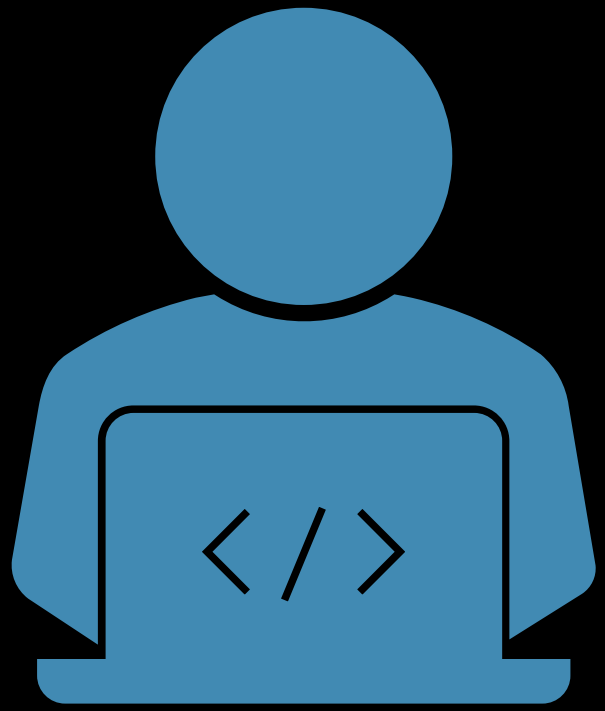


CENG204 - Programming Languages Concepts

Asst. Prof. Dr. Emre ŞATIR

Lecture 1
Introduction to the Course

Lecture 1 Topics

- What is a Programming Language?
- Reasons for Studying Concepts of Programming Languages
- The Number of Programming Languages

What is a Programming Language?

What is a (Programming) Language?

A language is a vocabulary and set of grammatical rules for communication between people.

(Natural Language)

A programming language is a vocabulary and set of grammatical rules for instructing a computer to perform specific tasks.

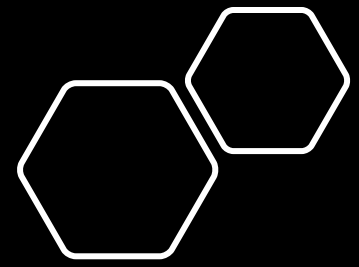
Some Course Goals

- Language as a framework for problem-solving
  - Understand the languages you use, by comparison
  - Appreciate history, diversity of ideas in programming
  - Be prepared for new methods, paradigms, tools
- Critical thought
  - Identify properties of language, not syntax or sales pitch
- Language and implementation tradeoffs
  - Every convenience has its cost
    - Recognize the cost of presenting an abstract view of machine
    - Understand tradeoffs in programming language design

Reasons for Studying Concepts of Programming Languages

Why Study Programming Languages?

- One or two languages is not enough for a computer scientist.
- You should know
  - the general concepts beneath the requirements
  - choices in designing programming languages.



Reasons for Studying Concepts of Programming Languages

- Increased capacity to express ideas
- Improved background for choosing appropriate languages
- Increased ability to learn new languages
- Better understanding of significance of implementation
- Better use of languages that are already known
- Overall advancement of computing

What's Worth Studying?

- Dominant languages and paradigms
  - C, C++, Java… JavaScript?
  - Imperative and object-oriented languages
- Important implementation ideas
- Performance challenges
  - Concurrency
- Design tradeoffs
- Concepts that research community is exploring for new programming languages and tools

The Number of Programming Languages

Q: How many Programming Languages do you know?

How many programming languages are out there?

700 +
Source: Wikipedia (excluding dialects of BASIC)

https://en.wikipedia.org/wiki/List_of_programming_languages

Relative Popularity of Programming Languages (February 2023)

https://www.tiobe.com/tiobe-index/

Feb 2023	Feb 2022	Change	Programming Language	Ratings	Change
1	1		Python	15.49%	+0.16%
2	2		C	15.39%	+1.31%
3	4	↑	C++	13.94%	+5.93%
4	3	↓	Java	13.21%	+1.07%
5	5		C#	6.38%	+1.01%
6	6		Visual Basic	4.14%	-1.09%
7	7		JavaScript	2.52%	+0.70%
8	10	↑	SQL	2.12%	+0.58%
9	9		Assembly language	1.38%	-0.21%
10	8	↓	PHP	1.29%	-0.49%

Relative Popularity of Programming Languages (February 2024)

https://www.tiobe.com/tiobe-index/

Feb 2024	Feb 2023	Change	Programming Language	Ratings	Change
1	1		Python	15.16%	-0.32%
2	2		C	10.97%	-4.41%
3	3		C++	10.53%	-3.40%
4	4		Java	8.88%	-4.33%
5	5		C#	7.53%	+1.15%
6	7	↑	JavaScript	3.17%	+0.64%
7	8	↑	SQL	1.82%	-0.30%
8	11	↑	Go	1.73%	+0.61%
9	6	↓	Visual Basic	1.52%	-2.62%
10	10		PHP	1.51%	+0.21%

Relative Popularity of Programming Languages (February 2025)

https://www.tiobe.com/tiobe-index/

Feb 2025	Feb 2024	Change	Programming Language	Ratings	Change
1	1		Python	23.88%	+8.72%
2	3	↑	C++	11.37%	+0.84%
3	4	↑	Java	10.66%	+1.79%
4	2	↓	C	9.84%	-1.14%
5	5		C#	4.12%	-3.41%
6	6		JavaScript	3.78%	+0.61%
7	7		SQL	2.87%	+1.04%
8	8		Go	2.26%	+0.53%
9	12	↑	Delphi/Object Pascal	2.18%	+0.78%
10	9	↓	Visual Basic	2.04%	+0.52%

New Languages will Keep Coming

Language as a thought shaper

We will cover less traditional languages, too.

The reason:

> *A language that doesn't affect the way you think about programming, is not worth knowing.*
>
> *an Alan Perlis epigram <http://www.cs.yale.edu/quotes.html>*

One of thought-shaper languages is Prolog.

You will both program in it and implement it.

Latest Trends

- Commercial trends
  - Increasing use of type-safe languages: Java, C#, …
  - Scripting and other languages for Web applications
- Teaching trends: Java replacing C
- Research and development trends
  - Modularity
  - Program analysis
    - Automated error detection, programming environments, compilation
  - Isolation and security
    - Sandboxing, language-based security, …