CHAPTER 1:

INTRODUCTION TO COMPUTERS AND PROGRAMMING

Prepared By: Engr. Joyce Ann G. Acob

Introduction

com·put·er

[kəm'pyo͞odər] - an electronic device for storing and processing data, typically in binary form, according to instructions given to it in a variable program.

People use computers at...

- School for writing papers, research, email, online classes, etc.
- Work for analyzing data, make presentations, business transactions, communicating, control machines, etc.
- Home for paying bills, shopping online, communicating, playing computer games, etc.

Introduction

Devices that are computers...

- Smartphones
- iPhone
- Car navigation system (GPS)
- Tablets
- Any electronic equipment controlled by a CPU (central processing unit)

Computers are designed to do any job that their programs tell them to do.

A ***program*** is a set of instructions that a computer follows to perform a task.
For example: Microsoft Word and PowerPoint
Programs are commonly referred to as ***software***.

What software have you used?

Programmers or ***Software Developers*** are the individuals that create computer software. They have the training and skill to design, create, and test computer programs.

What are some of the fields in which computer programs are used?

Hardware and Software

Concept:

The physical devices that a computer is made of are referred to as the computer's hardware. The programs that run on a computer are referred to as software.

Hardware

- The physical devices that a computer is made of are referred to as the computer's hardware.
- A computer is a system of devices that work together.

Hardware

A Computer System consists of:

- Central Processing Unit (CPU)
- Main memory
- Secondary storage
- Input devices
- Output devices

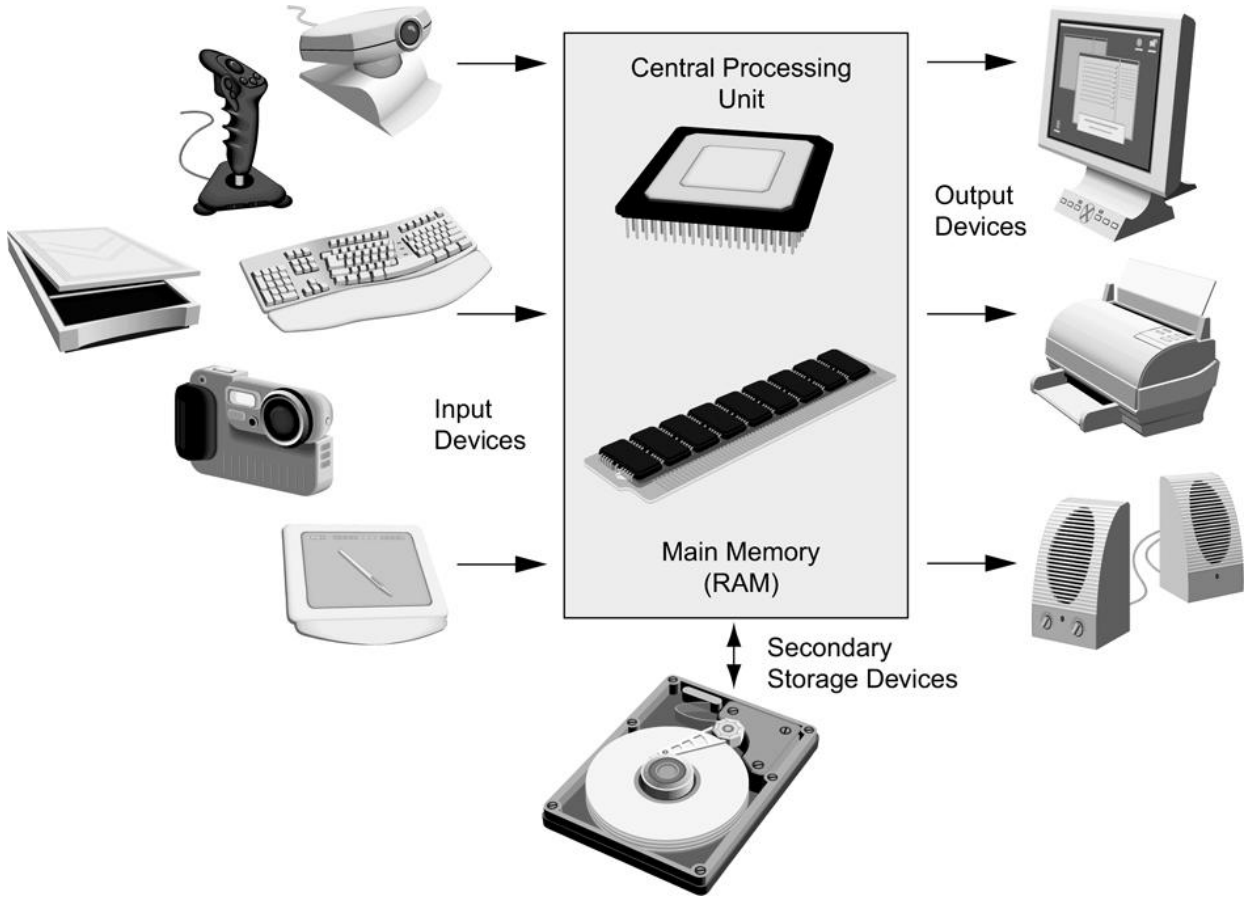
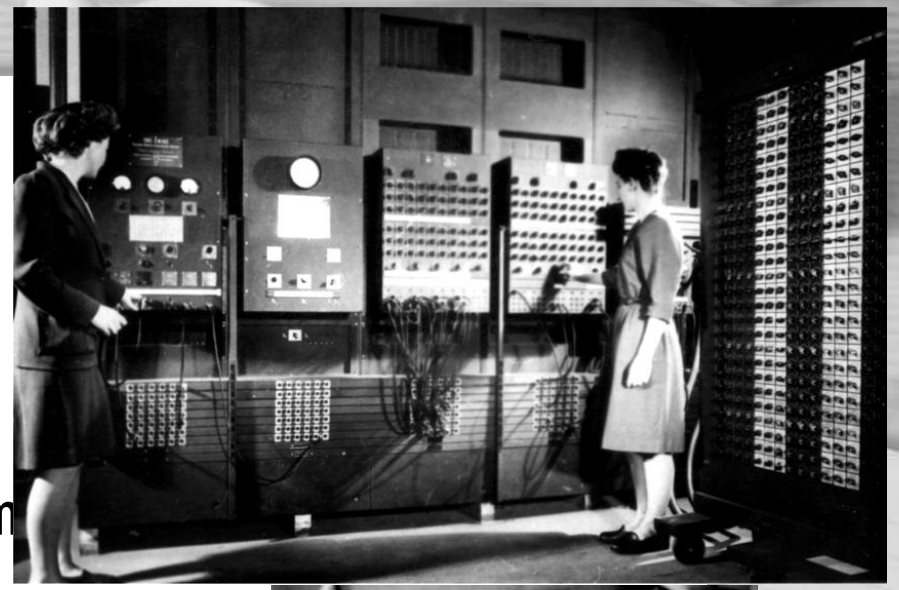


