Chapter One

Introduction

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Topics Covered

- Overview of ICT and Computer Science

- Knowledge Hierarchy (Data, Information, Knowledge and wisdom)

- What is an Information System?

- Components of Information Systems

- Applications of IS/ICT

What is computer Technology?

◇ **Computer Technology:** A Computer is a programmable, multiuse machine that accepts data, raw facts, and figures, and processes or manipulates it into information we can use, such as **summaries, totals, or reports**.

◇ Its purpose is to speed up problem solving and increase productivity.

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What is Communications Technology?

◇ **Communications Technology:** Communication or Telecommunications technologies consist of electromagnetic devices and systems for communicating information over long distances.
◇ Examples:
   ○ Telephone,
   ○ Radio,
   ○ Broadcast television,
   ○ Cable TV, and other telecom technologies.

What is Information Technology?

◇ **Information Technology (IT)** is a technology that merges **computing** with **high speed communication** links carrying data, sound, video, and other forms of multimedia.

What is Information Communications Technology?

◇ **Information Communications Technology (ICT)** is a generic name used to describe a **range of technologies** for creating, finding, storing, gathering, retrieving, processing, analyzing, sharing, and transmitting information

◇ The two technologies were developing independently, before they gradually fused together.

What is Information Communications Technology?

◇ **Technological Convergence** also known as digital convergence, is the technological merger of several industries through various devices that exchange information in the electronic, or digital format used by computers. The industries used Computers, Communications, Consumer Electronics, Entertainment, and Mass media.
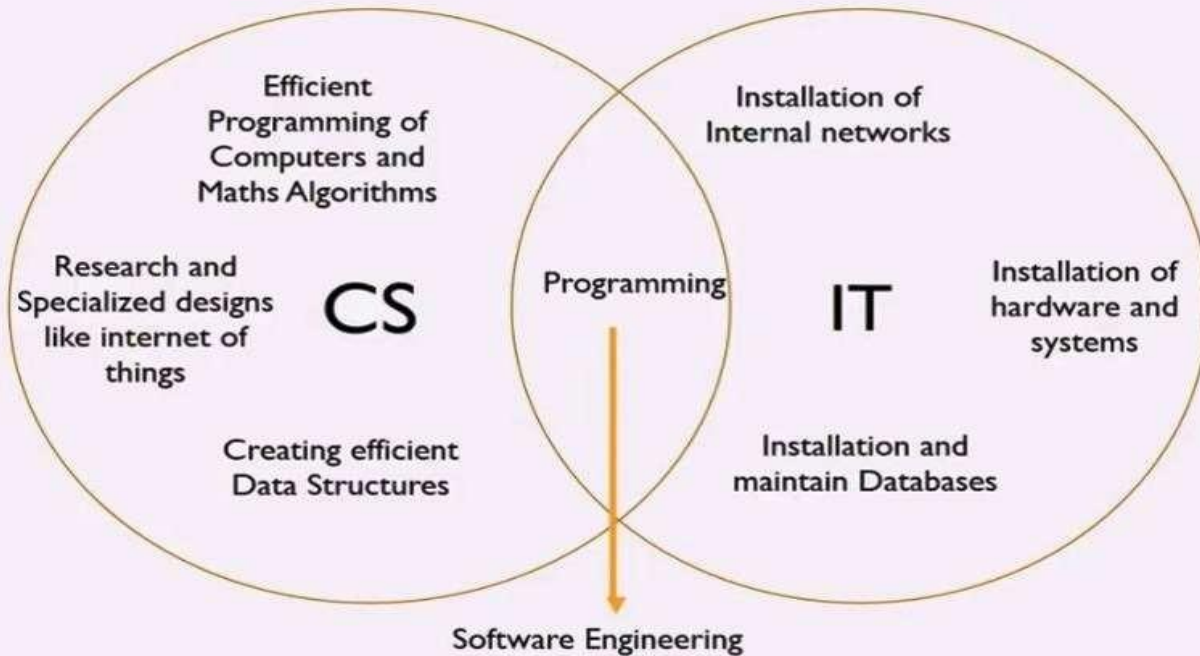
What is Computer Science

◇ CS is designing computing devices and programming them

◇ Computer science is the study of algorithms and much more than that

◇ A lot of computer science is about improving technology-- making it faster, smaller, cheaper or able to do new things through developing new theories

DIFFERENCE IN FIELD OF STUDY

Efficient Programming of Computers and Maths Algorithms

Research and Specialized designs like internet of things

CS

Creating efficient Data Structures

Programming

IT

Installation of Internal networks

Installation of hardware and systems

Installation and maintain Databases

Software Engineering

Computer science Vs Information Technology

◇ Computer science is **programming intensive**

◇ Involves

- system architecture

- software engineering

- application programming

- hardware engineering

- theory

◇ Information Technology is associated to **organization related applications**

- business related

- organizational automation

- ICT is a Change Agent (Enabler)

Data Vs Information

❖ The term data is used to refer raw facts and figures

❖ This data is input into a system in order to process and create meaningful information

❖ Data consists of numbers, words , sounds and images.

