

MIS, 11e

Module 2: Computers and Their Business Applications

Module Objectives

By the end of this module, you should be able to:

- 2.1 Define a computer system and its components.
- 2.2 Discuss the history of computer hardware and software.
- 2.3 Analyze the impact of the three factors distinguishing the computing power of computers.
- 2.4 Summarize the three basic computer operations.
- 2.5 Discuss the types of input, output, and memory devices.
- 2.6 Explain how computers are classified and their business applications.
- 2.7 Apply knowledge of two major types of software and their use in a business setting.
- 2.8 List the five generations of computer languages.
- 2.9 Define object-oriented programming.

Defining a Computer

A computer is a machine that:

- Accepts data as input
- Processes data without human intervention using stored instructions
- Outputs information

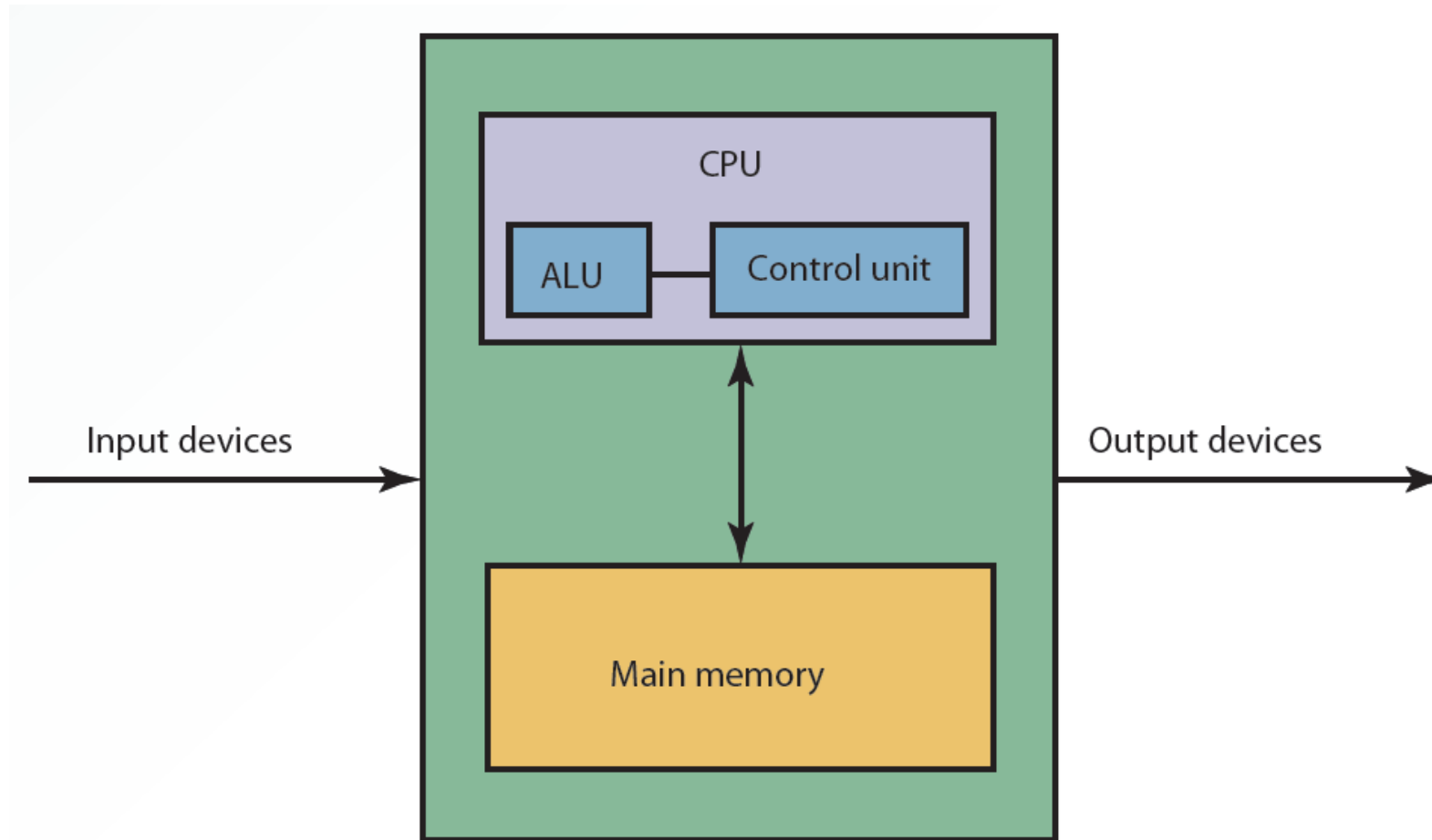
The instructions (or a program) are:

