

# Chapter 1: Introduction

- Overview of Computer Science and ICT
- Knowledge Hierarchy (Data, Information, Knowledge and wisdom)
- What is an Information System?
- Applications of IS/ICT
- Responsibilities of IS
- **Why study CS?**

# Chapter 1: Overview

**Computers and Communications:** “These are the parents of the information age,” says one writer. “When they meet the fireworks begin.”

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

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

# Cont...

**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 are Computers, Communications, Consumer Electronics, Entertainment, and Mass media.

## **The Merger of Computers and Communications;**

**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.

# Cont...

**Communications Technology:** Communications, or Telecommunications, Technology consists of electromagnetic devices and systems for communicating over long distances. The principal examples are telephone, radio, broadcast television, and cable TV, and other telecom technologies.

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

**Why have the worlds of computers and telecommunications remained so long before coming together?**

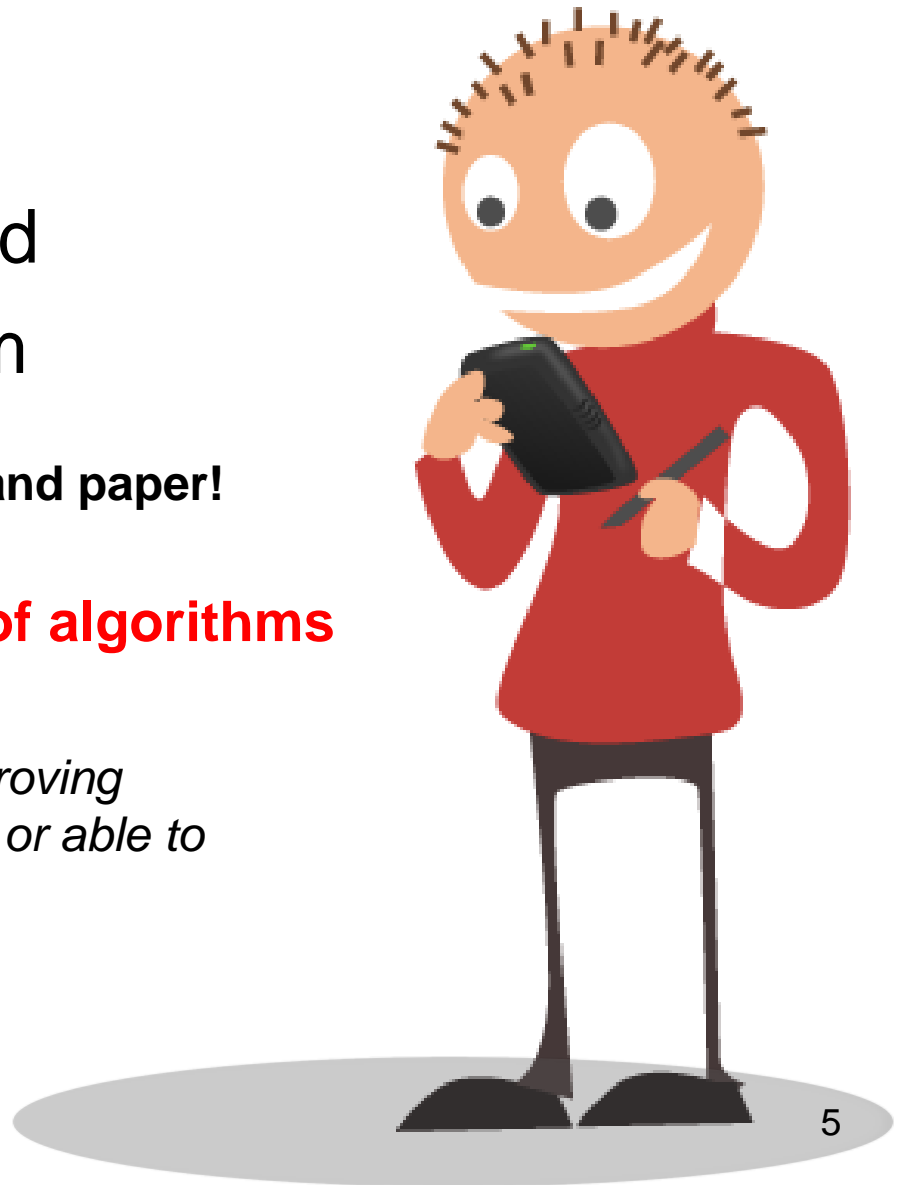
# What is Computer Science?