❖ Data does not have a particular meaning and cannot use to make decisions

Types of Data

❖ Documents which contain numbers (0…9), letters (a…z) punctuation marks and special symbols

    ❖ Audio

    ❖ Video

    ❖ Images

Classification of Data

- ❖ Quantitative
  - ❖ Quantitative data is numerical and acquired through counting or measuring
  - ❖ It can be presented with the numbers and which can be arranged in numerical order or can be subjected to arithmetic process
  - ❖ Qualitative Data
  - ❖ Qualitative data is not measurable but can be identified their properties
  - ❖ Example – Goodwill of an organization

Information

➢ **Information:** collection of facts organized in such a way that they have value beyond the facts themselves

- It is data that has been refined and organized by processing and purposeful intelligence;
- It is a resource created from a data to serve the management
- ◇ decision making needs of a business.
- Sets of Data + meaning   **(Semantics)**
- (Sets of data) + (relational connection among data sets)
- A red light is a form of data. But when we attach road traffic

  context to it, it becomes (i.e., STOP) information : Data + Context + Experience
- "What we collectively know"
- Cognitive state of awareness

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Data Vs Information

❖ Data = raw facts that represent the characteristics of an event
  ❖ Example 1:
    ❖ Event: Air temperature
    ❖ Data: 22° C
  ❖ Example 2:
    ❖ Event: Sale
    ❖ Data: Sale's date, item number, item description, etc.
❖ Information = facts within a given context
  ❖ Information results from transforming data by adding context to make it more useful.
  ❖ The temperature today at noon in Addis was 22° C

Data Vs Information
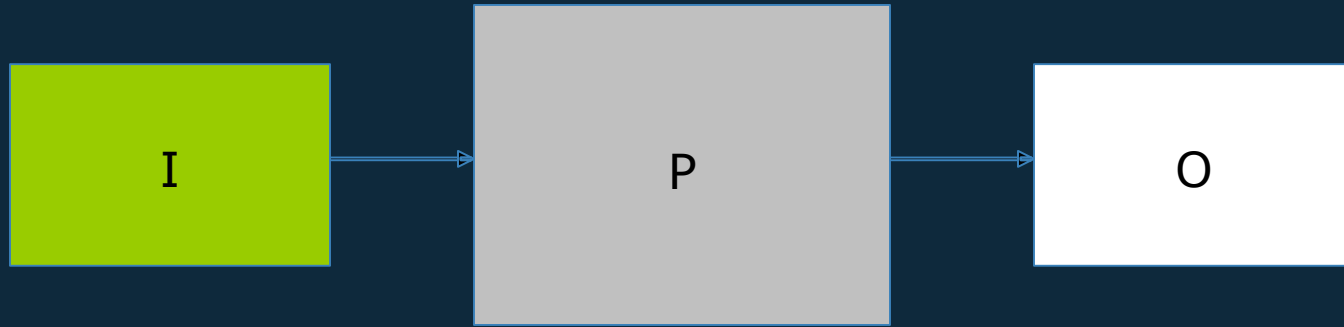
The process of transforming data to information

Data

Transformation process

Information

What is Knowledge?

❖ Once you spend some time interpreting and understanding a body of information, then you have knowledge

❖ Information + understanding pattern

❖ "What we individually know"

❖ There is information in a telephone book. The knowledge is understanding:
     Name - referring to a person (telephone subscriber), Number - referring to code enabling to operate the machine, How to use a telephone, How telephone circuit operates, etc.