- Step-by-step directions for performing a specific task
- Written in a language the computer can understand

A program = Source code

- Must be translated into object code – binary 0s and 1s
- Computer understands binary 0s and 1s as on or off signals

Exhibit 2.1 - The Building Blocks of a Computer



Components of a Computer System (1 of 3)

Main (primary) memory – store data and instructions

Central processing unit (CPU) – heart of a computer

- Arithmetic logic unit (ALU)
 - Performs arithmetic operations (+, -, *, /) and comparison or relational operations (<, >, =)
- Control unit
 - Tells the computer what to do

Must-watch Videos:

- <https://www.youtube.com/watch?v=Z5JC9Ve1sfl>
- <https://www.youtube.com/watch?v=1I5ZMmrOfnA>
- <https://www.youtube.com/watch?v=FZGugFqdr60>

Components of a Computer System (2 of 3)

Single processor – One CPU in a single computer

Multiprocessors – Two or more CPUs in a single computer

- Dual-core – Two cores in one CPU
- Quad-core – Four cores in one CPU
- Hexa-core – Six cores in one CPU
- Octa-core – Eight cores in one CPU

Bus

- Link between devices connected to the computer
- Parallel or serial
- Internal – Example: video card, memory
- External – Example: USB device

Components of a Computer System (3 of 3)

Processor size and Operating System (OS):

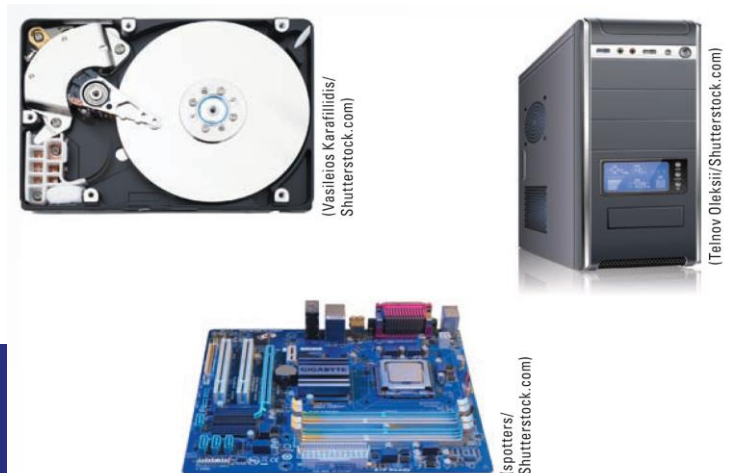
- 32-bit processor: Can only run a 32-bit OS, Use 2^{32} bytes (4 GB) of RAM
- 64-bit processor: Can run a 32-bit and 64-bit OS, Use 2^{64} bytes (16 EB, or exabytes) of RAM

Disk drive – Peripheral device for writing and reading data.

CPU case – Chassis or tower; an enclosure for computer components.

Motherboard – Main circuit board to attach CPU, memory, serial and parallel ports, expansion slots, etc.

