Programming for Engineers (0107200)

DEPARTMENT OF COMPUTER AND COMMUNICATIONS ENGINEERING

Outline

- Why is programming important for engineers?
- What is a programming?
- What is a computer program?
- Types of Programming Languages
- The Most Popular Programming Languages
- Integrated Development Environments (IDE)

Why is **programming** important for **engineers**?

▶ Problem Solving: Programming promotes analytical thinking and problem-solving skills

▶ Career Advancement and Future-Proofing

▶ Innovation and creativity

▶ Automation

▶ Data Analysis

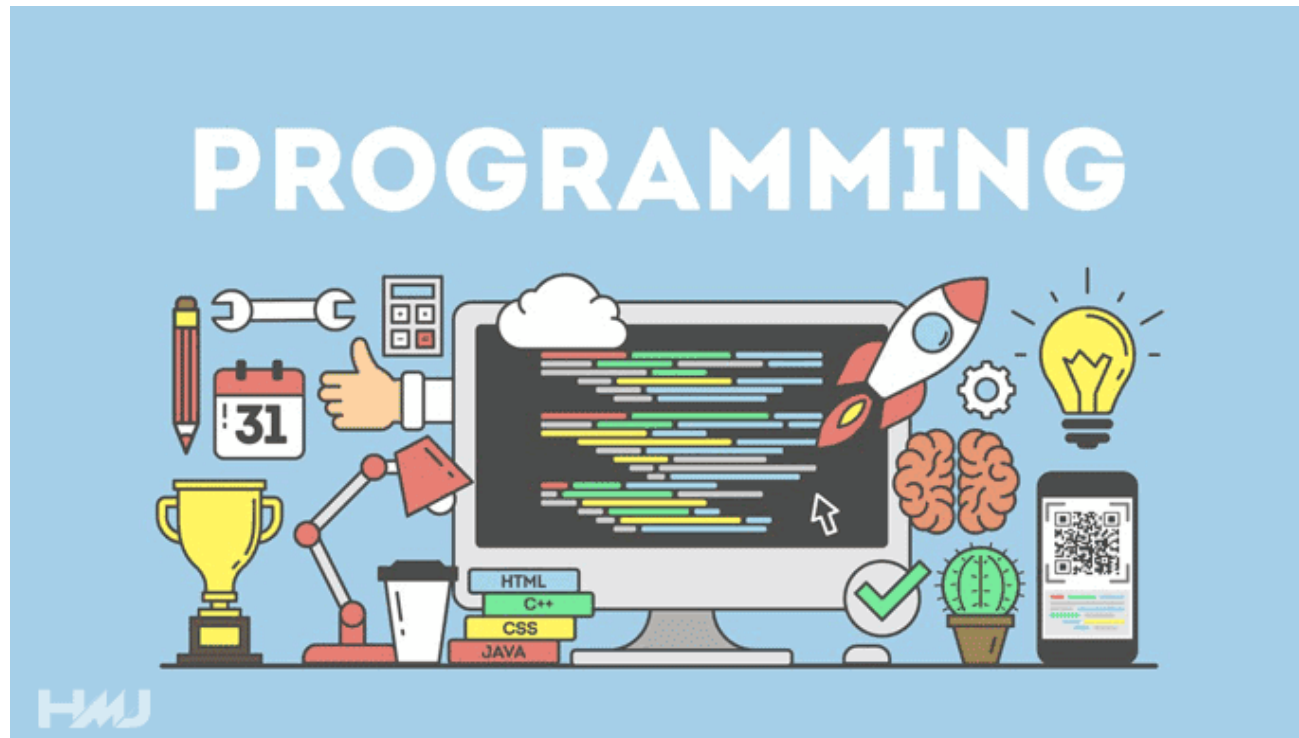▶ Modeling, Simulation, and Rapid Prototyping

▶ Control Systems

* **$117,000** Average annual salary for software engineer in United States (https://www.indeed.com/career/software-engineer/salaries)

* Answer is provided by ChatGPT

What is a **programming**?

