جامعة بيروت العربية
BEIRUT ARAB UNIVERSITY

CMPS 445: CONCEPTS OF PROGRAMMING LANGUAGES

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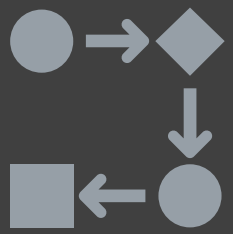
DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCEC

WHAT WE'LL DO TODAY

What is this course about?

Why learn concepts of programming?



How we'll proceed with the course?

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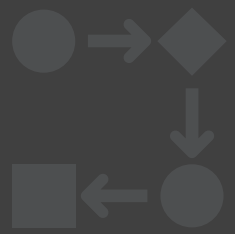

How we'll proceed with the course?

BAU COMPUTER SCIENCE PROGRAM

- Object Oriented Programming
  - Java
- Discrete Mathematics
  - Prolog, C++
- Mobile Programming
  - Java in Android Studio
- Web Programming
  - HTML, PHP, CSS
- Database
  - SQL
- Machine learning and Image Processing
  - Python

FUNDAMENTAL CONSTRUCTS OF PROGRAMMING LANGUAGES

- Design issues and choices of various constructs
- Compare programming languages, both from the user's and implementor's view
- Critical evaluation of existing and future programming languages

PROGRAMMING LANGUAGE STRUCTURE

- Formal methods of describing syntax and semantics of programming languages
- Implementation techniques of various programming language constructs

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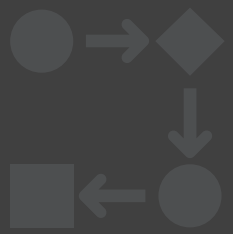


How we'll proceed with the course?

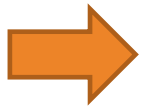
EXPRESS IDEAS

- Increased ability to express ideas
- Programmers are limited by language aspects
  - Data structures available
  - Abstractions
- Learn what constructs can be used in each language
- Simulate new constructs in other languages

EXPRESS IDEAS

A C programmer who had learned the structure and uses of dictionaries in Python

```
thisdict = {
  "brand": "Ford",
  "model": "Mustang",
  "year": 1964
}
```



Design structures that simulate associative arrays in C language

```
struct
{
    char key;
    char* value;
}pair;

struct pair map[size];
```

GREATER ABILITY

- Greater ability to learn new languages
- Computer programming is still evolving
- Continuous learning is essential
- Learn how concepts of programing are incorporated into new languages
- Same phenomenon occurs in natural languages

POPULARITY OF PROGRAMMING LANGUAGES

Aug 2025	Aug 2024	Change	Programming Language	Ratings	Change
1	1		Python	26.14%	+8.10%
2	2		C++	9.18%	-0.86%
3	3		C	9.03%	-0.15%
4	4		Java	8.59%	-0.58%
5	5		C#	5.52%	-0.87%
6	6		JavaScript	3.15%	-0.76%
7	8	↑	Visual Basic	2.33%	+0.15%
8	9	↑	Go	2.11%	+0.08%
9	25	⇈	Perl	2.08%	+1.17%
10	12	↑	Delphi/Object Pascal	1.82%	+0.19%
11	10	↓	Fortran	1.75%	-0.03%
12	7	⇊	SQL	1.72%	-0.49%
13	30	⇈	Ada	1.52%	+0.91%
14	19	⇈	R	1.37%	+0.26%
15	13	↓	PHP	1.27%	-0.19%
16	11	⇊	MATLAB	1.19%	-0.53%
17	20	↑	Scratch	1.15%	+0.06%
18	14	⇊	Rust	1.13%	-0.15%
19	18	↓	Kotlin	1.10%	-0.04%
20	17	↓	Assembly language	1.03%	-0.19%

