follow-up
  - System maintenance and evaluation

System Design

System Design Specification

- System design has to focus on four important aspects:



System Design

System Design Specification

- **Architecture Design**: Architecture design focuses on establishing the foundational infrastructure comprising hardware, software, and networking components that the system will utilize.
- **Interface Design**: Interface design outlines how users will interact with the system, including navigation methods such as menus, forms, and reports, ensuring intuitive user experience.
- **Database Design**: Database and file design determine the structure and storage of data within the system, specifying what data will be stored and the corresponding storage locations.
- **Program Design**: Program design delineates the programs that need to be developed, detailing their functionality and operations.

System Design

Program Specification: (Coding)

- Once the design is completed it must be translated into machine language. Proper choice of software is made on the basis of
  - Clearly outlined software specification provided by designer.
  - Need & cost of the software, availability of programmers.
- The basic activities involved in this phase are
  - Checking of program specification
  - Expanding (detailing) of specification.
  - Breaking the system modules into smaller programs.
  - Allocating these programs to the respective team members of the development team
  - Writing codes in selected software language.

System Design

Testing:

- The primary objective of testing is to uncover errors within the software. Testing provides assurance that the software functions reliably according to specifications and meets user expectations.
- Key Testing Activities Include:
  - Testing Individual Programs: This involves scrutinizing the logic and interfaces of each program within the system to ensure functionality and coherence.
  - Running on Specific Data: Testing with specific data sets evaluates the quality of the code and establishes performance standards.
  - Validating Desired Results: Checking the accuracy of the desired output against expected results verifies the software's correctness and effectiveness.

System Design

Implementation

- Once the system is tested it is ready for implementation. Implementation includes following activities.
  - I Planning the implementation schedule.
  - II Procurement of hardware.
  - III Installation of software.
  - IV Recruitment of operating personnel.
  - V Motivation and training to the personnel.
  - VI Educating user through meetings & seminars.
  - VII Conversion of data files from old one to new one.
  - VIII After final change over gradually phasing out of the old system.

System Design

Follow-up

- There is need to have personnel to look after the system during operation and production which we call as follow-up.

System Design

Maintenance:

- Problems and errors may arise after the implementation of a new system, as no system can be considered foolproof.
- System maintenance becomes necessary as an ongoing process to address these issues.
- Typically, hardware and software vendors are responsible for maintaining their products.
- Documentation plays a crucial role in maintenance, making it a demanding task for system analysts.
- Maintenance is often seen as the "tail end" of the life cycle, but it is the most expensive phase as it consumes energy, time, and costs in the long run, as illustrated by the graph.

System Design

Maintenance:

- Corrective maintenance: It has to do with the diagnosis and the removal of residual errors in the system when it is delivered (means immediate problems till operational set up) as well as the intentionally introduced errors in software during maintenance.
- Adaptive Maintenance: It is concerned with adjustment of the application with the environment .For example: newly introduced hardware or operating system.
- Perfective maintenance: It involves changing the software to improve some of its qualities. For example: To add more features related to usability of software such as user-friendliness etc

System Design

System Design Specification

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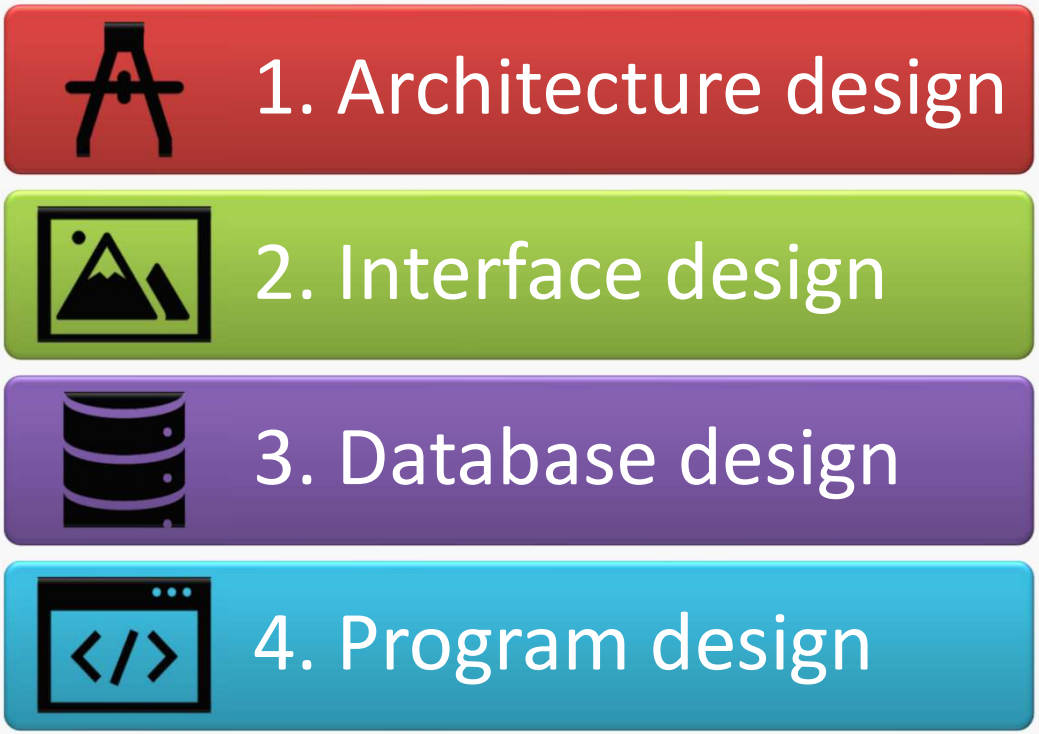

