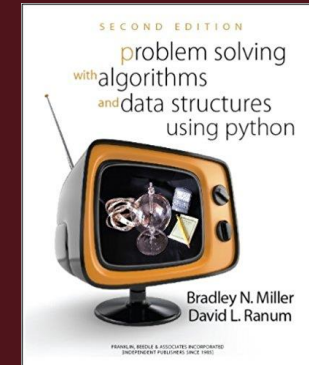


Problem Solving with Algorithms and Data Structure Using Python

Unit 1: Introduction

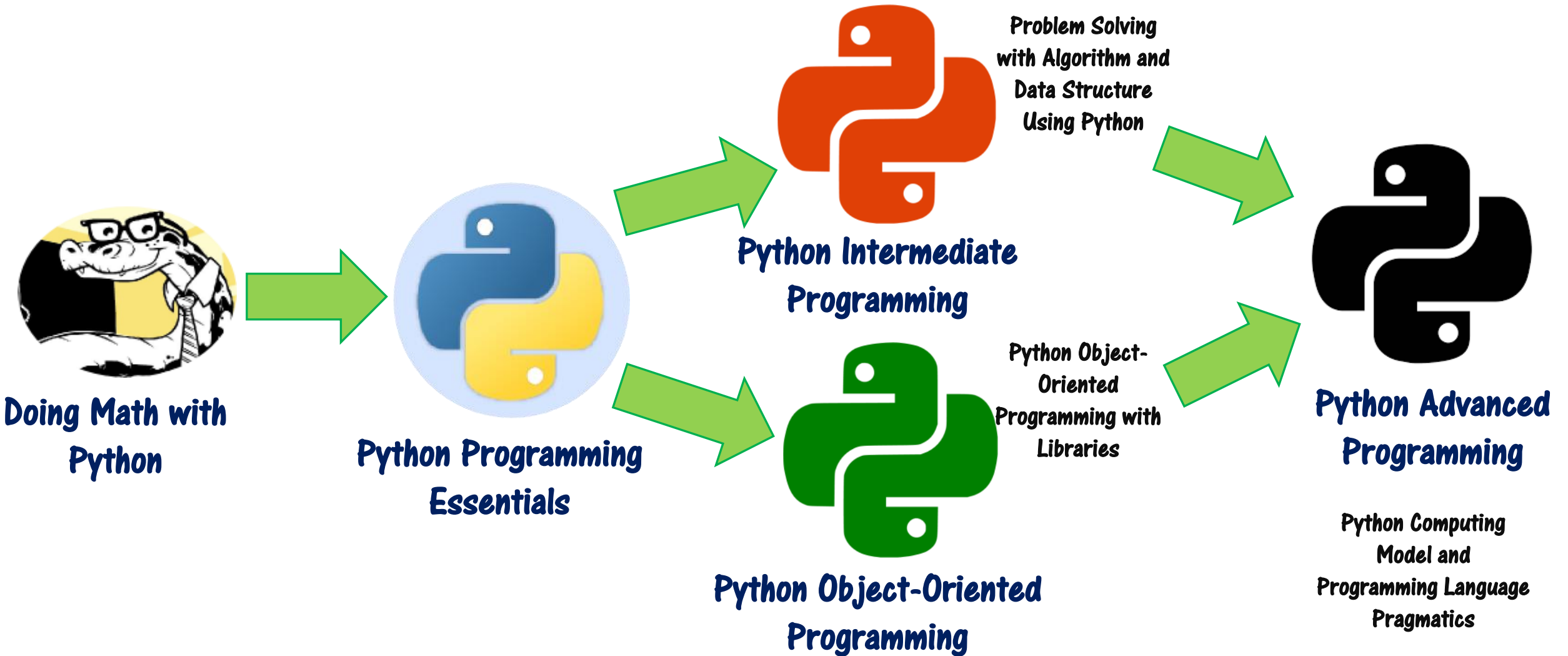


LECTURE 1: USING PYTHON AS PILOT LANGUAGE FOR PROBLEM SOLVING

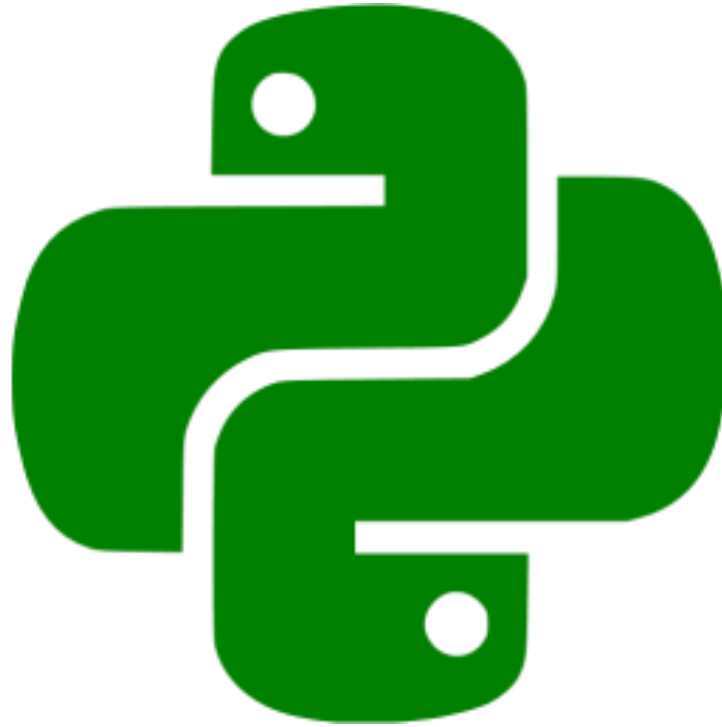
DR. ERIC CHOU

IEEE SENIOR MEMBER

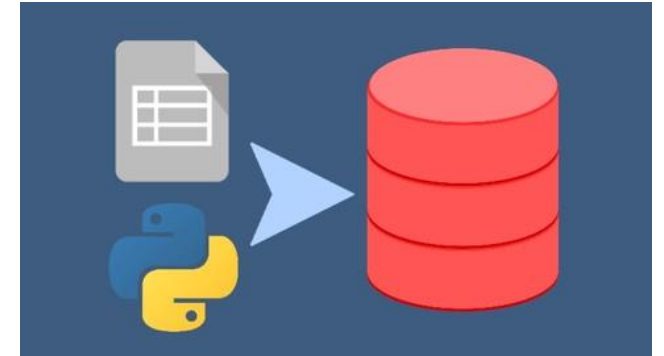
Python Course Series



Python Object-Oriented Programming with Libraries



Python Object-Oriented Programming





Objectives

- To review the ideas of computer science, programming, and problem-solving.
- To understand abstraction and the role it plays in the problem-solving process.
- To understand and implement the notion of an abstract data type.
- To review the Python programming language.

Overview

LECTURE 1



Getting Started

- Problem Solving with Computer
- Algorithms and data structures: known solution patterns.
- Analysis is for solution's efficiency: The complexity of large problems and the corresponding complexity of the solutions can tend to overshadow the fundamental ideas related to the problem-solving process.



Algorithm and Program

- An algorithm is a generic, step-by-step list of instructions for solving a problem. It is a method for solving any instance of the problem such that given a particular input, the algorithm produces the desired result.
- A program, on the other hand, is an algorithm that has been encoded into some programming language. There may be many programs for the same algorithm, depending on the programmer and the programming language being used.



What Is Algorithm Analysis?

- It is very common for beginning computer science students to compare their programs with one another.
- How to compare?
- This course has two goal:
 1. to study algorithms and data structures.
 2. to compare these solutions.



What is Computer Science?

- Computer science is the study of problems, problem-solving, and the solutions that come out of the problem-solving process.
- Given a problem, a computer scientist's goal is to develop an **algorithm**, a step-by-step list of instructions for solving any instance of the problem that might arise.
- Algorithms are finite processes that if followed will solve the problem. Algorithms are solutions.



What is Computer Science?

- Computer science can be thought of as the study of algorithms. However, we must be careful to include the fact that some problems may not have a solution. Although proving this statement is beyond the scope of this text, the fact that some problems cannot be solved is important for those who study computer science.
- We can fully define computer science, then, by including both types of problems and stating that computer science is the study of solutions to problems as well as the study of problems with no solutions.



What Is Programming?

Programming is the process of taking an algorithm and encoding it into a notation, a programming language.