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

GITHUB LANGUAGE POPULARITY

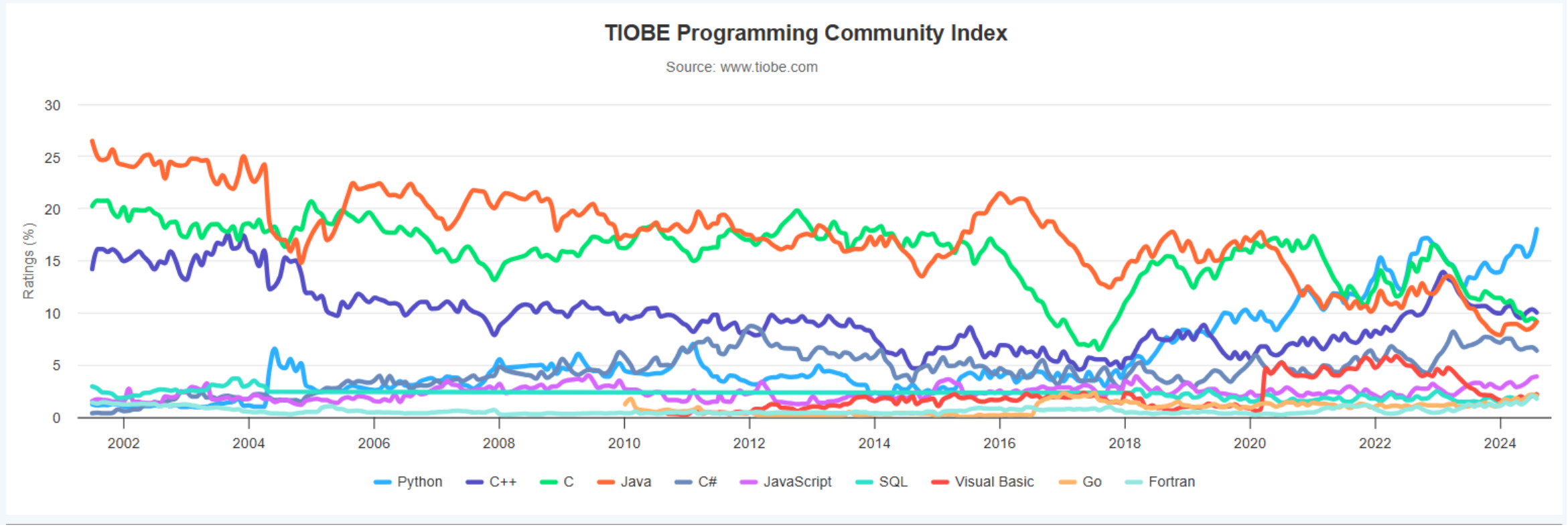
# Ranking	Programming Language	Percentage (YoY Change)	YoY Trend
1	Python	16.925% (-0.284%)	
2	Java	11.708% (+0.393%)	
3	Go	10.262% (-0.162%)	
4	JavaScript	9.859% (+0.306%)	^
5	C++	9.459% (-0.624%)	v
6	TypeScript	7.345% (-0.554%)	
7	PHP	5.665% (+0.357%)	
8	Ruby	4.706% (-0.307%)	
9	C	4.616% (+0.208%)	
10	C#	3.442% (+0.300%)	

https://madnight.github.io/githut/#/pull_requests/2024/1

IMPROVED BACKGROUND

- Improved background for choosing appropriate languages
- Languages get outdated
- New languages with new features
- Language you're most familiar with might be poorly suited for a project