CS is **designing**  
**computing devices** and  
**programming** them

A lot of work in CS is done with pen and paper!

**Computer science is the study of algorithms**

*A lot of computer science is about improving technology-- making it **faster**, **smaller** or able to do **new things**.*



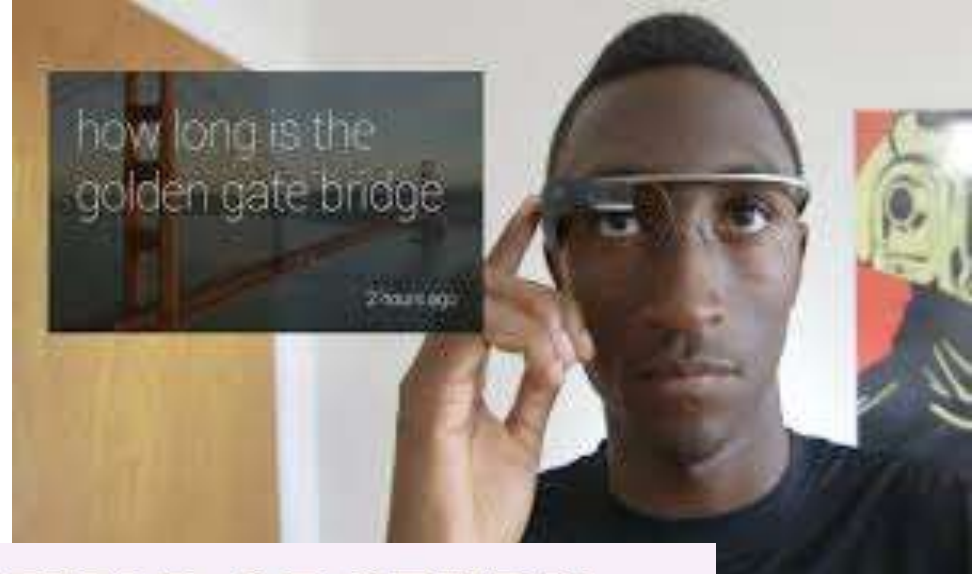
# Computer Science is *engineering new products*

**Do you  
want to:**

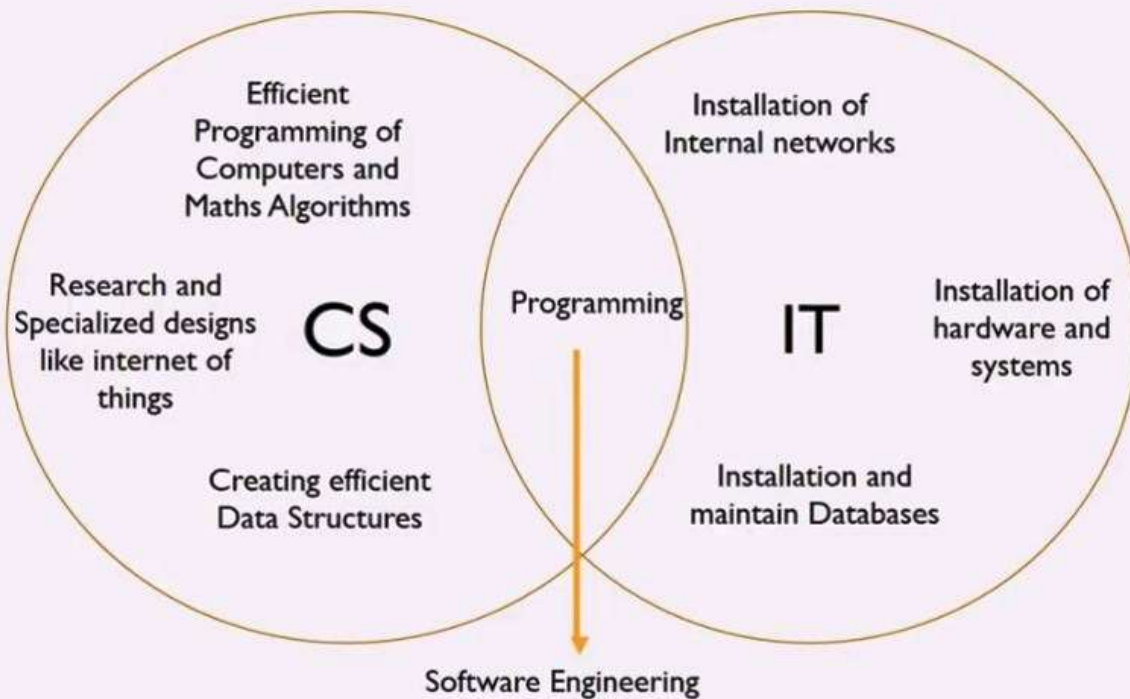
Create  
devices  
that can  
do the  
work for  
you?