– <https://www.youtube.com/watch?v=b2pd3Y6aBag>



Discussion Activity

As a group, evaluate your smartphone and/or desktop computer to determine the type of processor used by these devices.

What were the commonalities?

What were the differences?

How did you find out which processor the device is using?

The History of Computer Hardware and Software

- Major developments in hardware over the past 80 years
- Five generations of “technological breakthroughs”
- Computer designers focusing on gallium arsenide instead of silicon
 - Five times faster
 - Withstand higher temperatures
- IBM is using carbon nanotubes (CNTs) instead of silicon
- Optical technology also rising – The application and properties of light

Table 2.1 – Hardware Generations

Generation	Date	Major Technologies	Example
First	1946–1956	Vacuum tube	ENIAC
Second	1957–1963	Transistors	IBM 7094, 1401
Third	1964–1970	Integrated circuits, remote data entry, telecommunications	IBM 360, 370
Fourth	1971–1992	Miniaturization, VLSI, personal computers, optical discs	Cray XMP, Cray II
Fifth	1993– present	Parallel processing, gallium arsenide chips, optical technologies	IBM System zEnterprise EC12

The Power of Computers

Three factors: Speed, Accuracy, Storage and retrieval capabilities

Computer **speed** is measured as the number of instructions performed per fractions of a second (Millisecond, Microsecond, Nanosecond, Picosecond)

Degree of **accuracy** is critical in many computer applications

Storage and Retrieval

- Storage: saving data in memory
- Retrieval: accessing data from memory
- Data is stored in bits
 - 1 bit = 0 or 1
 - 8 bits = 1 byte = size of a character = “a”
- American Standard Code for Information Interchange (ASCII)
 - Data code for text files, PC applications, and the Internet
 - Defines up to 128 characters

Table 2.3 – Storage Measurements (Approximations)

Value	Size in Bytes
1 bit	A single value of 0 or 1
8 bits	1 byte or character
2^{10} bytes	1,000 bytes, or 1 kilobyte (KB)
2^{20} bytes	1,000,000 bytes, or 1 megabyte (MB)
2^{30} bytes	1,000,000,000 bytes, or 1 gigabyte (GB)
2^{40} bytes	1,000,000,000,000 bytes, or 1 terabyte (TB)
2^{50} bytes	1,000,000,000,000,000 bytes, or 1 petabyte (PB)
2^{60} bytes	1,000,000,000,000,000,000 bytes, or 1 exabyte (EB)

Knowledge Check Activity 2-1

How many bytes are in 1 gigabyte of data?

- a. 1,000,000,000
- b. 1,000
- c. 1,000,000
- d. 1,000,000,000,000

Knowledge Check Activity 2-1: Answer

How many bytes are in 1 gigabyte of data?

Answer: 1,000,000,000

1 billion bytes equal 1 gigabyte of data

Computer Operations

- Computer functions
 - Three basic tasks: **arithmetic operations, logical operations, and storage and retrieval operations**
 - Add, subtract, multiply, divide, and raise numbers to a power (exponentiation)
 - Perform comparison operations by comparing two numbers
 - Store massive amounts of data in very small spaces and locate a particular item quickly