PROGRAMMING LANGUAGE POPULARITY GRAPH



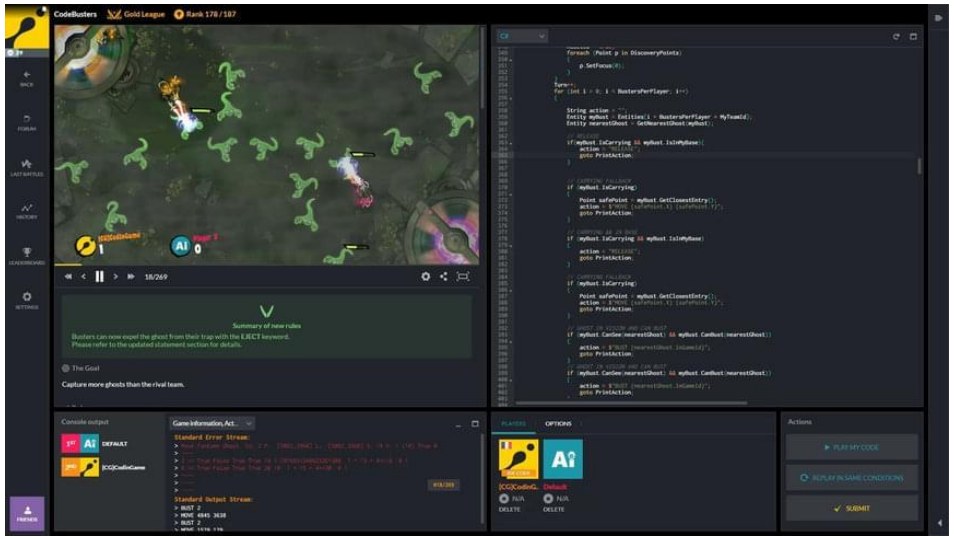
MORE REASONS

- Understand significance of implementation
- Use better languages that you already know
- Overall enhancement of computing
- Ability to design new languages

PROGRAMMING DOMAINS

Myriad of different areas ➔ very different goals

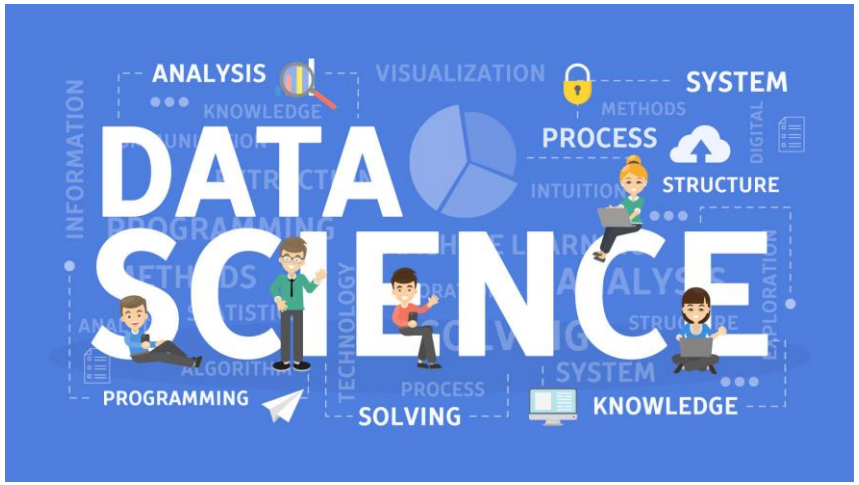
controlling nuclear power plants



building a video game

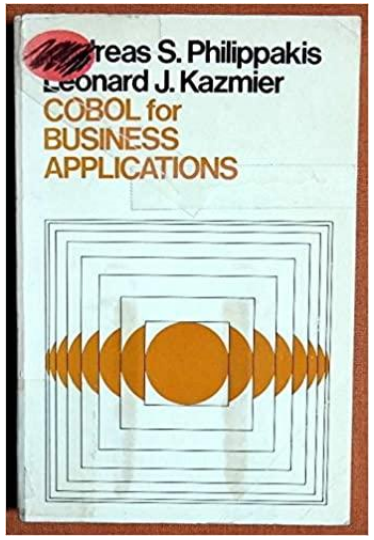
SCIENTIFIC APPLICATIONS

- Simple data structures
  - Arrays
  - Matrices
- Large numbers of floating-point arithmetic computations
- Loops and selections
- Java and R programming language
- Fortran in earlier times



BUSINESS APPLICATIONS

- Storing decimal numbers and character data
- C# and Java programming language
- COBOL programming language in earlier times