- Programming: the process of designing and writing a computer programs.

What is a computer **program**?

▶ A computer **program**: a set of **instructions** or a sequence of commands (**code**) that a computer can understand and execute. These instructions are written in a **programming language** and provide a step-by-step recipe (**algorithm**) for the computer to follow to perform specific tasks or solve particular problems.

▶ Program: a sequence of instructions to do something.

▶ Software: computer programs and associated documentation, configuration data and files.

```c
hello.c
hello.c > ...
1  #include <stdio.h>
2  int main(void)
3  {
4      printf("Hello world");
5  }
```

# What is a computer **program**?

What is a computer **program**?

▶ **Programming Languages**: Programmers use programming languages (e.g., Python, Java, C++, JavaScript) to write code. Each language has its syntax and rules for defining algorithms, data structures, and logical operations.

▶ **Algorithms**: Algorithms are step-by-step procedures or sets of rules used to solve problems. Programmers design algorithms to achieve specific tasks efficiently.

▶ **Data Structures**: Data structures are used to organize and store data in a way that facilitates efficient access and manipulation. Examples include arrays, lists, stacks, queues, and trees.

▶ **Logic and Control Flow**: Programming involves implementing logical structures, such as conditional statements (if-else), loops (for, while), and functions, to control the flow of execution based on specific conditions.

▶ **Debugging**: Debugging is the process of identifying and fixing errors (bugs) in the code. Programmers use debugging tools and techniques to ensure that their programs work correctly.

▶ **Testing**: Programmers write tests to verify that their code behaves as expected under different conditions. Automated testing frameworks and practices are commonly used to ensure software reliability.

* by ChatGPT

Types of **Programming Languages**

- ▶ High-Level Programming Languages:

  - ▶ General-Purpose Languages: used for a wide range of applications.   Examples: C/C++, Python, Java, C#, Ruby, Swift

  - ▶ Scripting Languages: used for automating tasks, web development, and quick prototyping. Examples: JavaScript, Python, Ruby, Perl.

  - ▶ Domain-Specific Languages (DSLs): Tailored for specific industries or applications. Examples: SQL (for databases), HTML/CSS (for web development), MATLAB (for engineering and scientific computations).

- ▶ Low-Level Programming Languages:

  - ▶ Machine Language: The lowest-level language that consists of binary instructions directly executable by a computer's CPU (1011001101).

  - ▶ Assembly Languages: Closer to machine code and specific to a particular computer architecture (MOV AX,8h). Examples: x86 Assembly, ARM Assembly.

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Types of **Programming Languages**

▶ Compiled Languages: translated into machine code or intermediate code by a **compiler** before execution. Examples: C, C++, Rust, Fortran.