Figure 1-2 Typical components of a computer system

Hardware

ENIAC

World's first programmable computer
Built in 1945
Designed to calculate artillery ballistic tables for the U.S. Arm
CPU was 8 feet tall, 100 feet long, and weighed 30 tons



Microprocessor

Much smaller
Much more powerful

Figure 1-3 The ENIAC computer (courtesy of U.S. Army Historic Computer Images)
Figure 1-4 A lab technician holds a modern microprocessor (photo courtesy of Intel Corporation)

Hardware

Main Memory

- Considered the computer's work area
- Computer stores the program that is running as well as the data
- Commonly known as the random-access memory (RAM)
- Data is quickly accessed
- RAM is a volatile type of memory
- Used for temporary storage
- RAM is erased when computer is turned off

Secondary Storage Devices

- Type of memory that can hold data for long periods of time.
- Programs and important data are stored in secondary storage

Disk drive is a common type of secondary storage

- Data is stored by magnetically encoding it onto a circular disk

- Most computers have an internal disk drive
- Some have external disk drives; they are used to create backup copies

Floppy drives record data onto a small floppy disk

- Holds only a small amount of data
- Slow to access data
- Can be unreliable

Hardware

Secondary Storage Devices

- USB drives are small devices that plug into the computer's universal serial bus (USB) port

i. It does not contain a disk
ii. The data is stored on flash memory
iii. Also known as memory sticks and flash drives
iv. Inexpensive, reliable, and small

- Optical devices (CD or DVD)

i. Data is encoded as a series of pits on the disc's surface
ii. Uses laser to encode the data
iii. Holds large amounts of data
iv. Good medium for creating backups

Hardware

Input Devices

Any data the computer collects from people and from other devices is called input.
The hardware component that collects the data is called an input device.

Common input devices are:

- Keyboard
- Mouse
- Scanner
- Microphone
- Digital camera

Can you think of any other input devices?