SYSTEM

- A **System** is a complex whole comprising interrelated and interdependent parts that work together to achieve a common goal.
- **In the context of information systems**, this often involves hardware, software, data, processes, and human resources.
- **Examples of a system: Library Management System** etc
  - A Library Management System is a comprehensive system that includes hardware, software, processes, data, and human resources working together to efficiently manage library resources.

System Analysis

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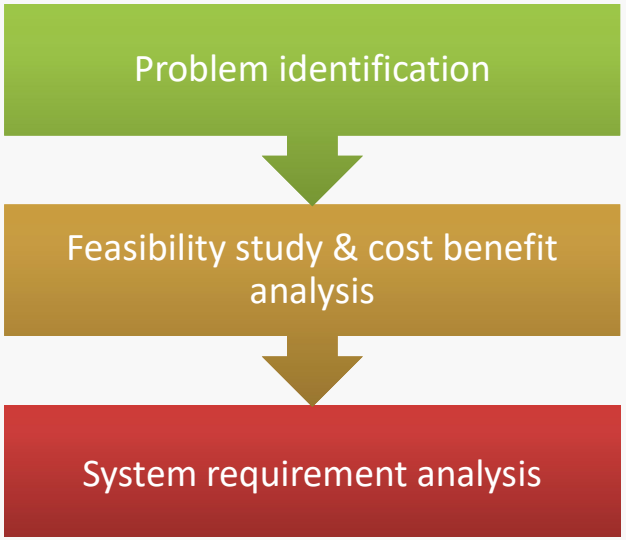

Figure 2: System Analysis Flow

System Analysis

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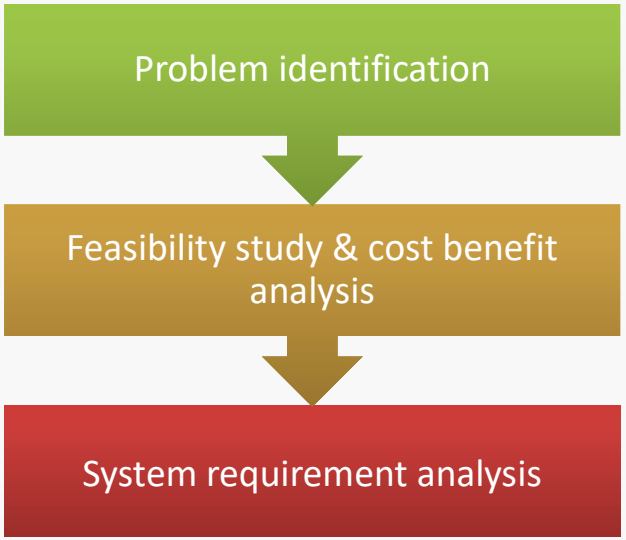

Figure 2: System Analysis Flow

SYSTEM COMPONENTS

Inputs	Inputs: Elements that enter the system for processing.
Processes	Processes: Activities or transformations that occur within the system.
Outputs:	Outputs: Results or outcomes produced by the system.
Feedback	Feedback: Information that the system gathers to evaluate and adjust its performance.
Environment	Environment: The external elements that interact with the system.