Input, Output, and Memory Devices

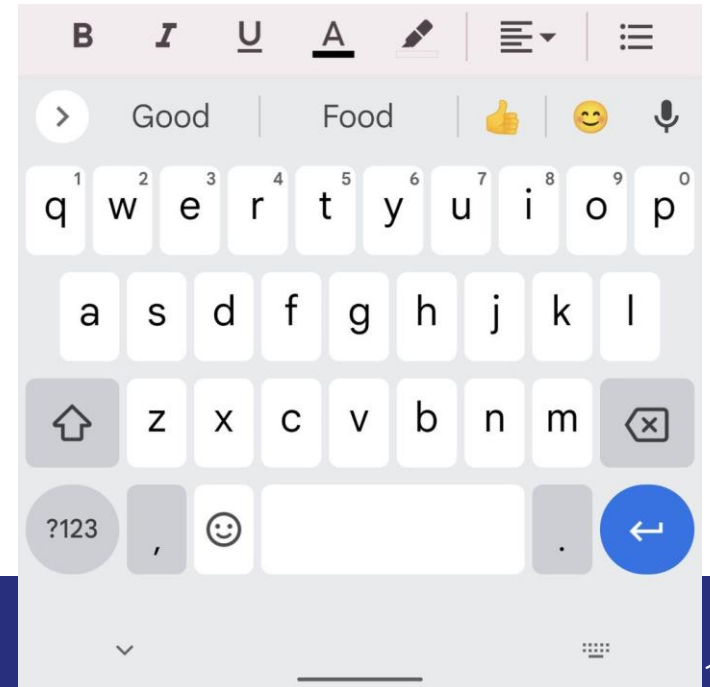
Three major components to using a computer and processing data:

- Input
- Output
- Memory

Input Devices

- Send data and information to the computer
 - Keyboard
 - Mouse
 - Touch screen
 - Stylus
 - Trackball
 - Barcode reader
 - Optical character reader (OCR)
 - Data tablet
 - Magnetic ink character recognition (MICR) system
 - Optical mark recognition (OMR) system
 - Camera and microphone
 - **Wearable devices**

KeyBoard



Mouse



- TouchScreen
- Stylus
- Trackball
- Barcode Reader
- Optical Character Reader
- Camera and microphone
- **Wearable devices**



Output Devices

- “Soft Copy” displays – displayed on a screen
 - CRT, LCD, OLED screens
- “Hard Copy” displays – displayed on print
 - Inkjet, Laser printers
- Other output devices include:
 - Plotters – to convert output to graphics
 - Voice synthesizers – to convert output to voice