Keyboard


Mouse


Joy Stick


Mic


Barcode Reader


Stylus/Pen


Web Camera


Touch pad


Touch Screen


Finger Print reader

Hardware

Output Devices

Any data the computer produces for people or for other devices is called *output*.
The hardware component that formats and presents the data is called an *output device*.

Common output devices are:

- monitor
- printer

Can you think of any other output devices?

Software

Everything a computer does is controlled by software.

Two categories of software:

- System software
- Application software

Software

System Software

Programs that control and manage the basic operations of a computer are referred to as *system software*.

Includes the following types:

- Operating System controls the internal operations of the computer's hardware and manages all of the devices connected to the computer.
- Utility Programs perform a specialized task that enhances the computer's operation or safeguards data.
- Software Developments Tools are programs that are used to create, modify, and test software.

How Computers Store Data

Concept:

All data that is stored in a computer is converted to sequences of 0s and 1s.

How Computers Store Data

A computer's memory is divided into tiny storage locations known as bytes
One byte represents one number
A byte is divided into eight smaller storage locations known as bits (binary digits)
Bits are tiny electrical components that can hold either a positive or a negative charge.

- A positive charge is similar to a switch in the on position
- A negative charge is similar to a switch in the off position

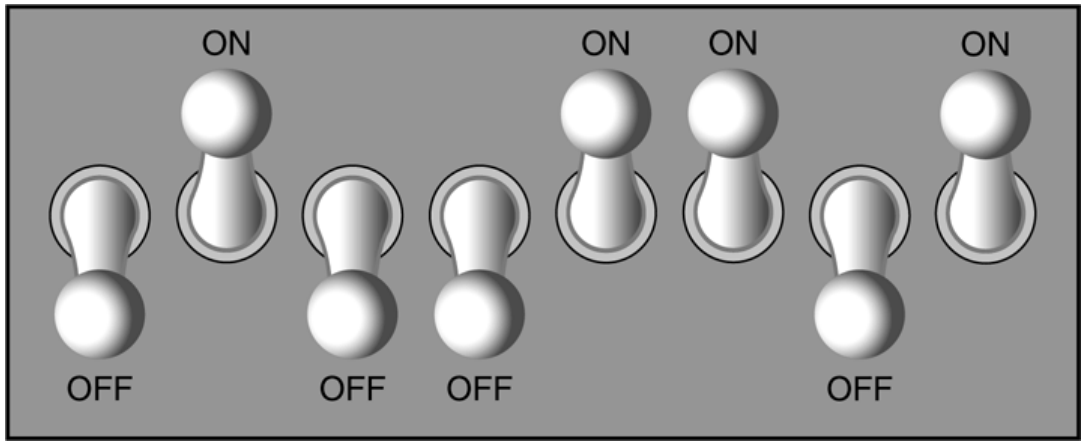


Figure 1-6 Think of a byte as eight switches

How Computers Store Data

Storing Numbers

- The positive charge or the on position is represented by the digit 1
- The negative charge or the off position is represented by the digit 0
- This corresponds to the binary numbering system where all numeric values are written as a sequence of 0s and 1s
- Each digit in a binary number has a value assigned to it