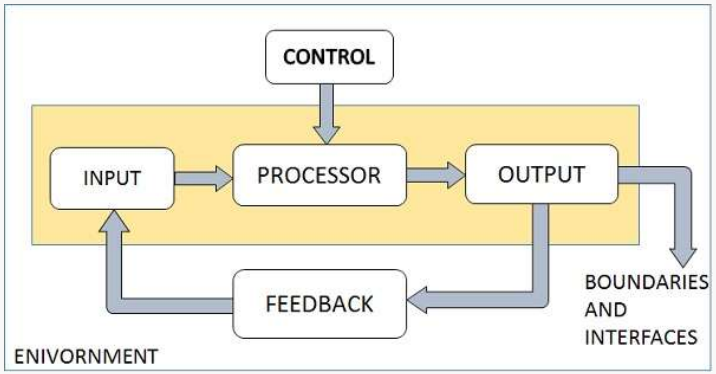

Figure 1: Components of a stem

SYSTEM CONCEPTS

- In order to build any system only the knowledge of its elements does not serve the purpose, there should be fundamental clarity of some important concepts which are essential to build the efficient system & to keep it in equilibrium. The major concepts are

  I. Boundary & environment

  II. Subsystem

  III. Interface

  IV. Feedback control

  V. Black box

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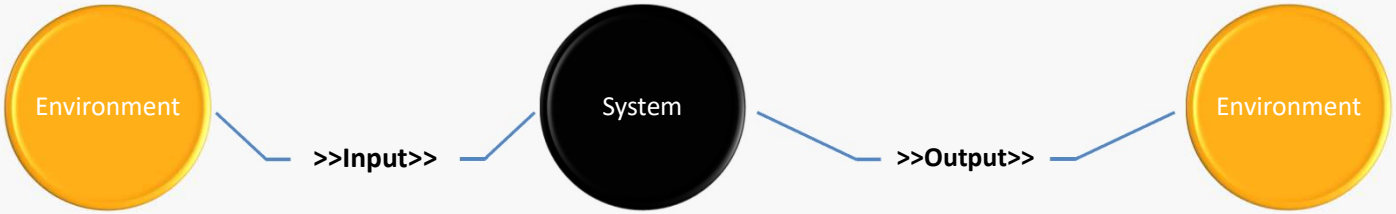
SYSTEM CONCEPTS

Boundary & environment

- Boundary: It is the entity/bound that determines the limits and the sphere of influence & control of a system.
- Environment: Everything within the circumscribed space is called system & everything outside it is environment.
- Flow from environment to the system is its input while a flow from system to its environment is the output. Boundary of the system may exist physically or conceptually.



SYSTEM CONCEPTS

Subsystems

- Subsystem: An irreducible part or aggregation of parts that makes up a system; also called a subsystem.
- A complex system is difficult to implement when consider as a whole. However if we divide it into smaller functional units which are of manageable sizes then every small function unit becomes a subsystem.
- In the formation of subsystem the components performing same or similar functions are grouped.

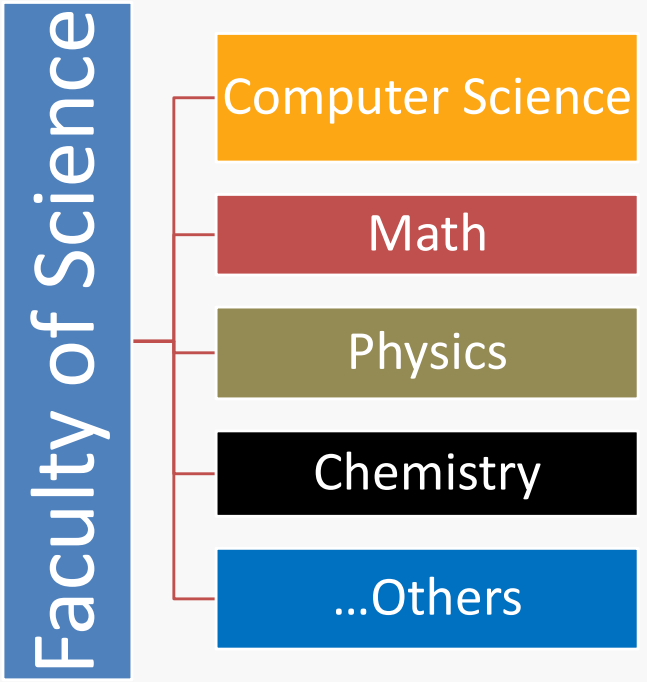


Figure 2: Example of Subsystems

SYSTEM CONCEPTS

Interface, Feedback and Blackbox

- Interface: The interconnections & interactions among the subsystems are termed as interfaces. In fact each interface implies a communication path. Number of interfaces increase with number of subsystems.
- **Feedback control**: In order to improve the performance of any system feedback control mechanism can be used as a tool or device to control or modify the input of the system after analyzing the output properly.
- **Black box**: Black box is the subsystems at lowest level where the inputs are defined, outputs are determined but the processor of the system is not defined means it difficult to understand how the transformation of input to output takes place.