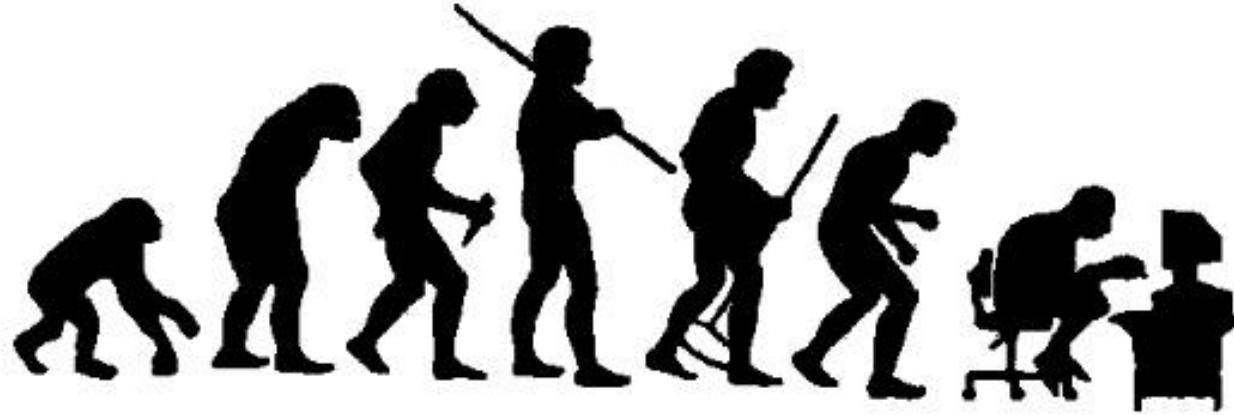
Computer science is not the study of programming. Computer Scientist are problem solver.

Programming, however, is an important part of what a computer scientist does.

Algorithms describe the solution to a problem in terms of the data needed to represent the problem instance and the set of steps necessary to produce the intended result.

Programming languages must provide a notational way to represent both the process and the data.