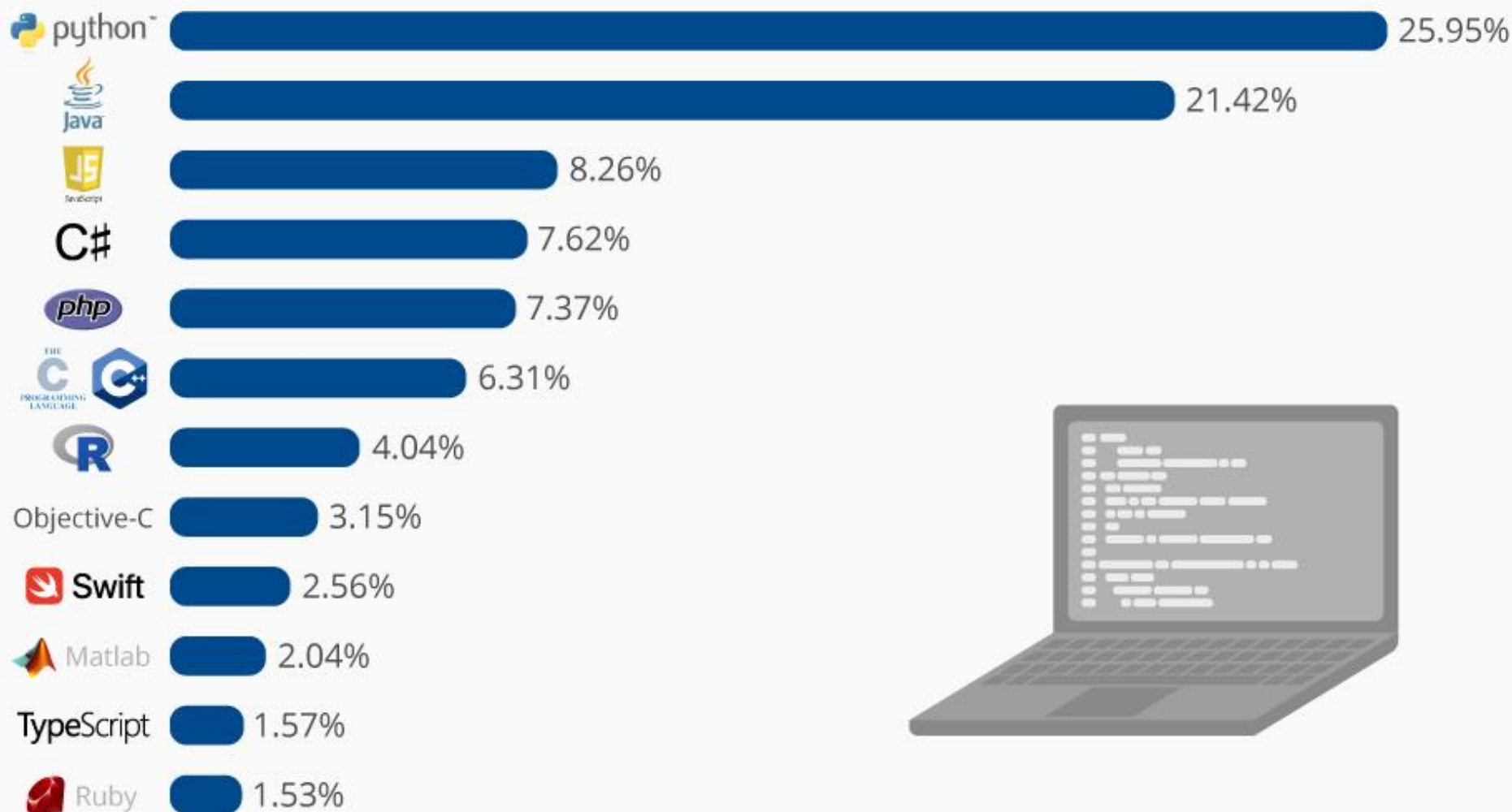▶ Interpreted Languages: executed line by line by an **interpreter**. Examples: Python, JavaScript, Ruby, Matlab.