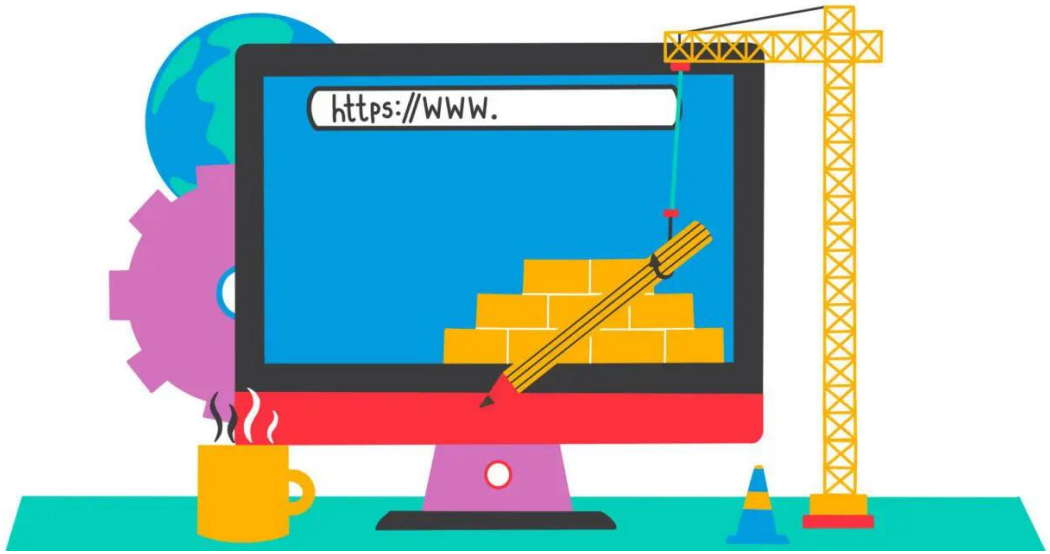


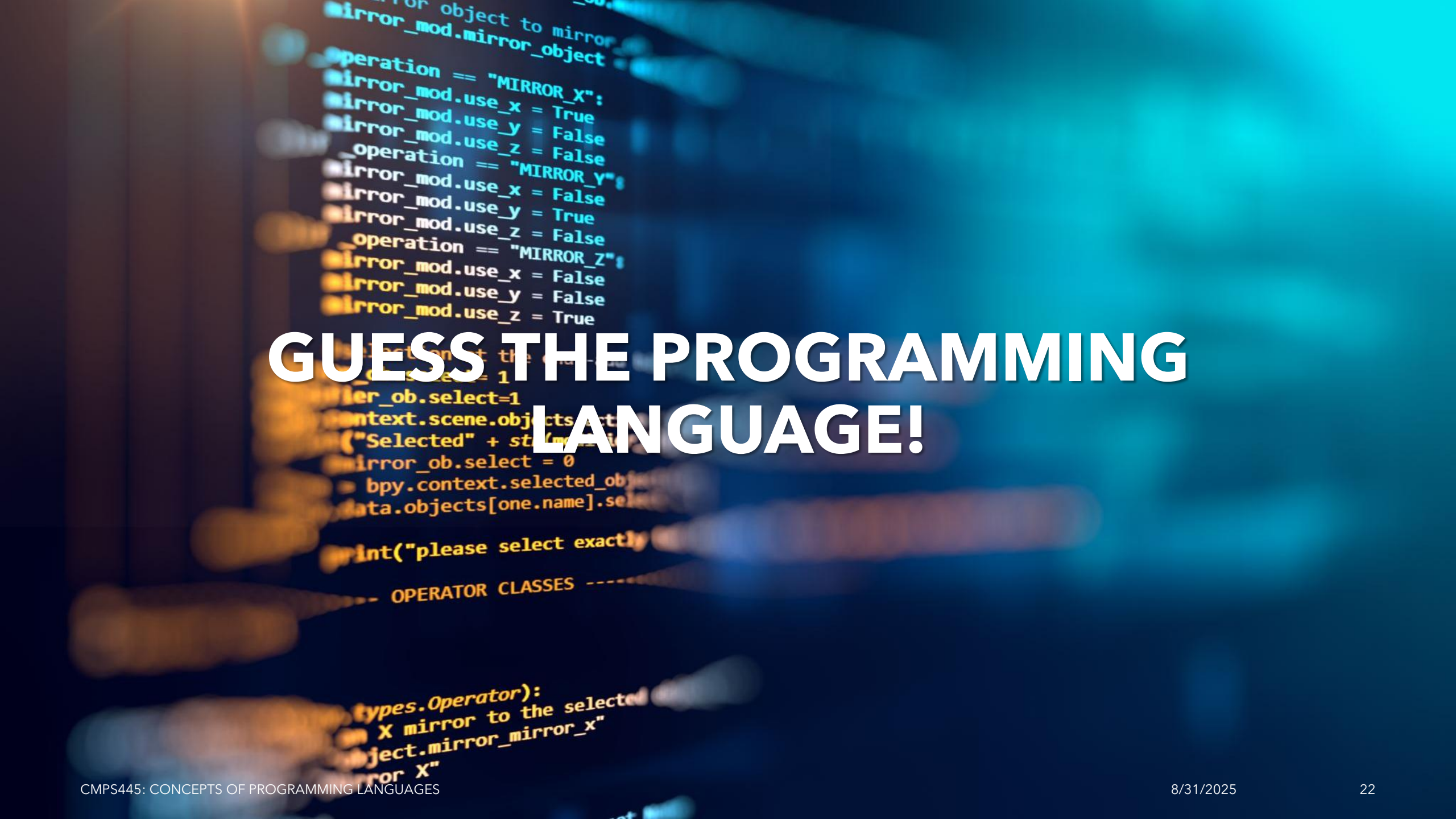
ARTIFICIAL INTELLIGENCE

- Symbolic rather than numeric computations
- Linked list data structures
- Python programming language
- Lisp and Prolog in earlier times

WEB SOFTWARE

- World Wide Web
- Content presentation
- Markup languages such as HTML
- Embedded code using JavaScript and PHP




GUESS THE PROGRAMMING LANGUAGE!

This language is multi-paradigm, with strong support for object-oriented, procedural, and even functional programming. It's known for its readability and extensive standard library.

PYTHON

This language is primarily object-oriented, supporting features like inheritance, encapsulation, and polymorphism. It emphasizes portability with its "write once, run anywhere

JAVA

This language is procedural and known for its efficiency and control over low-level system resources. It emphasizes structured programming and is widely used in systems programming.

C

This language is based on the logic programming paradigm. It emphasizes rule-based and declarative problem solving, commonly used in AI and expert systems.

PROLOG

This language is primarily used for web development and supports multiple paradigms, including event-driven, functional, and imperative programming. It’s known for its asynchronous capabilities.

JAVASCRIPT

This language is object-oriented and imperative, designed for iOS and macOS development. It emphasizes safety and performance with modern syntax.

SWIFT

This language is primarily used for statistical computing and graphics. It supports procedural programming but is heavily used in data analysis with its built-in support for vectors and matrices.

R

This language is widely used for server-side scripting. It follows a procedural paradigm with growing support for object-oriented programming.

PHP

One of the oldest high-level languages, this language is procedural and used primarily in scientific computing. It's known for its efficient handling of mathematical operations.

FORTRAN

A programming language designed and developed by Google. It can be used to develop web and mobile apps as well as server and desktop applications, especially famous after FLUTTER.