Cont…

❖ The process of creating knowledge is time taking. Technology has greatly reduced the cost involved in **assembling** and **storing data,** and in **transferring** and **storing** information. **Creating knowledge still takes human brain,** human **thoughts** and **time** - especially today when there is too much information available

"You don't just learn knowledge; you have to create it. Get in the driver's seat, don't just be a passenger. You have to contribute to it or you don't understand it." (Dr. W. Edwards Deming)

Cont…

❖ **Wisdom**

- The state of being wise: Acting based on broader perspective, From self-interest towards social contribution, to create a better future grounded on the past experience;

- Informed by multiple forms of intelligence : Reason, Intuition, Spirit, Values

- Knowledge + Principles (ethics, Values)

- What do we mean by Ethics?

- Is there any possible knowledge hierarchy beyond wisdom?

The Knowledge Hierarchy

Knowledge on Knowledge;
How, when, and where to apply knowledge

**Wisdom
or
Meta-Knowledge**

Knowledge: Understanding of a domain can be applied to solve problems (**Pragmatics**)

Information: Lower volume, higher value, with context and associated meanings

Data: Large volume, low value, usually no meaning or context

Noise: May contain irrelevant items which obscure data

Reading Assignment

➤ Read about **tacit** and **explicit** knowledge.

➤ Read about **knowledge management**.

System and Information System

What is a system?

❖ Is a set of interrelated components interacting together to achieve a common goal.

❖ Is a **whole** containing two or more interacting parts that each of which can affect the properties or behavior of the whole

Systems Thinking

❖ A system is bigger than the sum of its components;

❖ It's a mind set or way of thinking **to view** the world (**everything** in the world) **as a system**.

❖ It emphasizes on interaction that keeps the system alive.

❖ Before changing the part, you have to demonstrate it improves the whole (Systemic thinking or systemic principle).

❖ Today's problems are the results of yesterday's solutions.

❖ Every solution creates new problems.

Information systems

❖ Are arrangement of people, data, process, interface, communication and IT that interact
   ❖ to support and improve day-to-day operations in business
   ❖ support the problem solving and decision making needs of management and users
❖ Can exist with or without computers
❖ Transform data in to useful information

Cont…

❖ Information technology can help all kinds of businesses improve the efficiency and effectiveness of their business processes, managerial decision making, and workgroup collaboration, which strengthens their competitive positions in rapidly changing marketplaces.

Simplified Information Systems   diagram
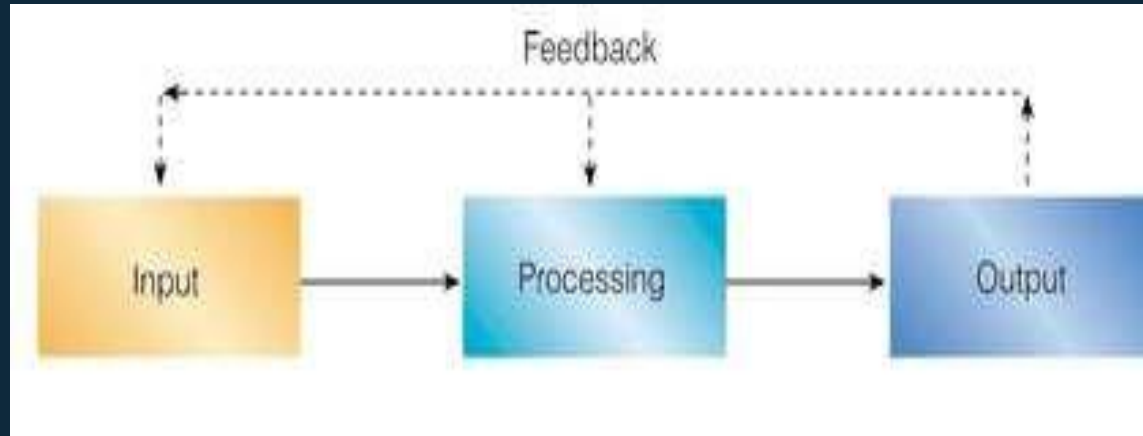
Components of Computer Based Information Systems

❖ Considera system for email exchange and list the components participating in the process!

❖ Computer Based Information Systems (CBIS) consist of the following components:
- Hardware
- Software
- Databases (data / information)
- Human resources (people)
- Procedures (Process)
- Telecommunications

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Components of a CBIS

Procedures: Strategies, policies, methods, and rules for using a CBIS.