Google Glass, *the first wearable computer* 6



## DIFFERENCE IN FIELD OF STUDY





- Computer science is **programming intensive**
- Involves
  - system architecture
  - software engineering
  - application programming
  - hardware
  - theory
- Information Technology is associated to **organization related applications**
  - business related
  - organizational automation
  - ICT is a Change Agent (Enabler)



# Information Concepts



# Data vs. Information

- **Data:** raw facts and figures
  - Symbols + Rules    **(Syntax level)**
  - Representing events and/or objects or organization
  - has no meaning
  - By-product of doing business/transaction
  - Types of Data
    - Quantitative (Structured) /material
    - Qualitative (Unstructured) /textual, image, voice
    - Financial
  - Forms of Data
    - Quantity – weight in KG, liter, ...
    - Quality – taste, choice, ...
    - Currency – Finance in birr, dollar, ...

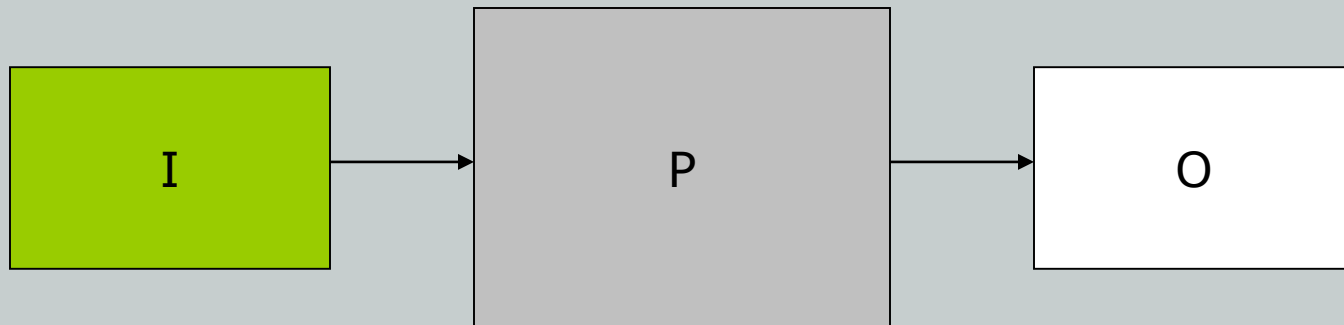
# Information

- **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 the business.
  - Sets of Data + meaning **(Semantics level)**
  - (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
  - “What we collectively know”
  - Cognitive state of awareness

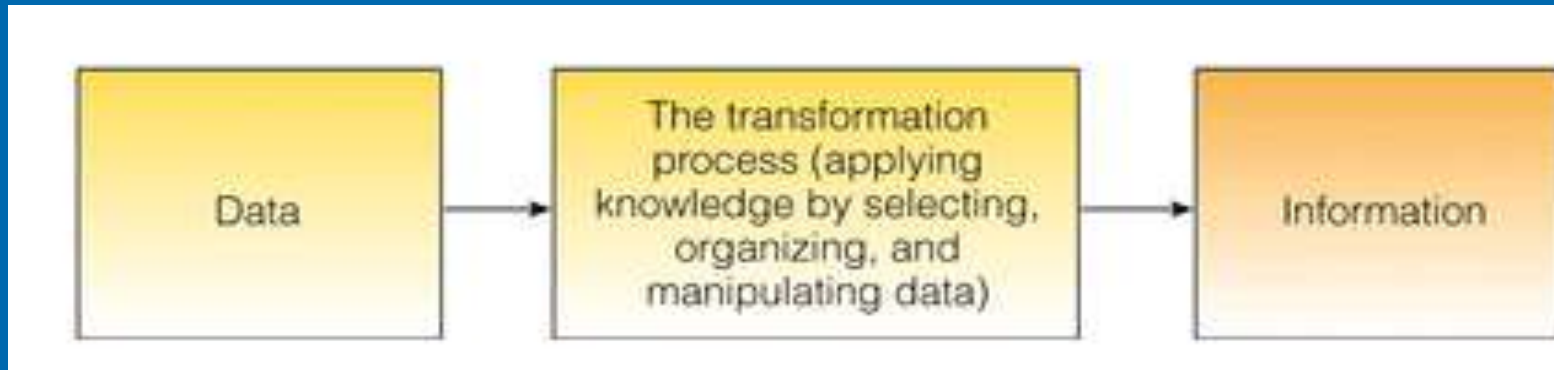
# Data versus Information

---

- ❑ Data = raw facts that represent the characteristics of an event
  - Example 1:
    - ❑ Event: High 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 Ababa** was 22° C