Computing Paradigm Evolution



Mainframe
Computing



Personal
Computing



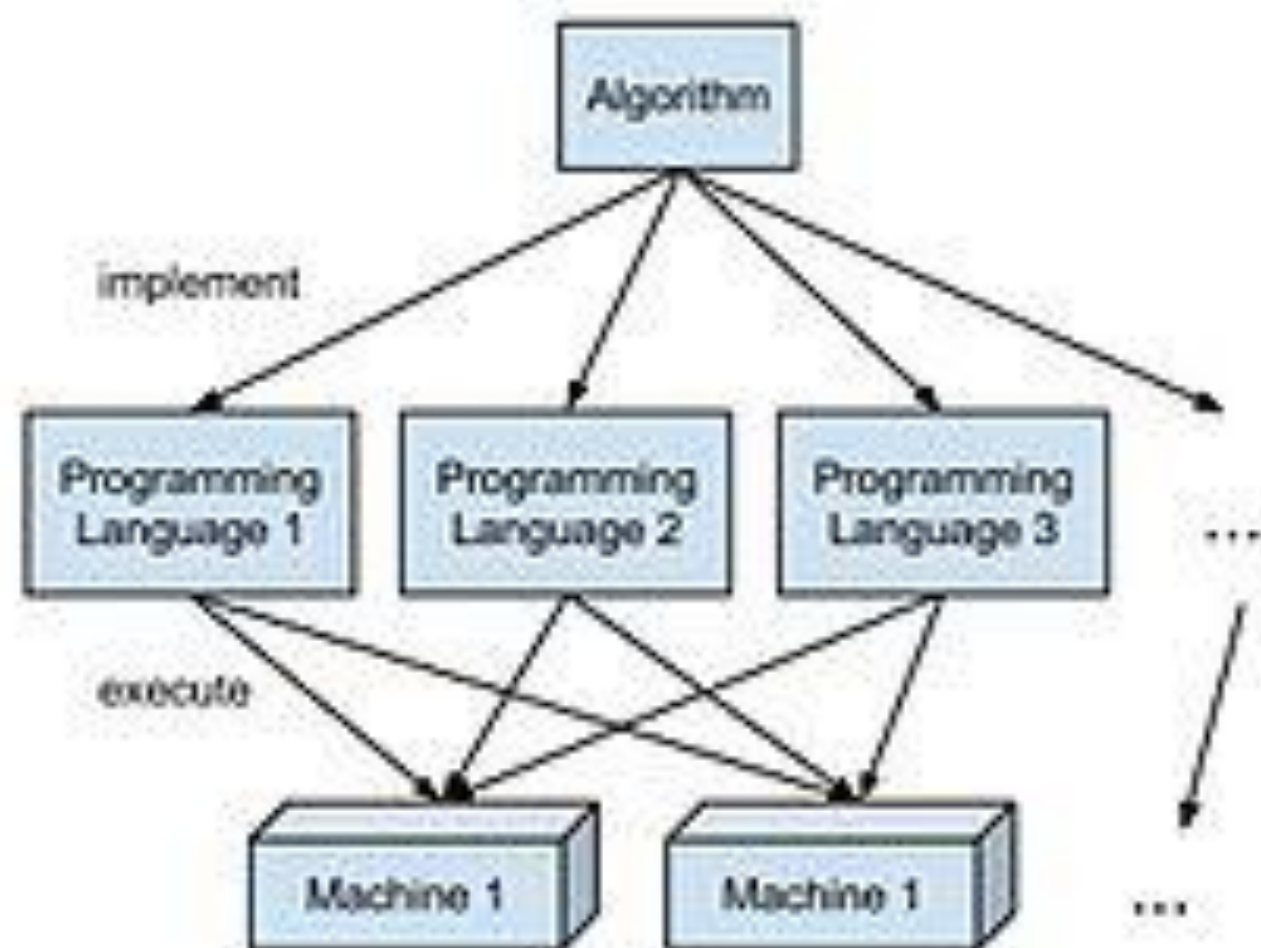
Client/Server
Computing



Mobile
Computing

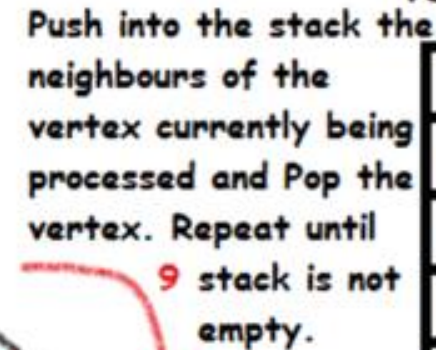


Cloud
Computing





Red arrows indicate the order of search.