Telecommunications: Electronic transmission of signals for communication
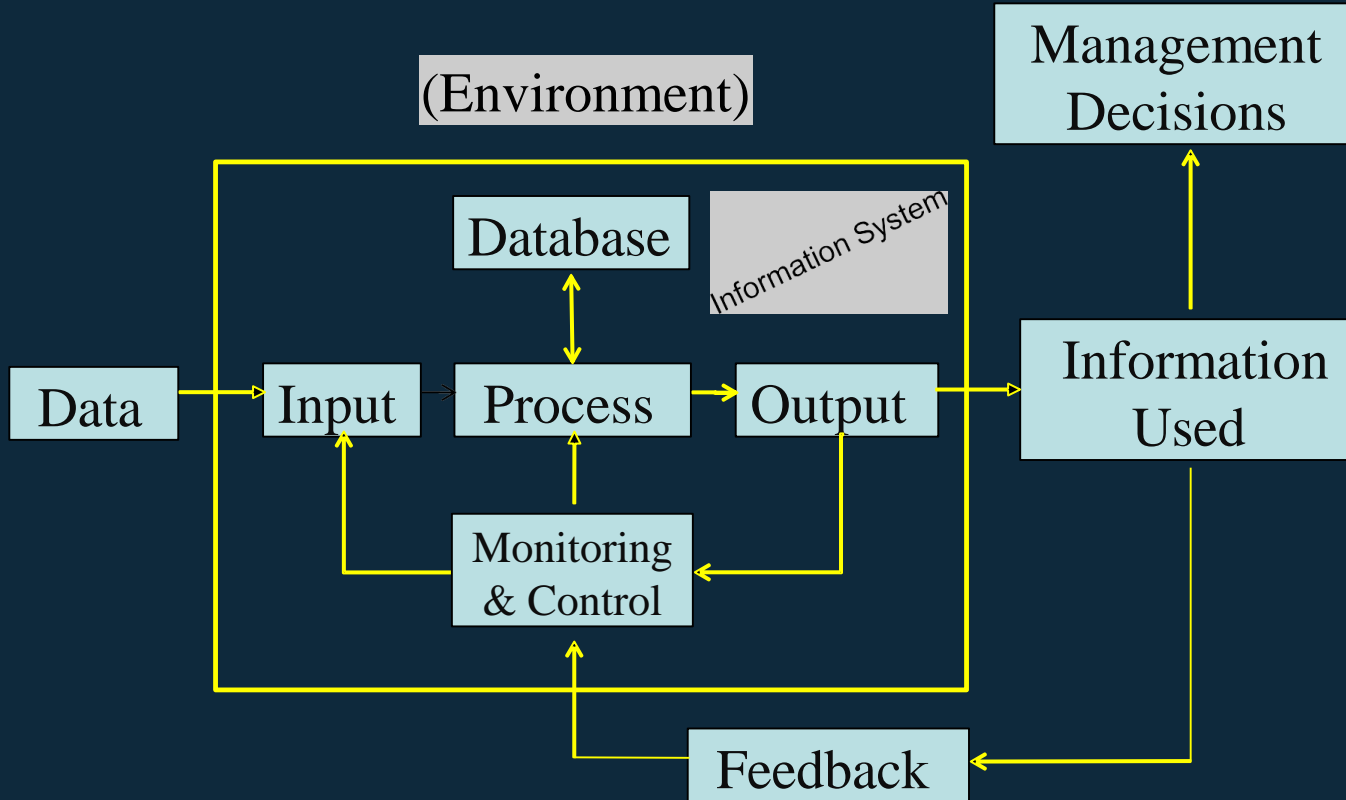
Hardware: Computer Equipment

Software: Computer Programs

Databases: An organized collections of facts

People: Users, system analysts, programmers, CIO, etc.

General Information Systems Diagram

Information Systems

❖ The objectives of a system are realized in its outputs.

❖ Outputs meet requirements of its stakeholders;

❖ The components collect, process or transform, and disseminate data and information

➢ **Examples**

Banking Systems, ERP, Airline Reservation Systems; Student Management Systems, HRM, Library Systems, Scheduler, SCM, TPS, Expert Systems, POS in groceries, GIS…

Information systems

➢ Information systems use data stored in computer databases to provide needed information.

➢ A database is an organized collection of interrelated data reflecting a major aspect of a firm's activities.

- ❖ Information systems **capture data from the organization** (internal data) and its environment (external data).

- ❖ Store the database items over an extensive period of time.

- ❖ When specific information is needed, the appropriate data items are manipulated as necessary, and the user receives the resulting information.

- ❖ Depending on the type of information system, the information **output** may take the form of a **query** response, decision outcome, **expert-system** advice, **transaction** document, or a **report**.