# The Process of Transforming Data into Information



# Cont..

## ➤ Knowledge

- Once you spend some time interpreting and understanding a body of information, then you have knowledge
- Information + understanding pattern
- “What we individually know”, “Your Know-how”
- 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
- Information with Experience
- Cognitive state beyond awareness

# 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

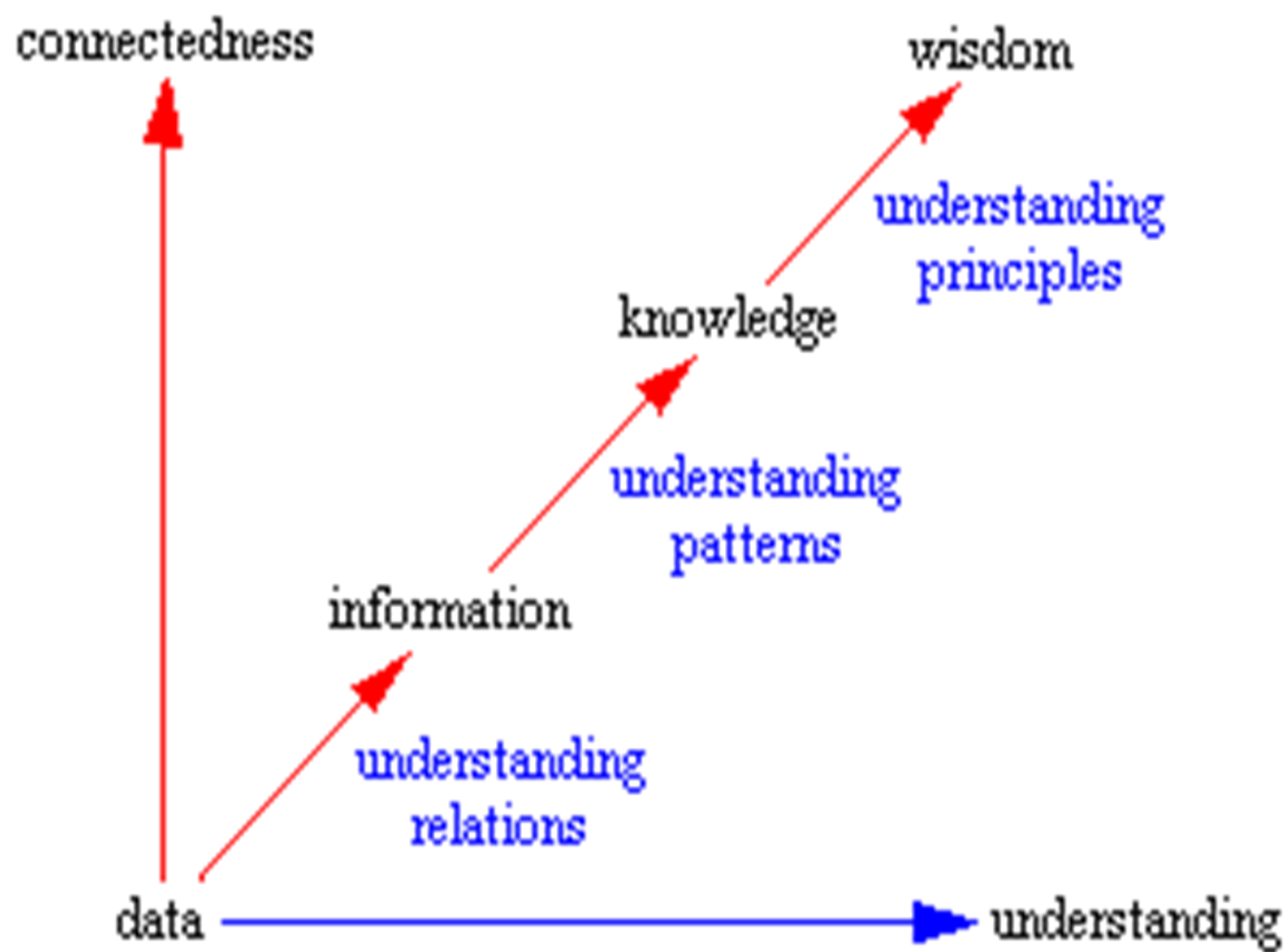
**Wisdom  
or  
Meta-Knowledge**

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

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

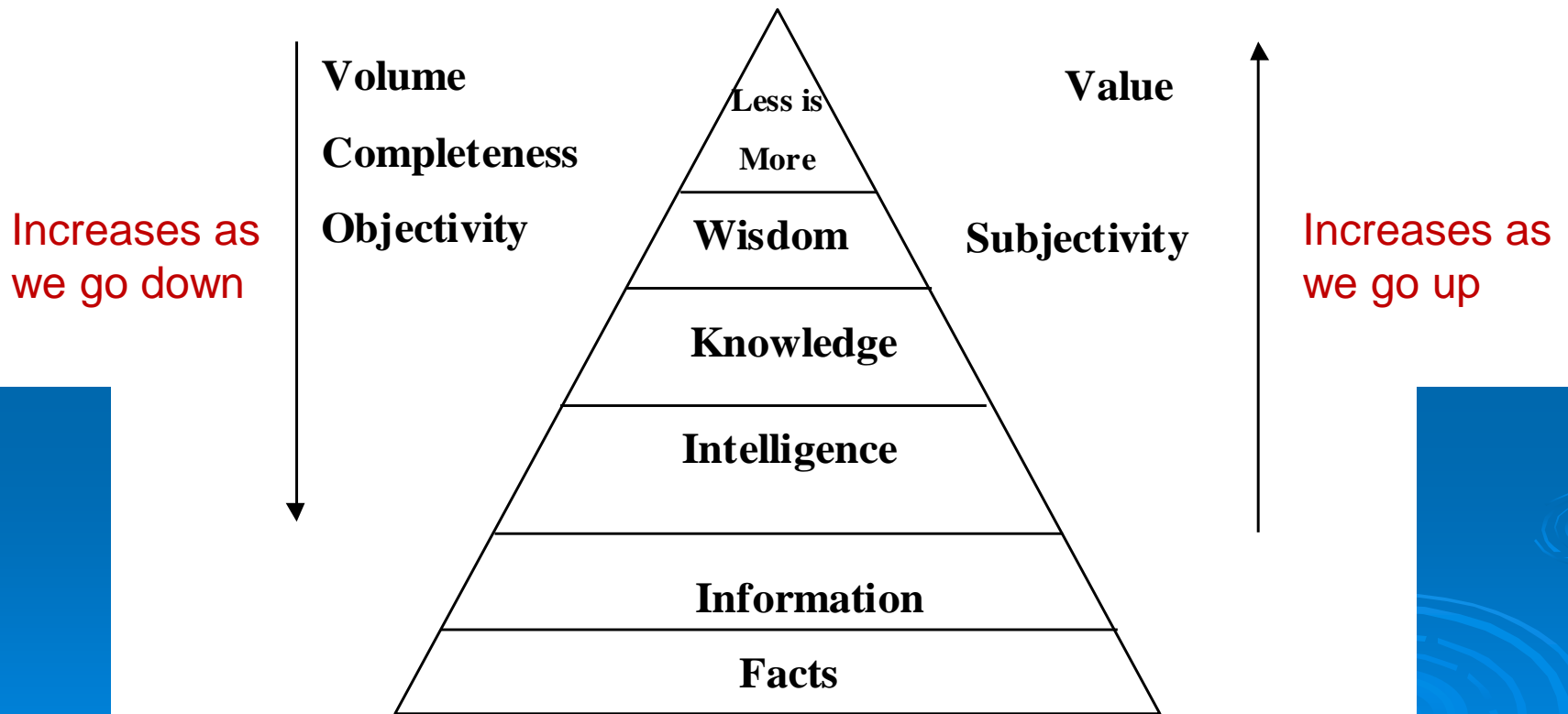
**Data:** Large volume, low value, usually no meaning  
or context