CHARACTERISTICS OF A SYSTEM

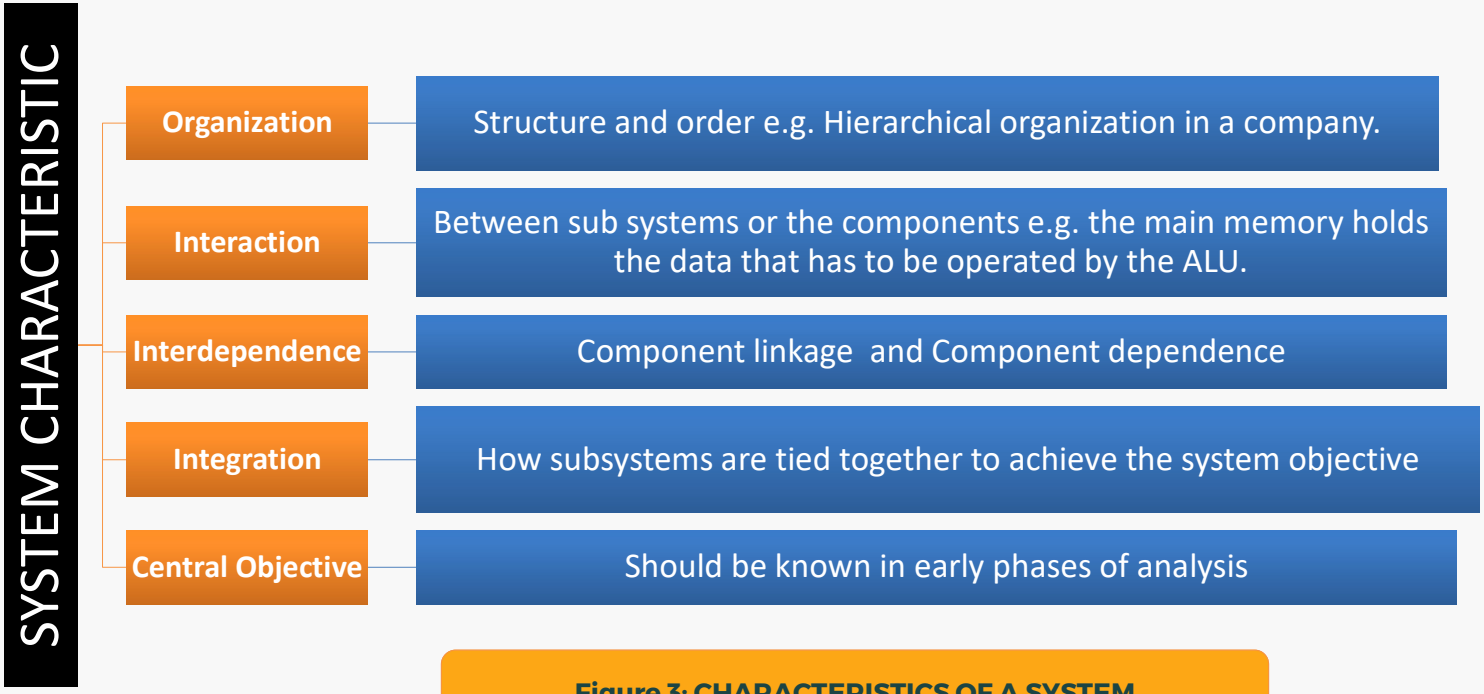


Figure 3: CHARACTERISTICS OF A SYSTEM

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TYPES OF SYSTEM

- Open or Closed Systems
- Physical or Abstract Systems
- Natural & Artificial Systems
- Deterministic or Probabilistic Systems
- Integrated Systems

TYPES OF SYSTEM

Physical or Abstract Systems

- Physical system: These are the concrete operational systems made up of people , material, machines energy & other physical things. For example: Management information system.
- Abstract (conceptual) system is an orderly arrangement of independent ideas. For example: Economic theory, Theory of relativity.
- Physical systems being operational systems can display activities or behavior. While conceptual system as it works on different ideas or concepts it displays theoretical structures.

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TYPES OF SYSTEM

Natural or Artificial Systems

- Natural systems All the naturally occurring systems are called as natural systems For example: Solar system.
- Artificial system: All man made systems are called as artificial systems.