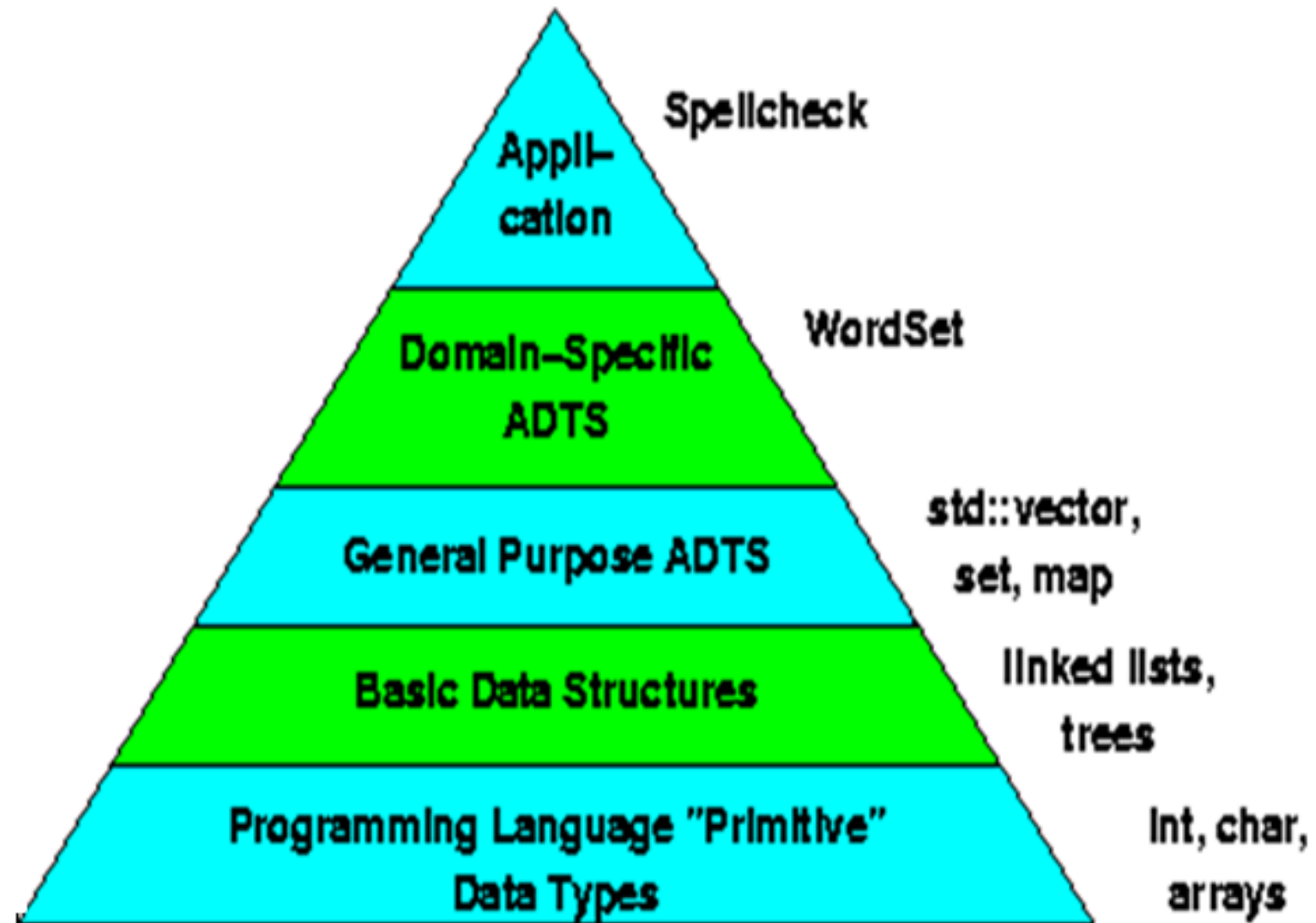


Depth First Search

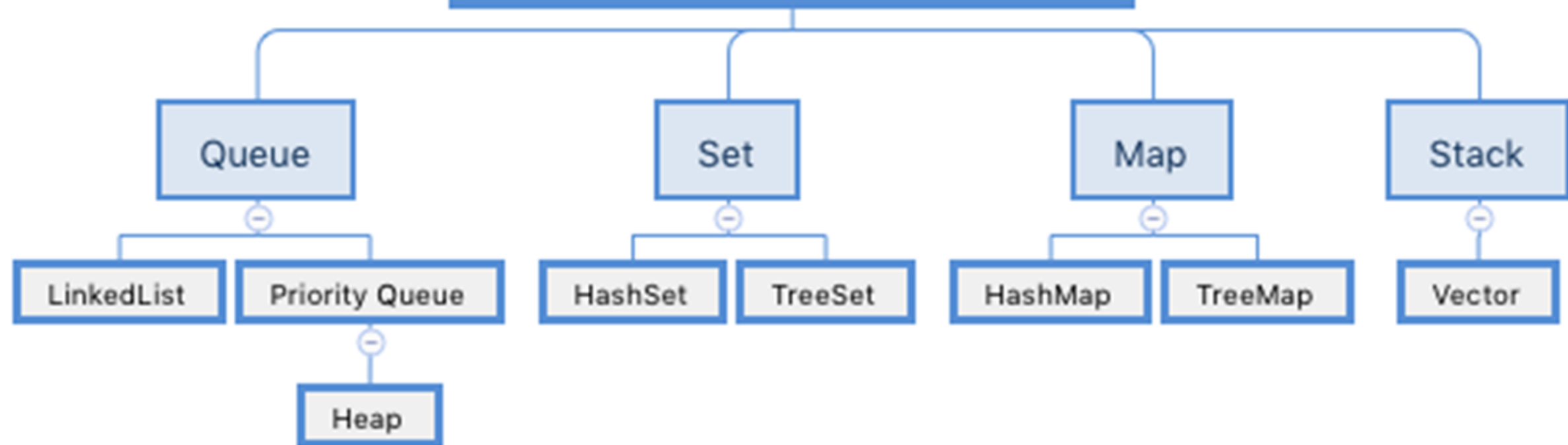
Abstraction

LECTURE 2