**Noise:** May contain irrelevant items which obscure data



# From Facts to Wisdom

## one example of the hierarchy



# Characteristics of Valuable Information

Characteristics	Definitions
Accurate	Accurate information is error free. In some cases, inaccurate information is generated because inaccurate data is fed into the transformation process (this is commonly called garbage in, garbage out [GIGO]).
Complete	Complete information contains all the important facts. For example, an investment report that does not include all important costs is not complete.
Economical	Information should also be relatively economical to produce. Decision makers must always balance the value of information with the cost of producing it.
Flexible	Flexible information can be used for a variety of purposes. For example, information on how much inventory is on hand for a particular part can be used by a sales representative in closing a sale, by a production manager to determine whether more inventory is needed, and by a financial executive to determine the total value the company has invested in inventory.
Reliable	Reliable information can be depended on. In many cases, the reliability of the information depends on the reliability of the data collection method. In other instances, reliability depends on the source of the information. A rumor from an unknown source that oil prices might go up may not be reliable.
Relevant	Relevant information is important to the decision maker. Information that lumber prices might drop may not be relevant to a computer chip manufacturer.
Simple	Information should also be simple, not overly complex. Sophisticated and detailed information may not be needed. In fact, too much information can cause information overload, whereby a decision maker has too much information and is unable to determine what is really important.
Timely	Timely information is delivered when it is needed. Knowing last week's weather conditions will not help when trying to decide what coat to wear today.
Verifiable	Information should be verifiable. This means that you can check it to make sure it is correct, perhaps by checking many sources for the same information.
Accessible	Information should be easily accessible by authorized users to be obtained in the right format and at the right time to meet their needs.
Secure	Information should be secure from access by unauthorized users.

# Advantages and Disadvantages of Using Computers

## Advantages of Using Computers

Speed

Reliability

Consistency

Storage

Communications

## Disadvantages of Using Computers

Health Risks

Violation of Privacy

Public Safety

Impact on Labor Force

Impact on Environment

# Types of Data

Data	Represented by
Alphanumeric data	Numbers, letters, and other characters
Image data	Graphic images or pictures
Audio data	Sound, noise, tones
Video data	Moving images or pictures



# Reading Assignment

- Read about the two types of knowledge; **tacit** and **explicit** knowledge.
- Read about **knowledge management**.

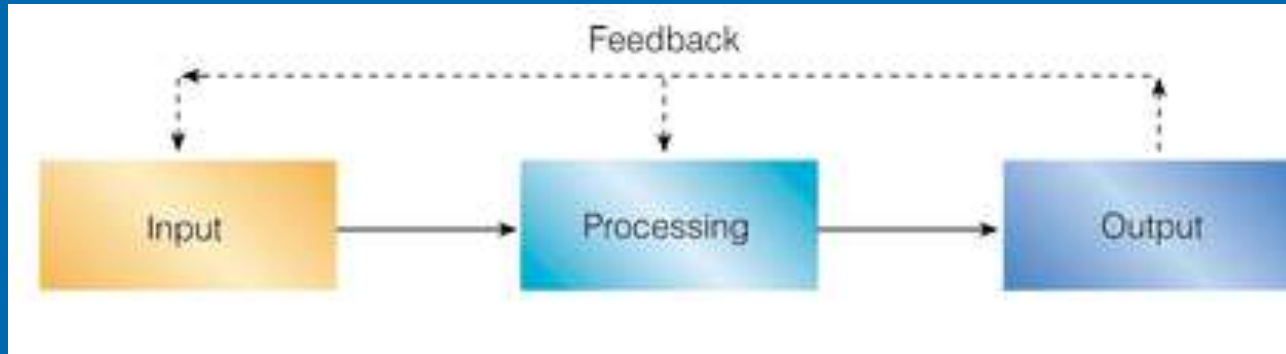
# Chapter 1: Introduction

- Overview of ICT and CS
- Knowledge Hierarchy( Data , Information, Knowledge and wisdom) and Knowledge Management
- **What is a System? What is an Information System?**
- Applications of IS/ICT
- Responsibilities of IS
- **Why study CS?**

# 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
- Basic **characteristics** :
  - **Emergent properties or behaviors, Hierarchy, Communications, Monitoring and Control Mechanisms**
  - Input, output, environment, scope or boundary, objectives, sub-systems, interface, HW, SW, equipment, users;

# Simplified Information Systems diagram



- A System is an adaptive Whole.

The whole is the product of the interactions of its parts, not the sum of its parts taken separately. It is greater than the sum of its parts.

# 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. Or,
- Every solution creates new problems.