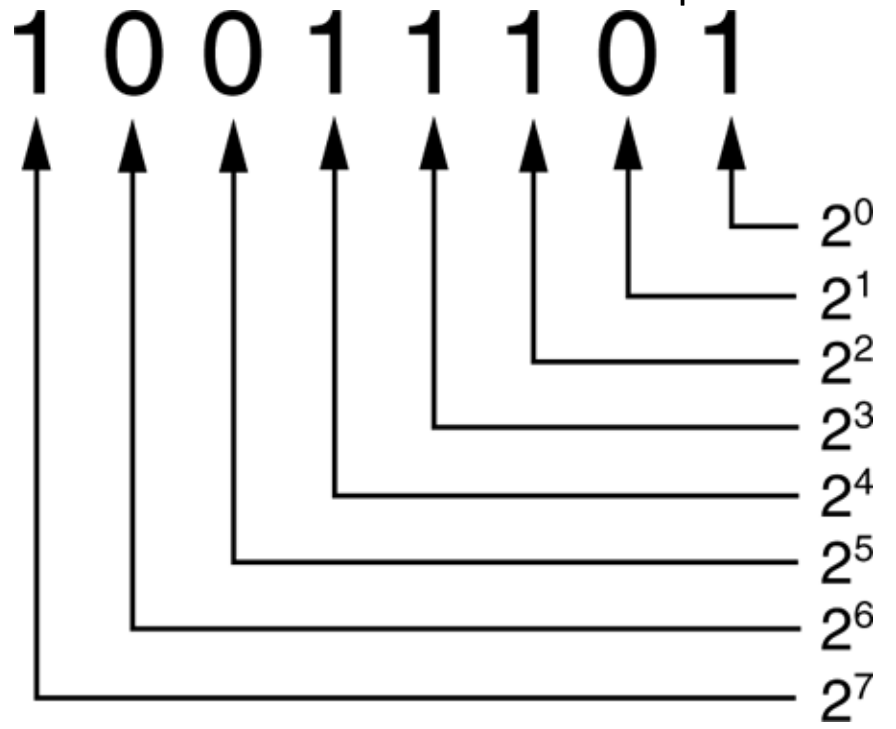


Figure 1-8 The values of binary digits as powers of 2

How Computers Store Data

Storing Numbers

For example:

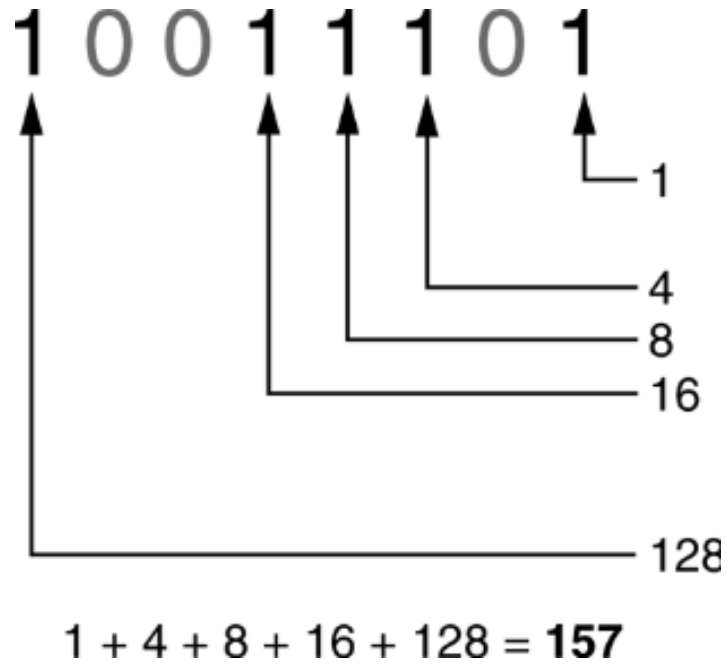


Figure 1-10 Determining the value of 10011101

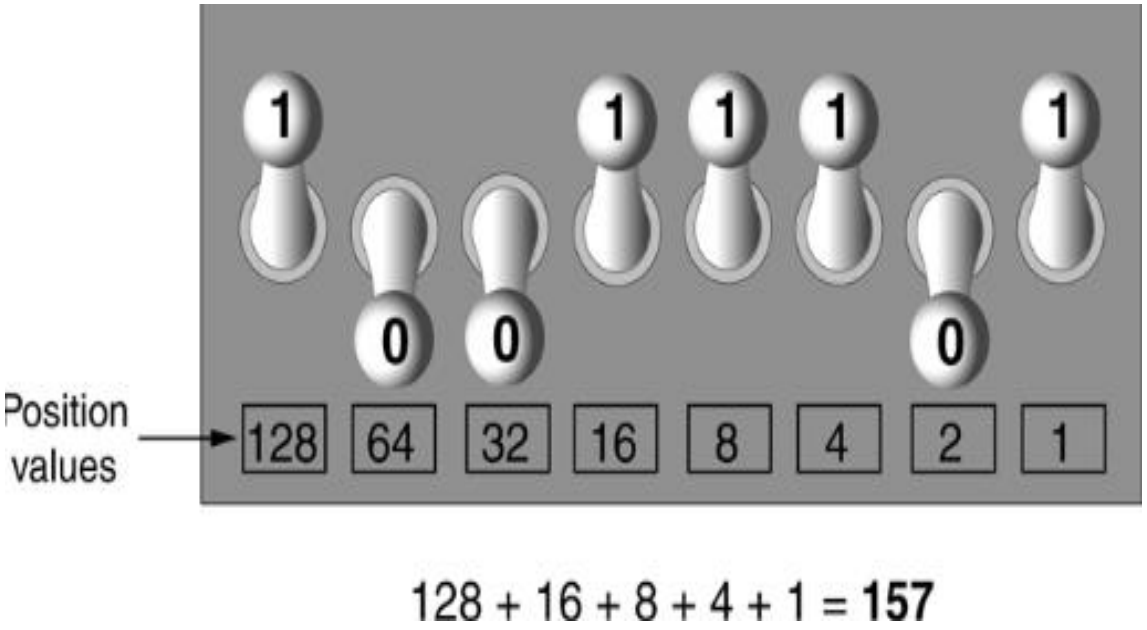
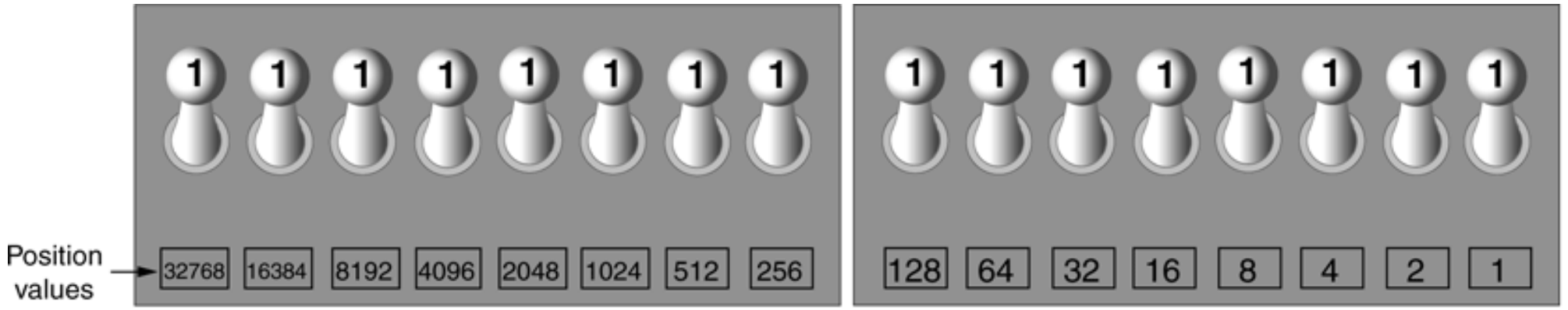