DART

WHAT WE'LL DO TODAY

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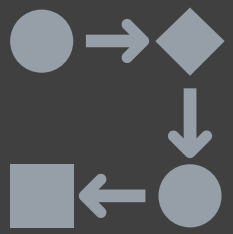
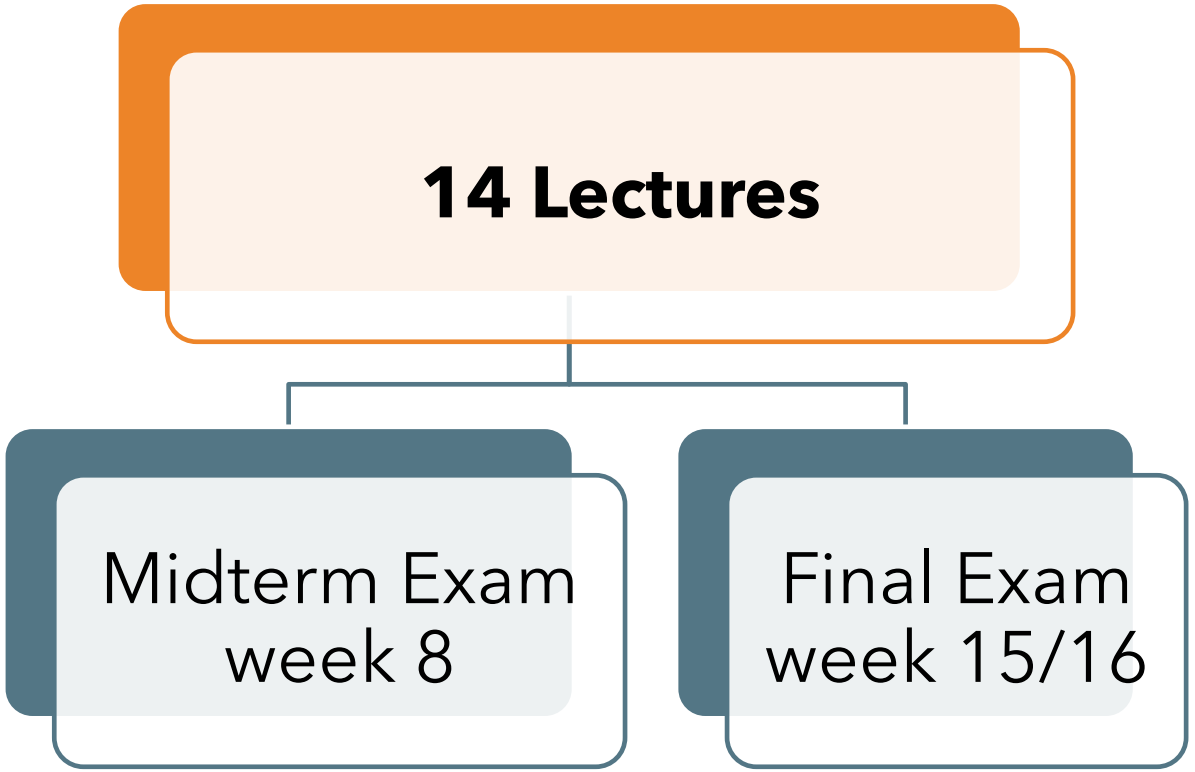


How we'll proceed with the course?

LECTURES & ASSESSMENTS



COURSE INFO

Prerequisites

CMPS 347

Grade Division

Attendance and Participation	5%
Lab (assignments, lab exercises, project…)	30%
Midterm Exam	25%
Final Exam	40%