Cont…

❖ Data captured by information systems relates to
- The **operations of the organization** internal information.
- In a competitive market place, firms need to access more and more external information.

❖ Environment (external data)
- the **stakeholders** of a firm, which includes extended partners and external stakeholders.
- Who are the **stakeholders** of a school?

Cont…

❖ Effectiveness and Efficiency

    ❖ The quality of the system may be evaluated in terms of its effectiveness and efficiency

    ❖ **Effectiveness** measures the extent to which a system meets its objectives.

    ❖ **Efficiency** is a measure of resources consumed to produce given outputs. The fewer resources a system consumes in producing given outputs, the more efficient it is.

Information Systems in Business
IS supports Businesses (Organizations)

❖ ⬜Business functions (horizontal)
   ❖ ⬜Buy, Make, Sale, Keep track, support, financial matters,
      ❖ people matters, etc.
❖ ⬜Business processes
   ❖ ⬜A series of interrelated activities through which work is organized and focused to produce a product or service
❖ ⬜Business levels (vertical)
   ❖ ⬜Strategic (lead people, long term planning)
   ❖ ⬜Tactical (coordinate , short to medium term planning)
   ❖ ⬜Operational (supervise, monitor, and customer services)

Six departments and *Three* management levels to which information must flow in an Organization

Information Systems Applications in an Organization

Decisions

Unstructured

Strategic

Semi-structured

Tactical

Technical (Operational)