Figure 1-11 The bit pattern for 157

How Computers Store Data

Storing Numbers

- The largest value that can be stored in a byte with eight bits is ***255***
- Two bytes are used for larger numbers; maximum value is ***65535***



32768 + 16384 + 8192 + 4096 + 2048 + 1024 + 512 + 256 + 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = **65535**

Figure 1-12 Two bytes used for a large number

How Computers Store Data

Storing Characters

- Characters are stored in the computer's memory as binary number
- ASCII (American Standard Code for Information Interchange) is a coding scheme

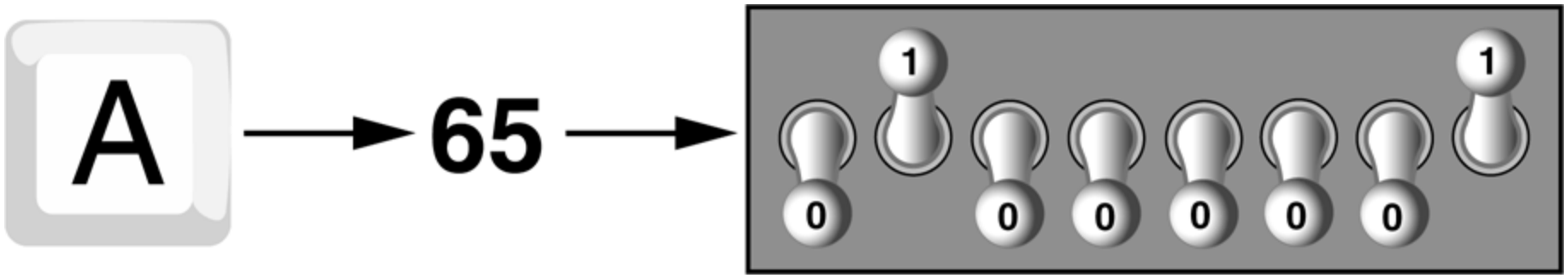


Figure 1-13 The letter A is stored in memory as the number 65

How Computers Store Data

Storing Characters

- ASCII is a set of 128 numeric codes
- ASCII is limited

Unicode is an extensive encoding scheme
It is compatible with ASCII
It represents characters for many languages in the world

Advanced Number Storage

- Binary numbering system can be used to represent only integer numbers
- Negative numbers are encoded using two's complement
- Real numbers are encoded using floating-point notation

How Computers Store Data

Other Types of Data

- Digital data is data that is stored in binary
- A digital device is any device that works with binary data
- Digital images are composed of tiny dots of color known as pixels (picture elements)
- Digital sound is broken into small pieces known as samples

How a Program works

Concept:

A computer's CPU can only understand instructions that are written in machine language. Because people find it very difficult to write entire programs in machine language, other programming languages have been invented.