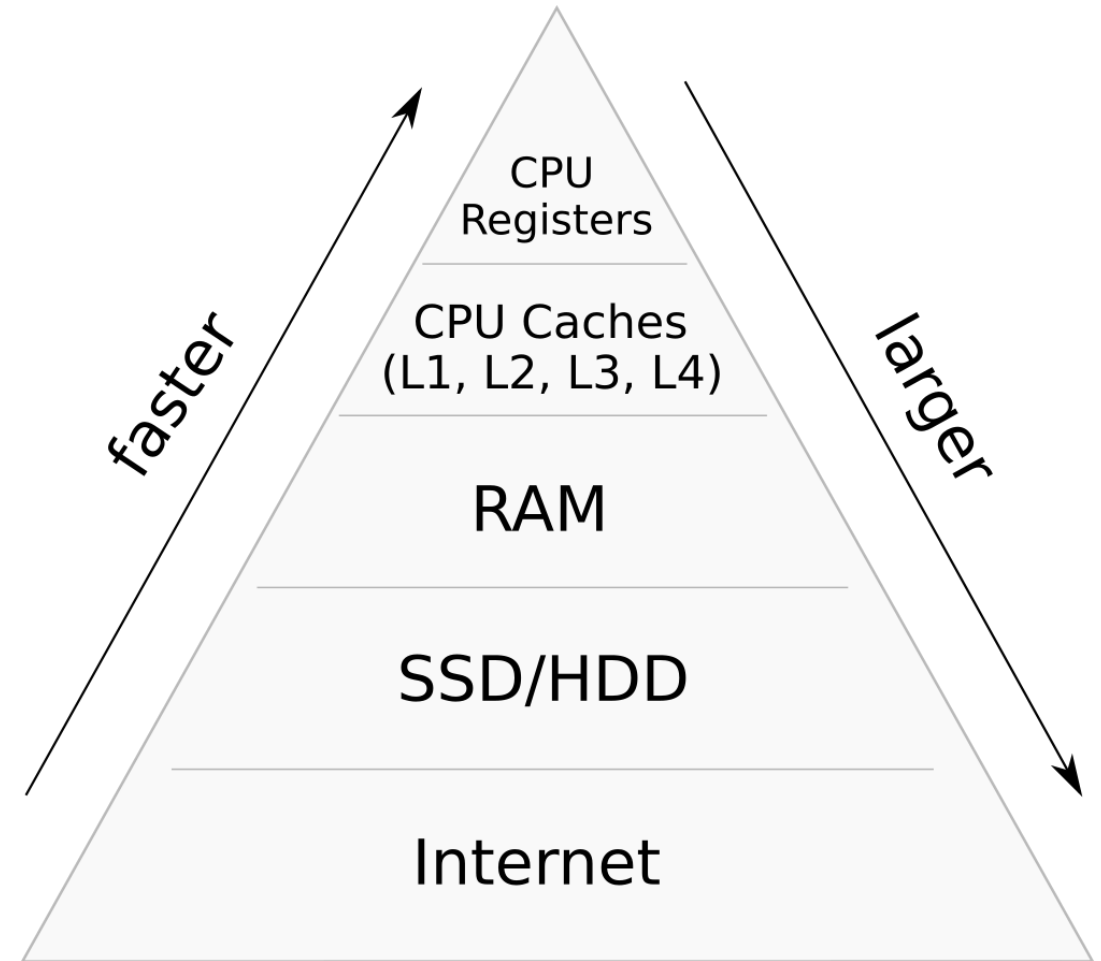
Output Devices



Memory Devices

Memory stores data and information

- Main memory
 - Usually, **volatile** - contents are lost when electrical power is turned off
- Secondary memory
 - **Nonvolatile** - holds data when the computer is off or during course of a program's operation

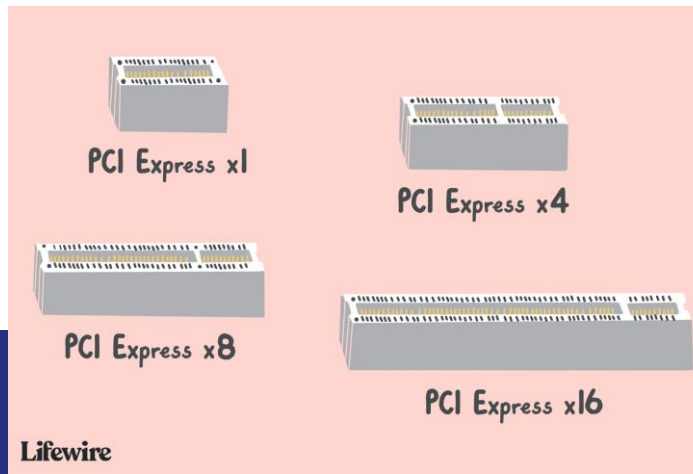


Main Memory Devices

- Random access memory (RAM)
- Cache RAM
- Read-only memory (ROM)
- Other types of ROM
 - Programmable read-only memory (PROM)
 - Erasable programmable read-only memory (EPROM)

Second Memory Devices

- Magnetic disks
- Magnetic tape
- USB flash drives and memory cards
- Solid-state drive (SSD)
- Non-volatile memory express (NVMe)
- Cloud storage



Storage Area Networks and Network-Attached Storage

- Storage area network (SAN) (<https://www.youtube.com/watch?v=BzjhHNfFQW0>)
 - Dedicated high-speed network consisting of both hardware and software
 - Connect and manage shared storage devices
 - Disk arrays
 - Tape libraries
 - Optical storage devices
- Network-attached storage (NAS) (<https://www.youtube.com/watch?v=3yZDDr0JKVc>)
 - Network-connected computer dedicated to provide file-based data storage services to other network devices
 - NAS software handles data storage, file access, and management

Knowledge Check Activity 2-2

Which of the main memory devices is also known as “read-write memory?”

- a. Cache RAM
- b. RAM
- c. EPROM
- d. ROM

Knowledge Check Activity 2-2: Answer

Which of the main memory devices is also known as “read-write memory?”