Structured

Management Levels

Senior Management

Knowledge and Data Workers

Middle Management

Lower Management

Functions

Types of Information Systems

ESS, EIS

DSS

GIS, CAD/CAM

MIS

OAS

TPS

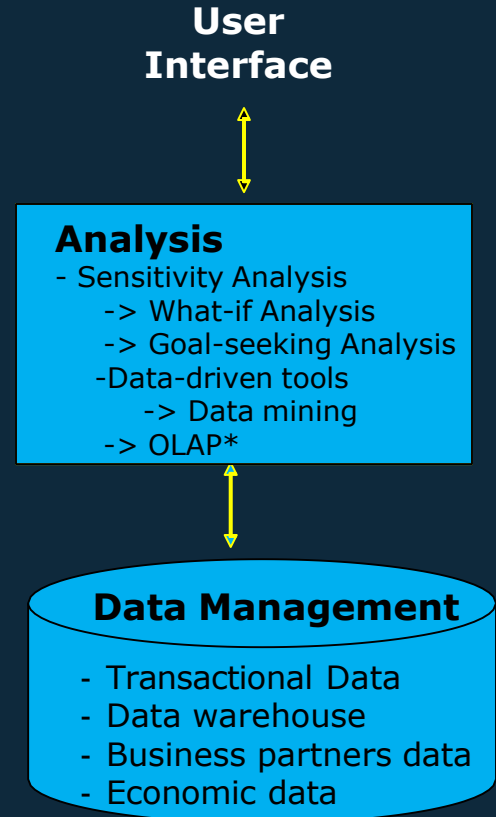Buy | Make | Sell | Keep Track

Non management Employees
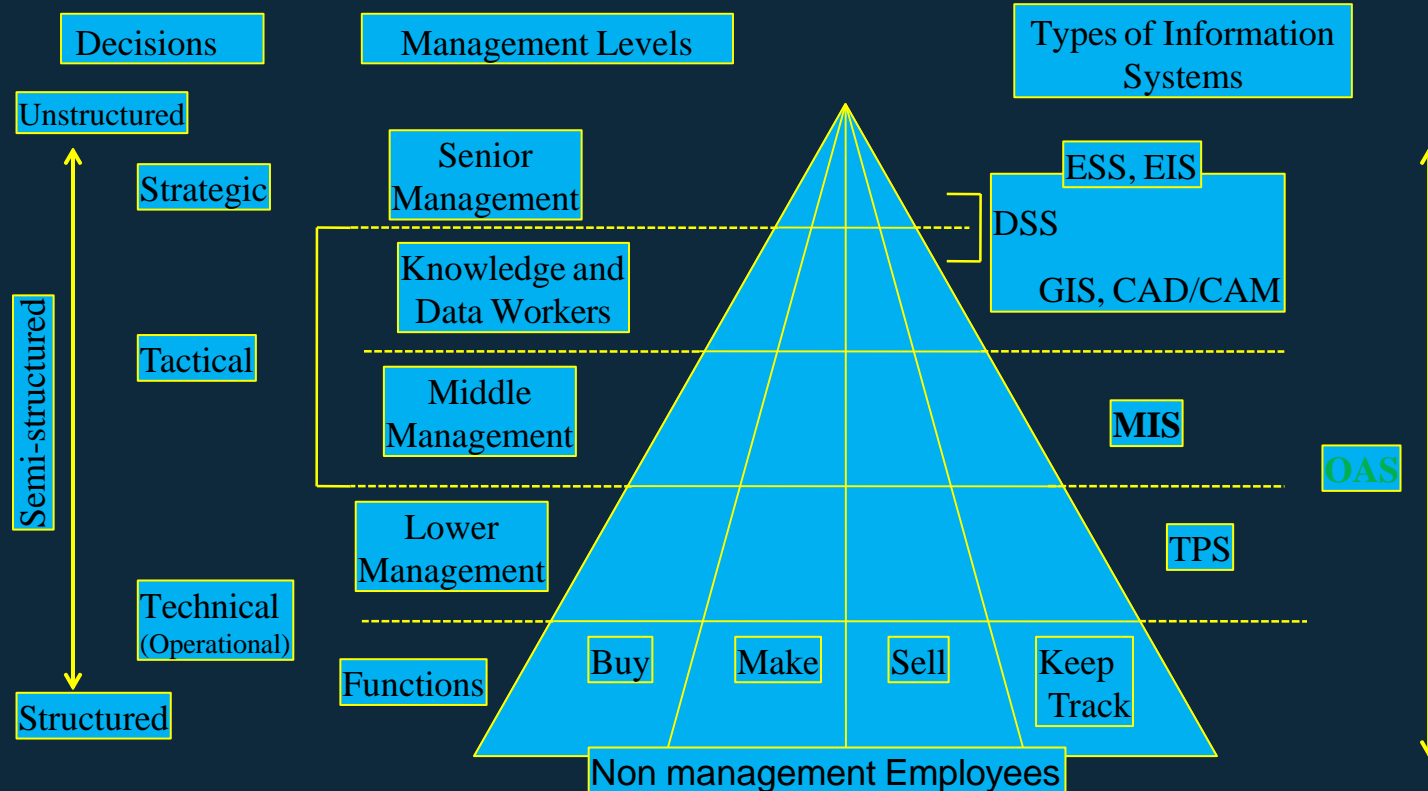
Administrative Information Systems

- Transaction Processing Systems (TPS)
  - Basic business system that serves the operational level in an organization
- Office Automation Systems (OAS) also OIS
  - Systems designed to help office workers in doing their job (fax, voicemail, email, document processing, etc.)
- Decision Support Systems (DSS)
  - Systems designed to support middle managers and business professionals during decision-making process
- Executive Information Systems (EIS) or Executive Support Systems (ESS)
  - Specialized DSS that help senior level executives make decisions.

DSS structure

- Systems designed to help middle managers make decisions
- Major components
  - Data management subsystem
    - Internal and external data sources
  - Analysis subsystem
    - Typically mathematical in nature
  - User interface
    - How the people interact with the DSS
    - Data visualization is the key
      - Text
      - Graphs
      - Charts

  * OLAP: OnLine Analytical Processing

User Interface

Analysis
- Sensitivity Analysis
  -> What-if Analysis
  -> Goal-seeking Analysis
-Data-driven tools
  -> Data mining
-> OLAP*

Data Management

- Transactional Data
- Data warehouse
- Business partners data
- Economic data

DSS' Model Management Tools

❖ Simulation is used to examine proposed solutions and their impact
- ❖ Sensitivity analysis
- ❖ Determine how changes in one part of the model influence other parts of the model
  - ❖ What-if analysis
    - ❖ Manipulate variables to see what would happen in given scenarios
  - ❖ Goal-seeking analysis
    - ❖ Work backward from desired outcome

What-if Analysis	Change in Interest Rate		
	Loan Amount	*Interest Rate	Monthly Payment
	$10,000	5.00%	$230.29
	$10,000	5.50%	$232.56
	$10,000	6.00%	$234.85
	$10,000	6.50%	$237.14
	$10,000	7.00%	$239.46
	$10,000	7.50%	$241.78
	$10,000	8.00%	$244.12

Determine monthly payment given various interest rates.

Why Learn Computer Science and Information Systems?

❖ Advance in your career

❖ Solve problems

❖ Realize opportunities and change

❖ Meet your career goals

❖ Information systems and technologies are vital components of successful businesses and organizations -- some would say they are business imperatives.