CPU is the most important component in a computer
CPU is not a brain
CPU is not smart
CPU is an electronic device that is designed to do specific things.

How a Program works

CPU is designed to perform the following operations:

- Read a piece of data from main memory
- Adding two numbers
- Subtracting one number from another number
- Multiplying two numbers
- Dividing one number by another number
- Moving a piece of data from one memory location to another
- Determining whether one value is equal to another value

How a Program works

- CPU only understands instructions written in machine language
- Machine language instructions are written in 1s and 0s
- The entire set of instructions that a CPU can execute is known as the CPU's instruction set
- Each brand of microprocessors (Intel, AMD, and Motorola) has a unique instruction set
- Fetch-decode-execute cycle is the term used when the CPU executes the instructions in a program.

The cycle consist of three steps:

- Fetch
- Decode
- Execute

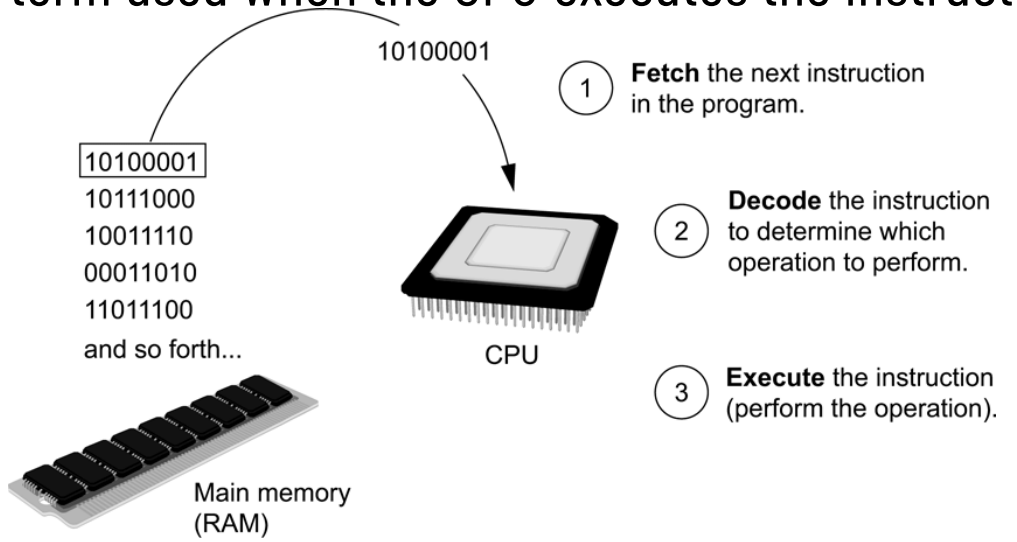


Figure 1-16 The fetch-decode-execute cycle

How a Program works

From Machine Language to Assembly Language

- Computers only understand machine language
- Machine language is difficult to write
- Assembly language uses short words that are known as mnemonics
- Assembler is used to translate an assembly language program to machine language