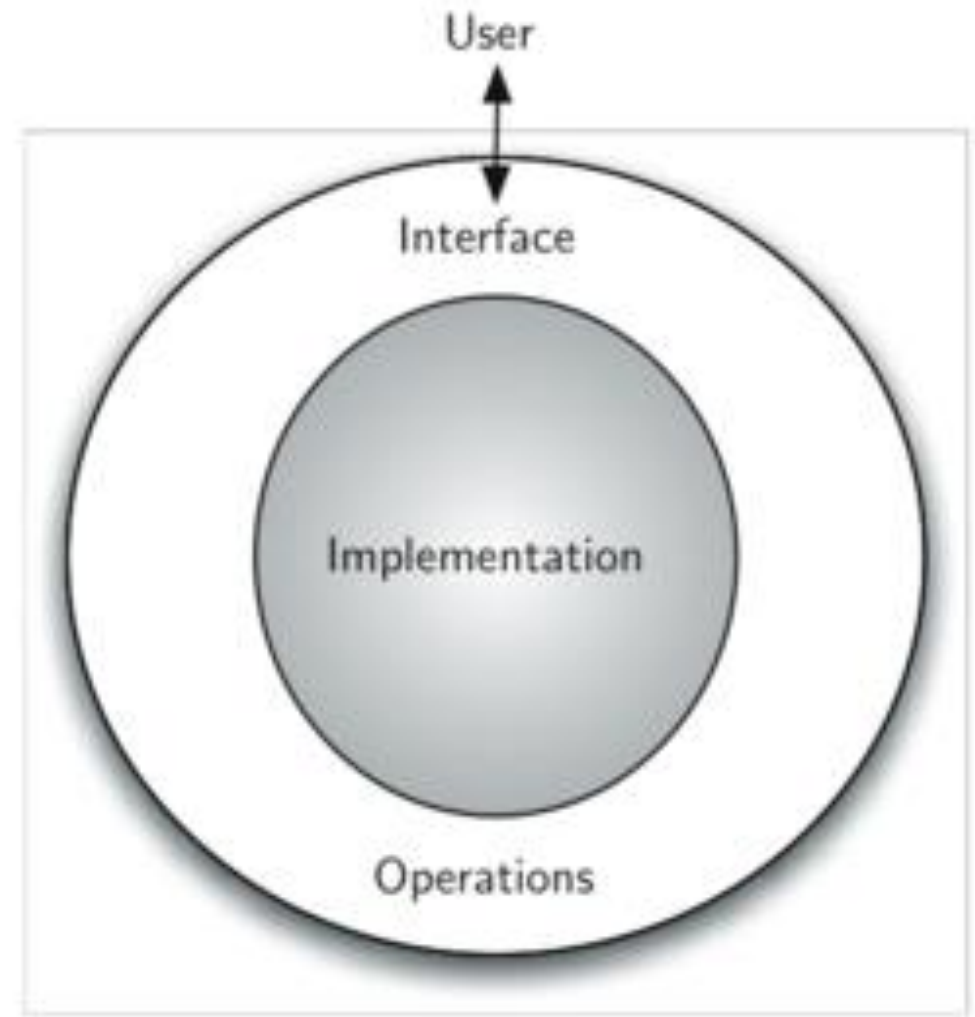
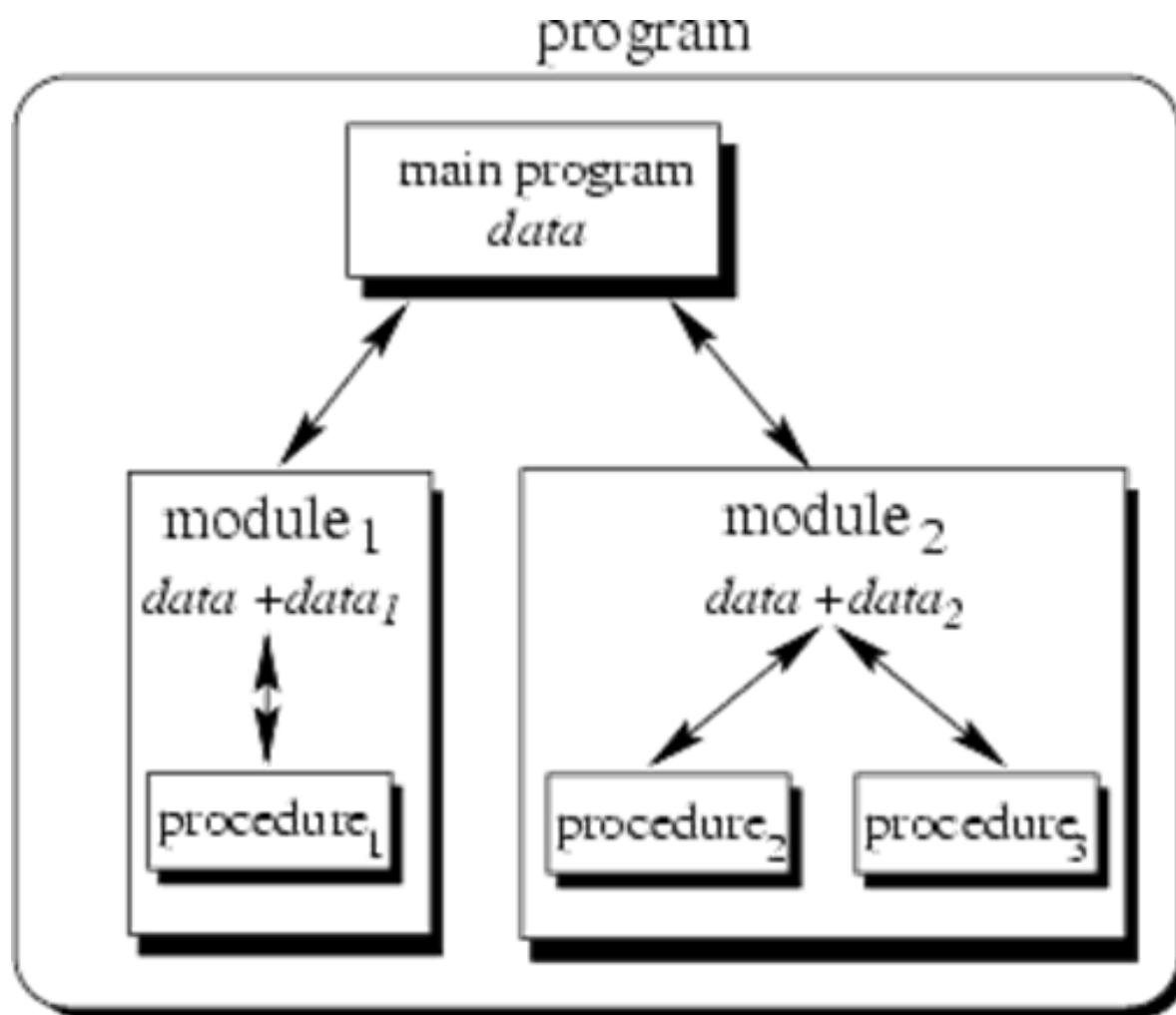
Data Abstraction in C Language



Abstract data type



Control Abstraction (Procedural Abstraction)





Why Study Data Structures and Abstract Data Types?