PROJECT GUIDELINES

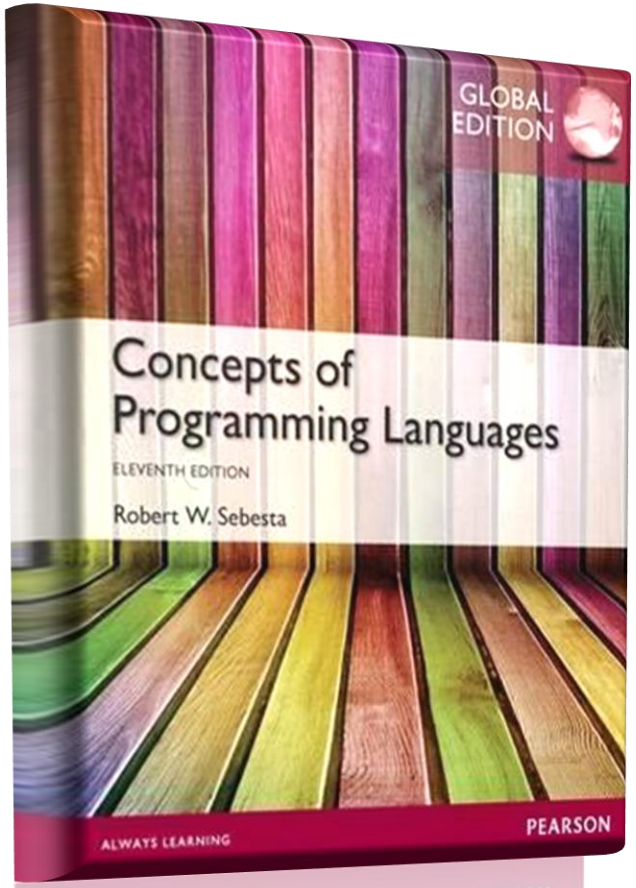
GROUPS OF TWO TO FOUR

CONSTITUTE 15% OF THE COURSE GRADE

APPLICATION WITH A NEW LANGUAGE

FINAL PRESENTATION + REPORT

RECOMMENDED TEXTBOOK



Robert W. Sebesta, Concepts of Programming Languages, (11th Edition), Pearson.

CLASS GUIDELINES

ATTEND ON TIME

KEEP ANY DISTRACTIONS AWAY

SHARE YOUR IDEAS AND DISCUSS

ASK QUESTIONS

LAB GUIDELINES

WILL BE GIVEN WEEKLY

SOLVING LAB EXERCISES HELPS YOU IN THE PROJECT

DON'T COPY

DISCUSS SOLUTIONS WITH ME OR WITH THE TA

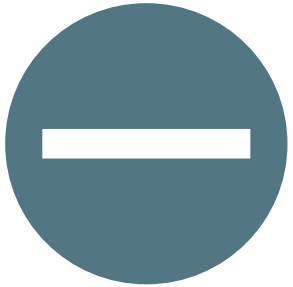
SUBMIT ON TIME

ASSESSMENT GUIDELINES

How many?

One Midterm Exam

+ Final Exam



No make-up exams are allowed

Prepare well

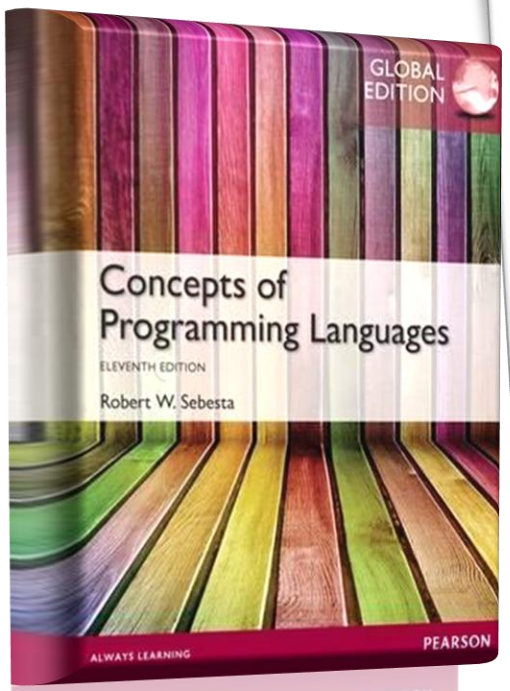
HOW TO GET HELP?

Send an email to l.affara@bau.edu.lb

Visit me for an Office Hour on Mondays 10-12

Keep track of Moodle

REFERENCES



SEE YOU NEXT WEEK!

PRELIMINARIES TO CONCEPTS OF PROGRAMMING LANGUAGES