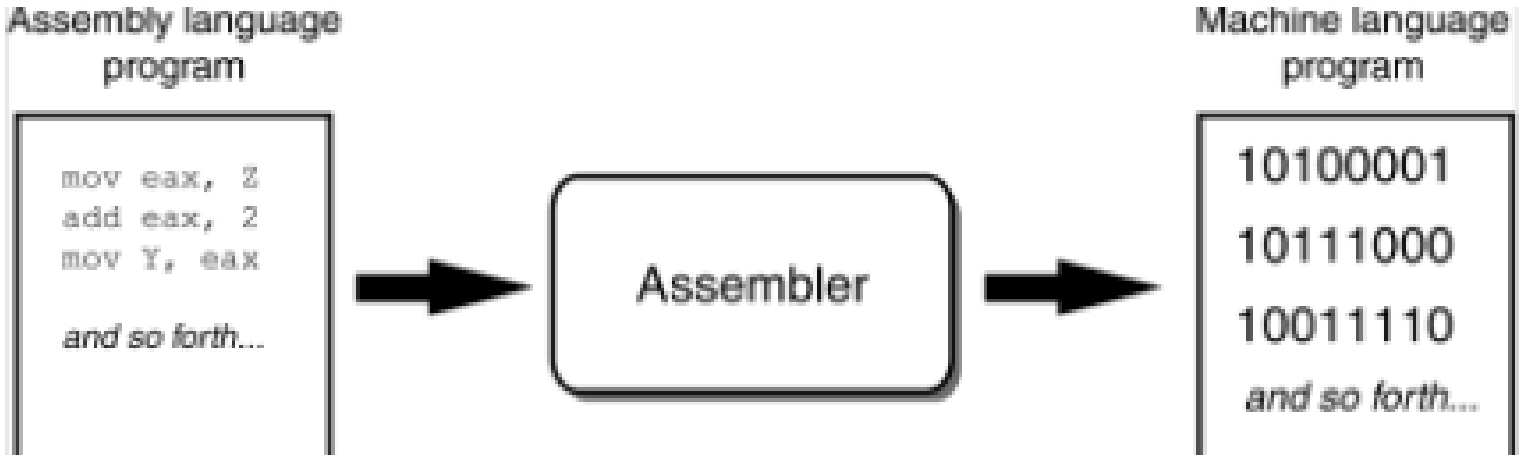


Figure 1-17 An assembler translates an assembly language program to a machine language program

How a Program works

High-Level Languages

- Assembly language is referred to as a low-level language
- High-level languages allow you to create powerful and complex programs without knowing how the CPU works, using words that are easy to understand.

For example:

Java, C++, Python, Visual Basic, C#, Ada, Fortran

Key Words, Operators, and Syntax: an Overview

- Key words or reserved words have specific meaning and purpose in the programming language
- Operators perform various operations on data
- Syntax is a set of rules that must be strictly followed when writing a program
- Statements are individual instructions written in a programming language

How a Program works

Compilers and Interpreters

- The statements written in a high-level language are called source code or simply code
- Source code is translated to machine language using a compiler or an interpreter

Syntax error is a mistake such as a:

- Misspelled word
- Missing punctuation character
- Incorrect use of an operator

Compiler is a program that translates a high-level language program into a separate machine language program

How a Program works

Compiler is a program that translates a high-level language program into a separate machine language program

