

CSc 1350:Preliminaries

Introduction

- What is Computer Science?
- Anatomy of a Computer
- What is *Java*TM?

1 What is Computer Science?

Definition 1. An **algorithm** is an ordered set of unambiguous, executable steps that defines a terminating process. Informally, an algorithm is a set of steps that defines how a task is performed.

Computer science is an academic discipline with its roots in the fields of applied mathematics and logic, and initially it was not even considered a new discipline. Computer science is not about the study of computers, nor is it the study of programming. Programming is a tool that computer science uses to explore new ideas and solutions to problems.

Definition 2. **Computer science** is primarily about the study of algorithms, which includes their mathematical properties, their hardware and linguistic realizations, and their applications.

Before a machine such as a computer can perform a task, an algorithm for performing that task must be discovered and represented in a form that is compatible with the machine.

Definition 3. A **computer program** is a representation of an algorithm in a programming language.

2 Anatomy of a Computer

A **computer** is an electronic device that performs arithmetic and logic operations. There are broadly four operations associated with a computer. *input*, *processing*, *storage* and *output* of data/information. There are three key actors in the computing ecosystem: humans, *hardware* and *software*. The process of developing a program, encoding it in machine-compatible form, and inserting it into a machine is called **programming**. These tasks are performed by humans. You will spend a substantial portion of this course learning how to develop a program in the *Java* programming language. Programs, and the algorithms they represent, are collectively referred to as **software**, in contrast to the physical machinery, which is known as **hardware**. A machine's software can be put into two broad categories: **application software** and **system software**. Application software consists of the programs for performing tasks particular to the machine's utilization. For example, *Matlab*, *Microsoft Office* and *Java* are examples of application software. System software performs those tasks that are common to computer systems in general. For example, Microsoft Windows is system software. Within the class of system software, there are two categories: one is the operating system itself and the other consists of software units collectively known as **utility software**. *Drivers* and diagnostic tools are examples of utility software. The computer hardware consists of several elements and components.

1. The circuitry in a computer that controls the manipulation of data is called the **central processing unit**, or **CPU** (often referred to as the processor). In most PCs, the CPU's connecting pins are plugged into a socket mounted on the machine's main circuit board (called the **motherboard**). A CPU consists of three parts: the **arithmetic/logic unit**, which contains the circuitry that performs logic and arithmetic operations on data; the **control unit**, which contains the circuitry for coordinating the machine's activities; and the **register unit**, which contains data storage cells (similar to main memory cells), called registers, that are used for temporary storage of information within the CPU.
2. A computer also contains data **storage** areas. Information is encoded as patterns of 0s and 1s, actually on and off electrical signals. These digits are called bits (short for binary digits). The computer contains a large collection of circuits, each capable of storing a single bit. This bit

reservoir is known as the machines *main memory*. Software runs in the main memory. A computers main memory is organized in manageable units called **cells**, with a typical cell size being eight bits. A string of eight bits is called a *byte*, the primary unit for measuring storage in a computer. A computer also has **secondary storage**, typically a *hard disk*. Some other secondary storage devices are CD ROMs and flash drives. Main memory has relatively faster data access, is made of more expensive components and generally has smaller capacity than secondary storage devices. Here is a loose analogy: secondary storage is to a warehouse as main memory is to a store. Customers interact with a retail business via the store. Software runs in the main memory. Goods are brought from the warehouse into the store for sale. Programs are uploaded from the hard disk into the main memory before they begin running.

3. The computer also has several **peripherals** to facilitate human interactivity. These include input/output devices such as keyboard, mouse, monitor, scanners and printers.

3 What is Java?

You will be learning how to develop programs in the *Java*TM language. Java was developed at Sun Microsystems, which was later purchased by Oracle. A Canadian computer scientist James Gosling designed Java. The first version of Java was released in 1996. It is widely used for two key reasons: it is safe and portable. By portable, we mean it can be used across multiple platforms. It contains a software component called the *Java Virtual Machine* that allows it to run on multiple platforms since the code runs in the virtual machine rather than on the underlying architecture. Java is an example of an *object-oriented programming (OOP)*. In the last third of this course, you will be more formally introduced to the fundamentals of OOP.

Definition 4. In **object-oriented programming** a software system is viewed as a collection of units, called *objects*, each of which is capable of performing the actions that are immediately related to itself as well as requesting actions of other objects. Together, these objects interact to solve the problem at hand.