Answer: Random access memory (RAM)

Think of RAM as “read-write memory.” In other words, data can be read from and written to RAM. Some examples of the type of information stored in RAM include open files, the clipboard’s contents, and running programs.

Class of Computers

- Classified based on cost, memory, speed, and sophistication.
- Computer classifications
 - Subnotebooks
 - Notebooks
 - Personal computers
 - Minicomputers
 - Mainframes
 - Supercomputers



Server Platforms: An Overview

- **Server** – A computer with software for managing network resources and offering services to a network
- Available server platforms:
 - Application servers
 - Database servers
 - Disk servers
 - Fax servers
 - File servers
 - Mail servers
 - Print servers
 - Remote access servers (RAS)
 - Web servers
 - Authentication servers
 - ...

What is Software?

- **Software** - All programs that run a computer system
- Classifications
 - System software
 - Works in the background
 - Example: Microsoft Windows 10
 - Application software
 - Performs specialized tasks
 - Example: Microsoft Excel or PowerPoint

Operating System Software

Operating System - A set of programs for controlling and managing computer hardware and software.

Kernel is the core of the OS:

- memory management
- network management
- device driver
- file management
- process management

Application Software

- Commercial software or software developed in house; used to perform a variety of tasks on a personal computer
 - Word processing, spreadsheet, database, presentation, and graphics
 - Desktop publishing
 - Financial planning and accounting
 - Project management
 - Computer-aided design (CAD)

What kind of application softwares do you use?

Knowledge Check Activity 2-3

Which of the following is an example of an operating system?

- a. Red Hat Enterprise Linux
- b. Adobe Photoshop
- c. Microsoft Word
- d. Microsoft Edge

Knowledge Check Activity 2-3: Answer

Which of the following is an example of an operating system?

Answer: Red Hat Enterprise Linux

Red Hat Enterprise Linux or RHEL is an operating system like Windows Server. Each has their own use case for a particular network environment.