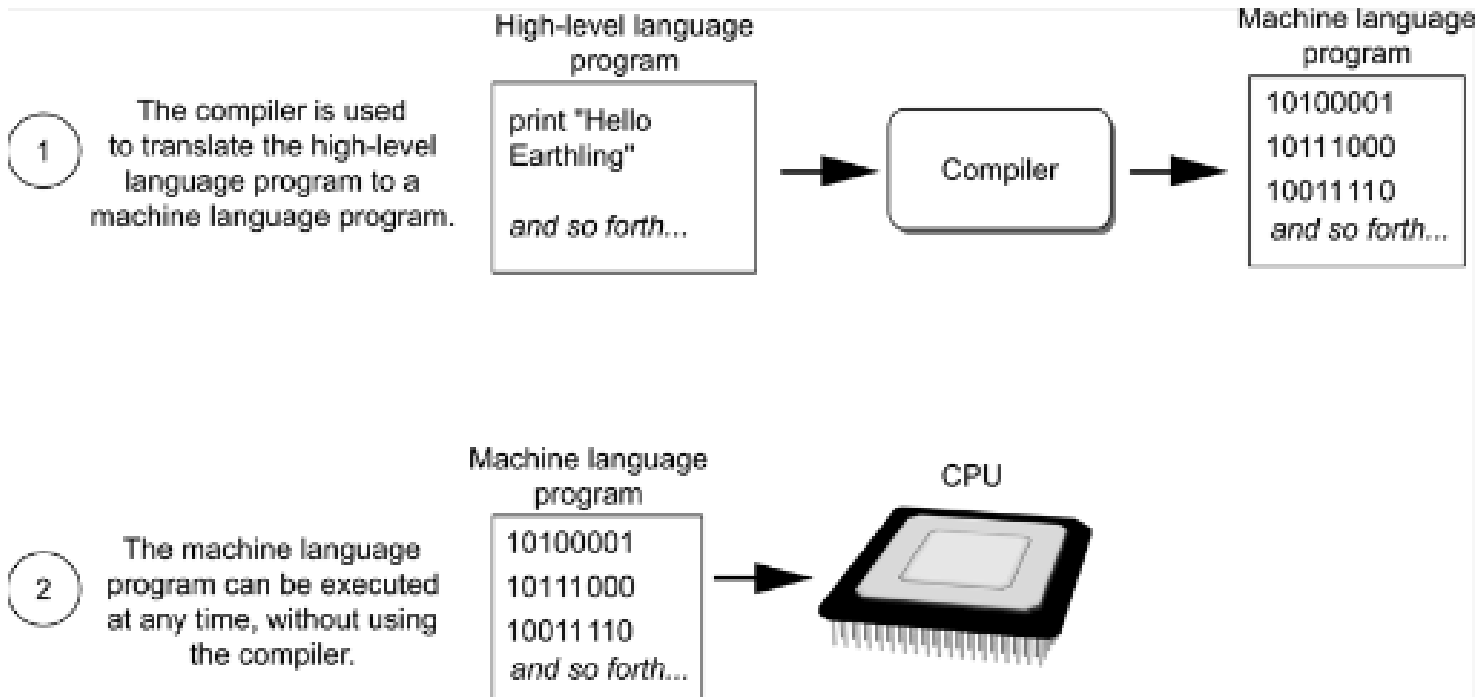


Figure 1-18 Compiling a high-level program and executing it

How a Program works

Compilers and Interpreters

An interpreter is a program that both translates and executes the instructions in a high-level language program

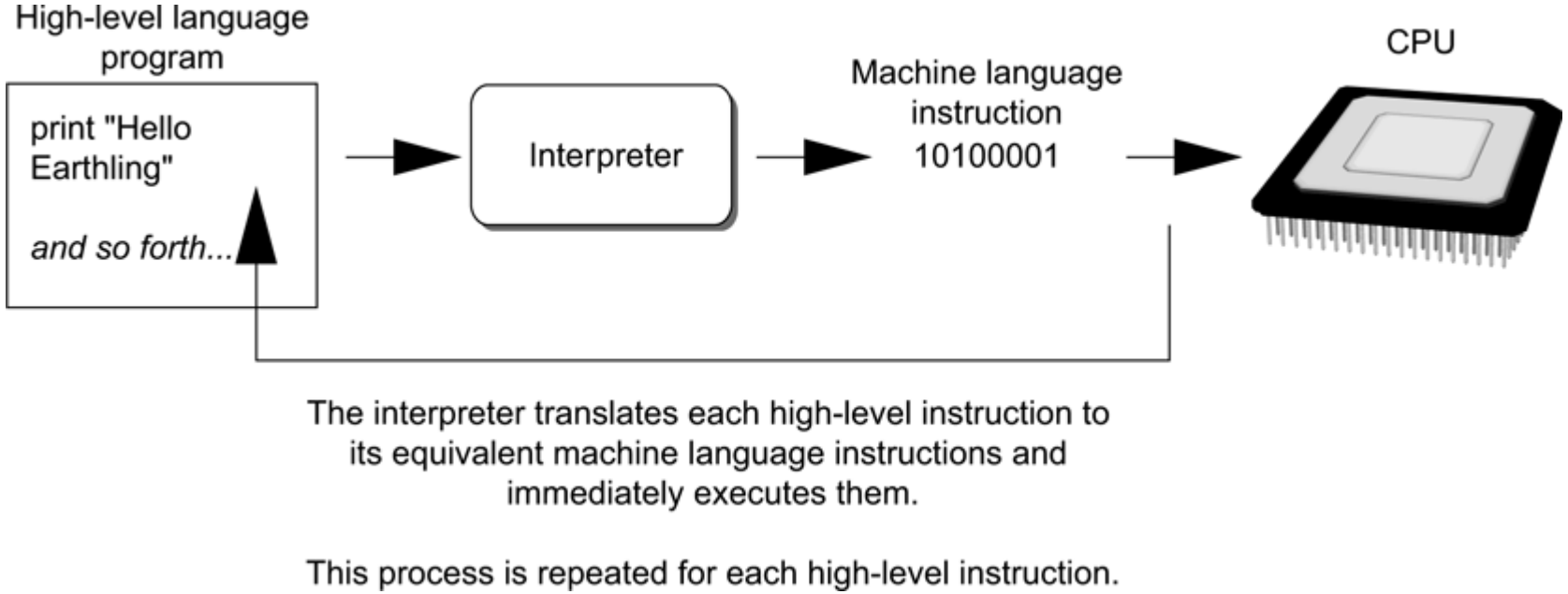


Figure 1-19 Executing a high-level program with an interpreter

Types of Software

Programs generally fit into one of two categories

System software

- The set of programs that control or enhance the operation of a computer such as an Operating System, Utility Programs, or Software Development Tools.

Application software

- Programs that make a computer useful for everyday tasks such as Microsoft Word, email programs, and Web browsers.

Thank You & God Bless!

Engr. Joyce Ann Acob