TYPES OF SYSTEM

Open or Close Systems

- **Open system**: Open system is that system which interacts with its environment. *For example: Any business organization system exchanges its material, manpower, money & information with its environment.*
- **Closed system**: Closed system is that system which does not interact with its environment. It has only controlled & well defined input & output. *For example: Television is itself is closed system which controls its sharpness, brightness automatically with sensors.*

TYPES OF SYSTEM

Deterministic & Probabilistic system

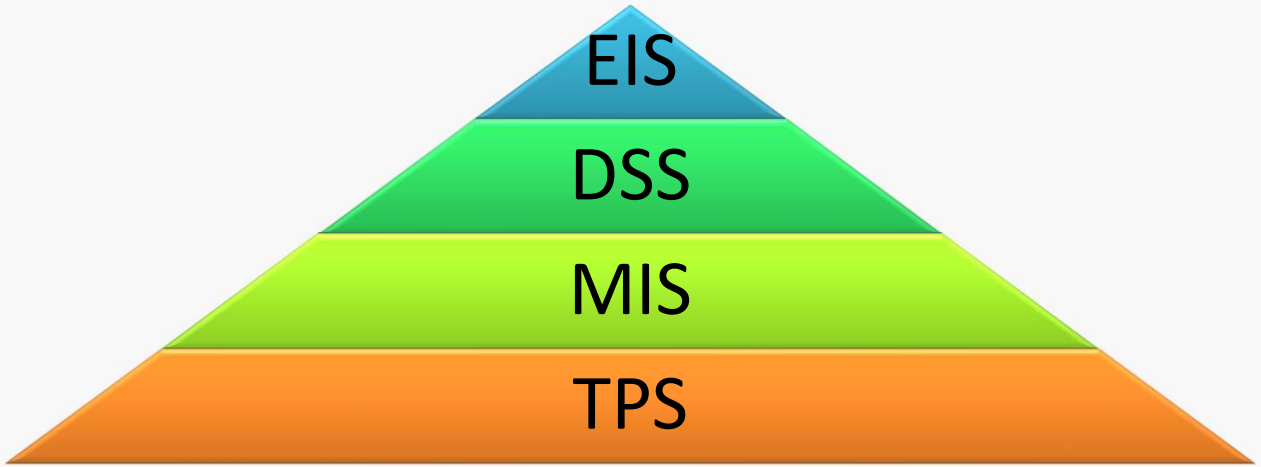
- **Deterministic system**: It is a system which operates in predictable manner. Stepwise execution is always possible & output is sure. *For example: computer system.*
- **Probabilistic system**: It is a system which operates in unpredictable manner & degree of error is always possible. Also output is not sure. *For example: Weather forecasting system.*

TYPES OF SYSTEM

Integrated system

- Integrated system: An integrated system is one that combines related subsystems to form a larger subsystem or total system. For example: Airline reservation system

MANAGEMENT INFORMATION SYSTEM



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MANAGEMENT INFORMATION SYSTEM

Transaction processing system (TPS)

- **Functions**: It updates history files, prepares summarized & processed transaction, and It generates detailed transaction reports.
- **Application areas**: Banking system, Sales accounting system, etc.
- **Users of the system**: Lower level management of the system.
- Benefits:
  i. Stores all transactions.
  ii. Helps to trace out the problem,
  iii. Gives current status of all the organizational entities.

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MANAGEMENT INFORMATION SYSTEM

Management information system (MIS)

- **Functions**: It makes use of output from the TPS as input and generates meaningful reports.
- **Application areas**: Marketing, production, personnel departments.
- **Users**: Middle level management
- **Benefits**:

i. Helps in planning.

ii. Helps in decision making.

iii. Suitable for analysis.

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MANAGEMENT INFORMATION SYSTEM

Decision support system (DSS)

- Functions:
  i. This system makes use of internal data from MIS for studying trends I
  ii. External data collected from environment to understand the environment.
- Benefits :
  i. It helps to prepare analytical & planning models.
  ii. It assists top level management in decision making.
- Application area: Production planning control system

MANAGEMENT INFORMATION SYSTEM

Executive information system (ESS)

- Function: It is structured & automated system provides rapid access to timely information & management reports. This system is supported with online information services such as electronic mail to keep the management updated with all current happenings in major areas.
- Benefits:
  i. User-friendly
  ii. Fast
  iii. Updated with graphics & reports

SYSTEM DEVELOPMENT METHODOLOGY

- A system development methodology is an orderly & integrated collection of various methods, tools & techniques. There are many approaches to the development of computer system, such as
  I. System development life cycle(SDLC)
  II. Structured system analysis & design method (SSADM)
  III. System prototype method (SPM)