The Most Popular **Programming Languages**

https://www.youtube.com/watch?v=iNI9QmnGiOE
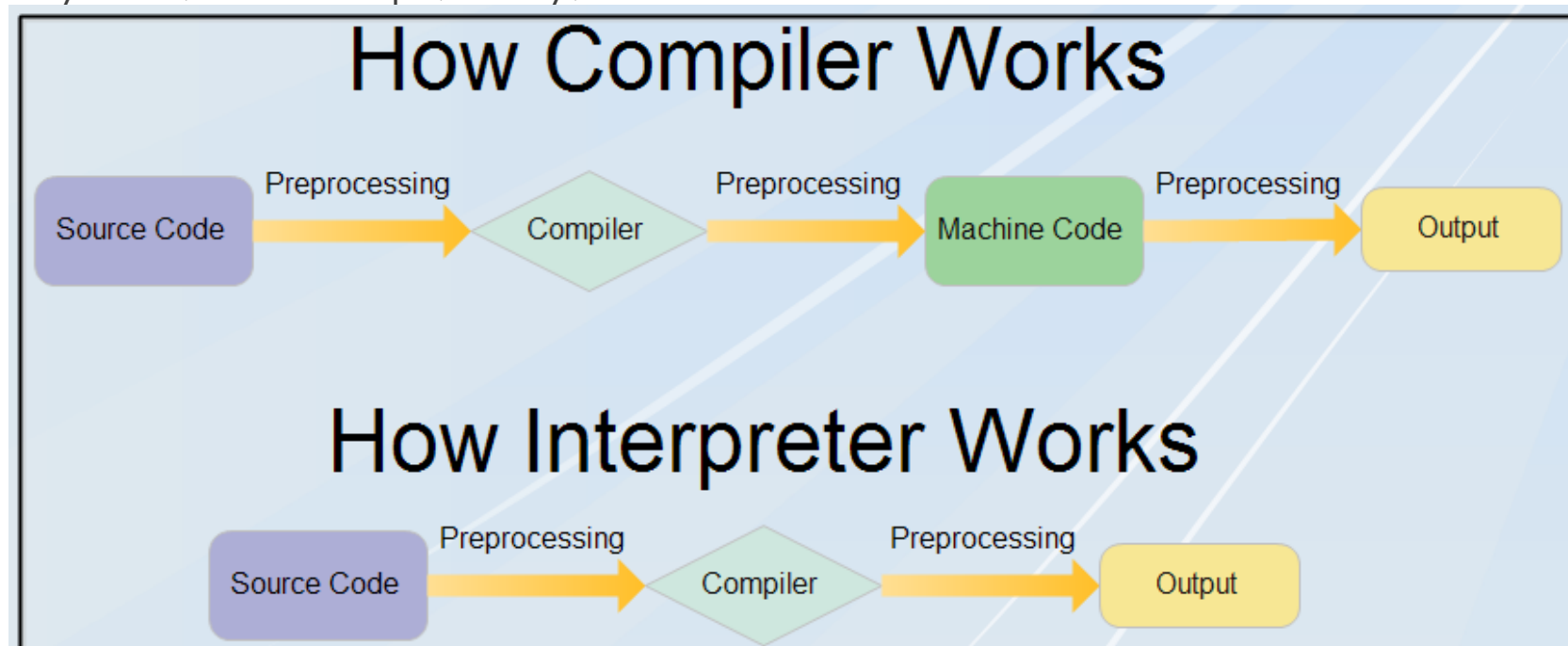
The Most Popular Programming Languages

Share of the most popular programming languages in the world*

Language	Share
python	25.95%
Java	21.42%
JS (JavaScript)	8.26%
C#	7.62%
php	7.37%
C/C++	6.31%
R	4.04%
Objective-C	3.15%
Swift	2.56%
Matlab	2.04%
TypeScript	1.57%
Ruby	1.53%

* Based on the PYPL-Index, an analysis of Google search trends
   for programming language tutorials.

@StatistaCharts   Source: PYPL

statista

The Most Popular **Programming Languages**

Rank	Language	Type			Score
1	Python ▾	🌐	🖥	⚙	100.0
2	Java ▾	🌐	📱 🖥		95.3
3	C ▾		📱 🖥	⚙	94.6
4	C++ ▾		📱 🖥	⚙	87.0
5	JavaScript ▾	🌐			79.5
6	R ▾		🖥		78.6
7	Arduino ▾			⚙	73.2
8	Go ▾	🌐	🖥		73.1
9	Swift ▾		📱 🖥		70.5
10	Matlab ▾		🖥		68.4

Integrated Development Environments (IDE)

▶ An Integrated Development Environment (IDE) is a software that provides a comprehensive set of tools and features to help programmers write, debug, run, test, and manage their code more efficiently.

▶ IDEs for C/C++ : Visual Studio, Code:: Blocks

▶ IDEs for Python: PyCharm, Jupyter Notebook

▶ Online IDE:

  ▶ https://www.onlinegdb.com/ (C/C++, Python)

  ▶ https://colab.research.google.com/ (Python)