



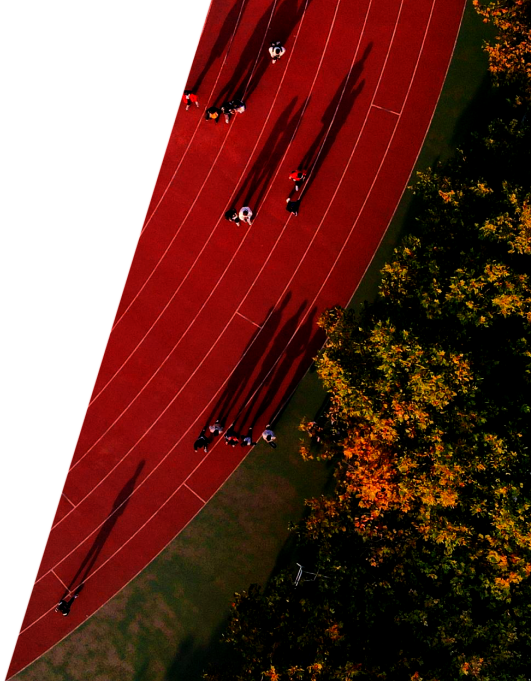
# 数据结构与算法

## Data Structure and Algorithm

Introduction

ZHANG Luping

2023 年 6 月 24 日





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## 1 课程介绍

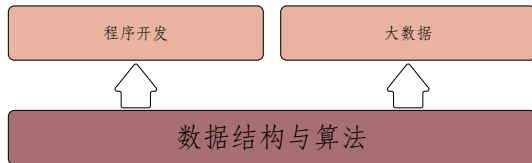
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# 课程所处地位

## 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 and 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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# 期望目标

## 2 目标

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. 能够理论和实验分析算法性能，并识别不同策略之间的常见权衡和取舍。
4. 能够在现代编程语言库中明智地使用现有的数据结构和算法。
5. 在大多数基础数据结构和算法的具体实现方面有经验。
6. 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

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# Declarative knowledge vs. Imperative knowledge

## 3 算法概述

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

- **Declarative knowledge** is composed of statements of fact.



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  - *It is possible to travel by train from Qingdao to Beijing*
- **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

- 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**.



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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

### 3 算法概述

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.

```
1      # Find the cube root of a perfect cube
2      x = int(input("Enter an integer: "))
3      ans = 0
4      while ans**3 < abs(x):
5          ans += 1
6      if ans**3 != abs(x):
7          print(x, "is not a perfect cube")
8      else:
9          if x < 0:
10             ans = -ans
11             print("Cube root of" , x, "is", ans)
12
```



## Examples: Prime number

### 3 算法概述

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

```
1      # Test if an int > 2 is prime. If not, print smallest divisor
2      x = int(input("Enter an integer greater than 2: "))
3      smallest_divisor = None
4      for guess in range(2, x):
5          if x%guess == 0:
6              smallest_divisor = guess
7              break
8      if smallest_divisor != None:
9          print("Smallest divisor of", x, "is", smallest_divisor)
10     else:
11         print(x, "is a prime number")
12
```



# Examples: Approximation to the square root of $x$

## 3 算法概述

```
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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# Q&A

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