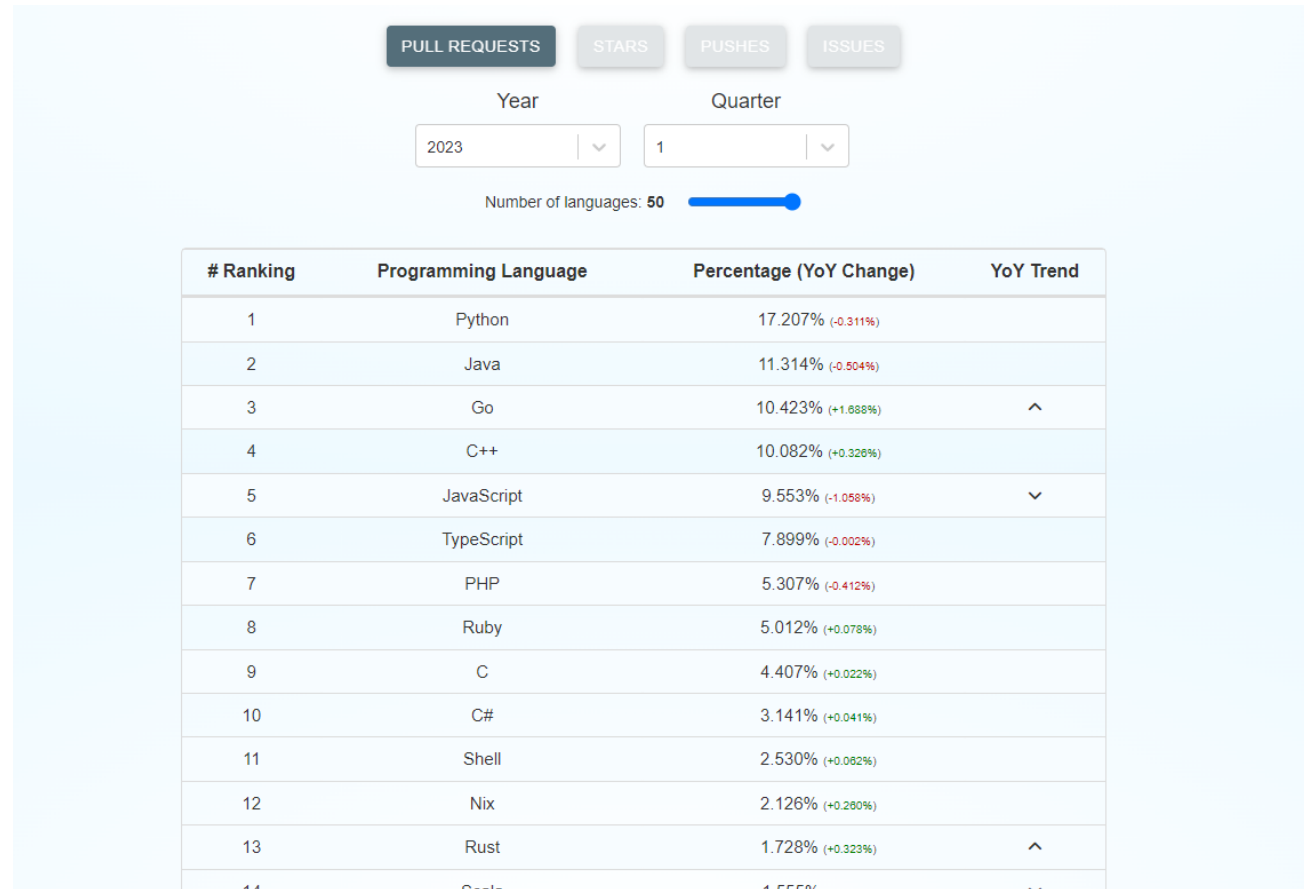
Computer Languages (1 of 2)

- Machine language
 - First generation of computer languages
 - Consists of a series of 0s and 1s representing data or instructions
- Assembly language
 - Uses a series of short codes, or mnemonics
 - Easier to write than machine language

Computer Languages (2 of 2)

- High-level languages
 - Used for Web development and Internet applications
 - Examples: C++, Python, Javascript
- Fourth-generation languages (4GLs)
 - Use macro codes
 - Example: SAS Advanced Analytics
- Fifth-generation languages (5GLs)
 - Artificial intelligence technologies

Popular Computer Languages



<https://madnight.github.io/github>

Object-Oriented Programming: A Quick Overview

- Object-oriented programming (OOP) language
 - Objects - items that contain both data and the procedures that read and manipulate it
 - Classes - define the format of the object and the action it performs
- OOP major advantages:
 - Modularity
 - Reuse of codes for other purposes
 - Effective problem solving


```
class Car:
    def __init__(self, make, model, year):
        self.make = make
        self.model = model
        self.year = year
        self.odometer_reading = 0

    def get_descriptive_name(self):
        long_name = f"{self.year} {self.make} {self.model}"
        return long_name.title()

    def read_odometer(self):
        print(f"This car has {self.odometer_reading} miles on it.")

    def update_odometer(self, mileage):
        if mileage >= self.odometer_reading:
            self.odometer_reading = mileage
        else:
            print("You can't roll back an odometer!")

    def increment_odometer(self, miles):
        self.odometer_reading += miles

my_car = Car('toyota', 'camry', 2022)
print(my_car.get_descriptive_name())
my_car.update_odometer(5000)
my_car.read_odometer()
```

Summary

Now that the lesson has ended, you should be able to:

- 2.1 Define a computer system and its components.
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- 2.6 Explain how computers are classified and their business applications.
- 2.7 Apply knowledge of two major types of software and their use in a business setting.
- 2.8 List the five generations of computer languages.
- 2.9 Define object-oriented programming.