数据结构与算法
Data Structure and Algorithm

Introduction

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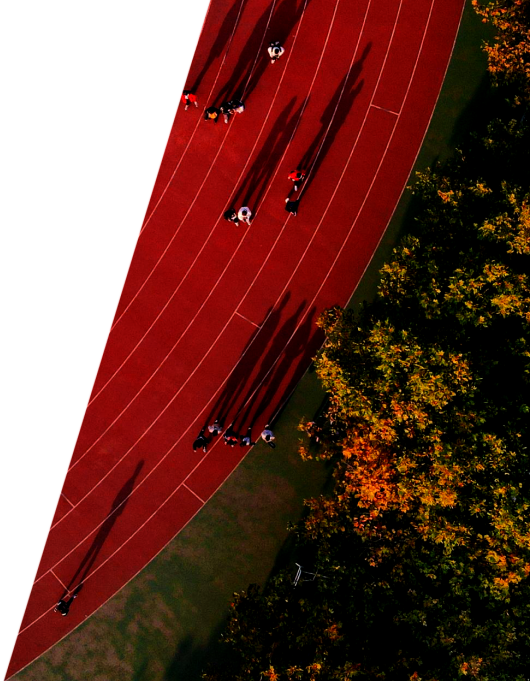

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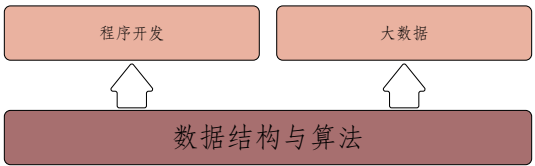
课程所处地位

1 课程介绍

- **《数据结构与算法》**是信息管理专业的核心基础课程之一。
- 它为学生提供解决实际问题和优化信息系统的关键工具和技术。
- 该课程与其他信息管理科学相关课程（如《管理信息系统》、《面向对象程序设计》、《商务智能与数据挖掘》、《信息系统分析与设计》等）相互关联，构建了信息管理专业的技术基础。



课程特征

1 课程介绍

- **抽象性强**：数据结构与算法课程涉及到抽象的数据模型和算法设计，需要学生具备抽象思维和逻辑推理能力。
- **实践性强**：该课程注重实践操作和算法实现，学生需要通过编程实践来加深对数据结构和算法的理解和应用。
- **算法思维培养**：该课程强调培养学生的算法思维，即解决问题的思考方式和技巧，让学生具备分析、设计和优化算法的能力。

主要讲授内容

1 课程介绍

- 基本数据结构：包括数组、链表、栈、队列、树等常用数据结构的定义、实现和操作。
- 常用算法：涵盖排序算法、搜索算法、图算法等，如冒泡排序、快速排序、二分查找、广度优先搜索、最短路径算法等。
- 数据结构和算法的应用：介绍数据结构和算法在实际问题求解和信息管理系统中的应用，如数据库、大数据分析等领域。

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2 目标

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1. 熟悉常见的数据集合抽象（例如栈、队列、列表、树、映射）。
2. 理解实现常见数据结构的高效算法策略。
3. 能够从理论和实验的角度分析算法性能，并识别不同策略之间的常见权衡和取舍。
4. 能够基于 Python 语言明智地使用现有的数据结构和算法。
5. 能够应用数据结构和算法解决复杂问题。

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3 算法概述

Declarative knowledge vs. Imperative knowledge

All knowledge can be thought of as either **declarative （陈述性的）or imperative（命令性的）**.

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- **Imperative knowledge** is "how to" knowledge, or recipes for deducing information.

A way to compute the square root of a number

3 算法概述

A way to compute the square root of a number

3 算法概述

1. Start with a guess, g.
2. If $g \times g$ is close enough to x, stop and say that g is the answer.
3. Otherwise, create a new guess by averaging g and $\frac{x}{g}$, i.e., $\frac{(g+\frac{x}{g})}{2}$.
4. Using this new guess, which we again call g, repeat the process until $g \times g$ is close enough to x.

Definition of algorithm

3 算法概述

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- Note that the description of the method is **a sequence of simple steps, together with a flow of control** that specifies when to execute each step. Such a description is called an **algorithm**.
- More formally, *an algorithm is a finite list of instructions describing a set of* ***computations*** *that when executed on a set of inputs will proceed through a sequence of well-defined states and eventually produce an output.*

Examples: Perfect cube root

This code prints the integer cube root, if it exists, of an integer. If the input is not a perfect cube, it prints a message to that effect.

```
# Find the cube root of a perfect cube
x = int(input("Enter an integer: "))
ans = 0
while ans**3 < abs(x):
    ans += 1
if ans**3 != abs(x):
    print(x, "is not a perfect cube")
else:
    if x < 0:
        ans = -ans
    print("Cube root of" , x, "is", ans)

```

Examples: Prime number

This code tests whether an integer is a prime number and returning the smallest divisor if it is not.

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3 算法概述

This code tests whether an integer is a prime number and returning the smallest divisor if it is not.

```
# Test if an int > 2 is prime. If not, print smallest divisor
x = int(input("Enter an integer greater than 2: "))
smallest_divisor = None
for guess in range(2, x):
    if x%guess == 0:
        smallest_divisor = guess
        break
if smallest_divisor != None:
    print("Smallest divisor of", x, "is", smallest_divisor)
else:
    print(x, "is a prime number")

```

Examples: Finger exercise

Change the code in previous slide so that it returns the largest rather than the smallest divisor.

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Hint: if $y \times z = x$ and y is the smallest divisor of x, z is the largest divisor of x.

Examples: Approximation to the square root of x


```
1       epsilon = 0.01
2       step = epsilon**2
3       num_guesses = 0
4       while abs(ans**2 - x) >= epsilon and ans <= x:
5           ans += step
6           num_guesses += 1
7       print("number of guesses = ', num_guesses)
8       if abs(ans**2 - x) >= epsilon:
9           print("Failed on square root of", x)
10      else:
11          print(ans, "is close to square root of", x)
12
```

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4 数据结构概述

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5 参考书目

Q&A

Thank you for listening!
Your feedback will be highly appreciated!