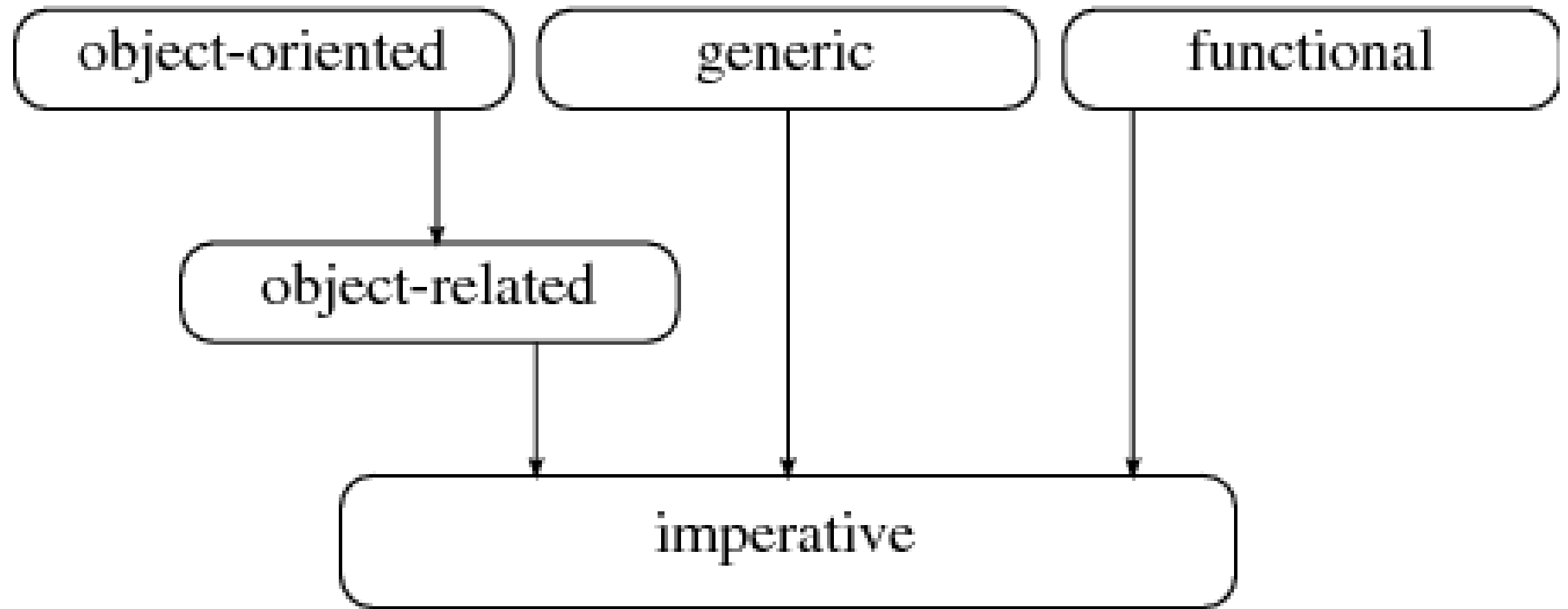
- Re-usability
- Implementation-Independent
- Easiness for maintenance
- Modularization
- Information Hiding
- Encapsulation



Why Study Algorithms?

- Learn design patterns
- Choose the most suitable design patterns
- Invent new problem solutions

As computer scientists, in addition to our ability to solve problems, we will also need to know and understand solution evaluation techniques. In the end, there are often many ways to solve a problem. Finding a solution and then deciding whether it is a good one are tasks that we will do over and over again.



C++11

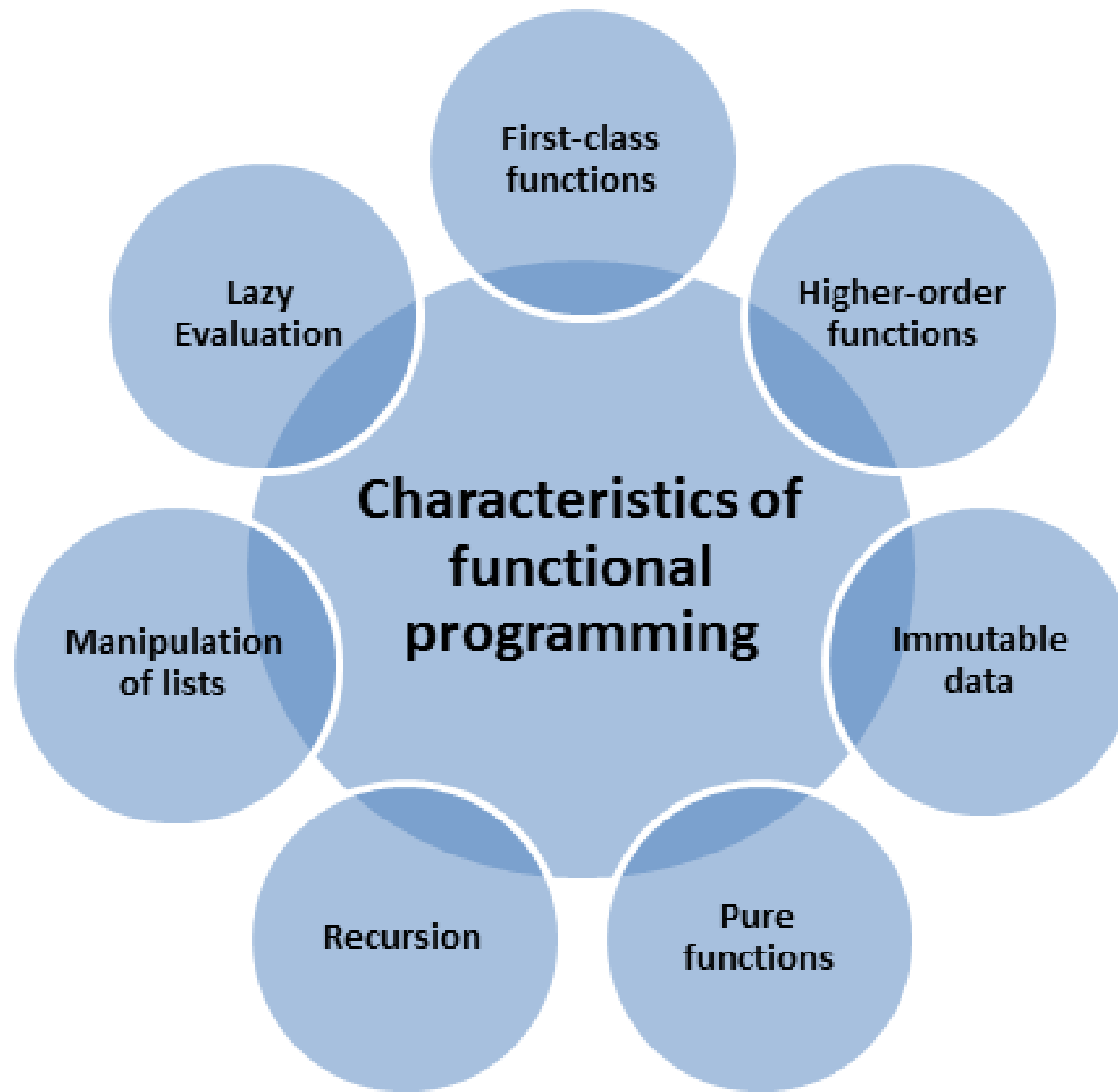
- Functional

C++

- Generic
- Object-Oriented

C

- Procedural
- Structured



Role of Python in Artificial Intelligence

LECTURE 3





Python

Python is a language with the best compilation of Lisp and Java both.

According to Norvig is his text comparing Lisp to Python, these two languages are very similar to each other with some minor differences.

There also exists JPython, giving access to the Java GUIs. This is the reason behind Peter Norvig choosing JPython to translate his programs from his AI book.

As JPython allowed him to have portable GUI demos, and portable http/ftp/html libraries.

Therefore, it is very good to use as AI language.



Benefits of Using Python over the Other Programming Languages for AI

1. Good quality documentation.
2. Platform agnostic, and present in virtually every *nix distribution.
3. Easy and fast to learn in comparison to any other OOP language.
4. Python has many image intensive libraries like Python Imaging Library, VTK and Maya 3D Visualization Toolkits, Numeric Python, Scientific Python and many other tools available for numeric and scientific applications.



Benefits of Using Python over the Other Programming Languages for AI

5. Python is very well designed, fast, robust, portable, and scalable. These are evidently the most important factors for AI applications.
6. Useful for a really broad range of programming tasks from little shell scripts to enterprise web applications to scientific uses.
7. Last but not the least, it is Open Source! Good community support available for the same.