数据结构与算法

Data Structure and Algorithm

XXX. 总结

授课人：Kevin Feng

特别感谢！

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- 班 长

按拼音顺序排列，排名不分先后

课程简介 | Course Introduction

2 个月高强度学习IT面试必考知识

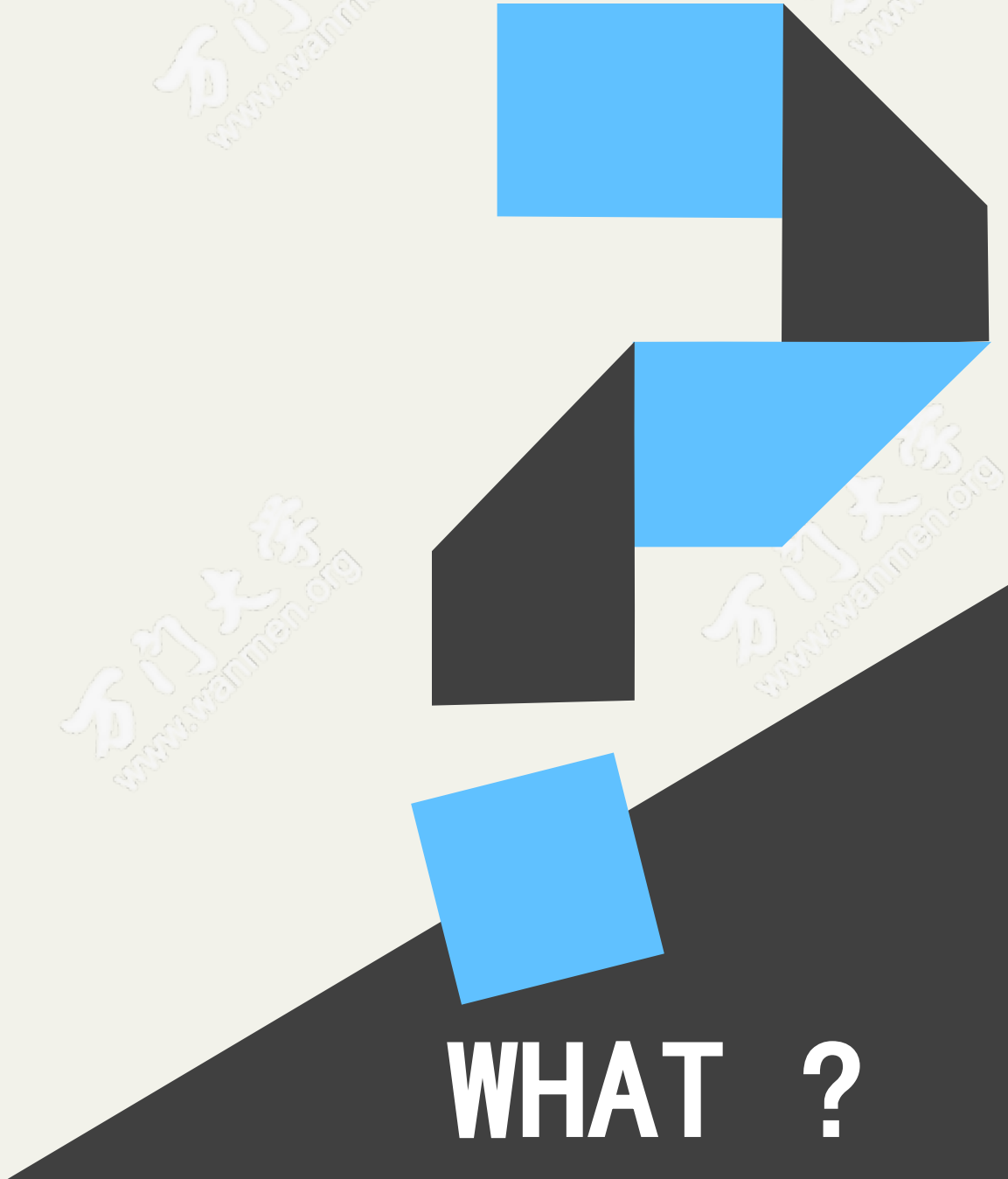
60 课时系统讲解数据结构和算法

300 道顶尖科技公司技术面试真题

3 大火热职位：
- 数据科学家：容易
- 数据工程师：容易到中等难度
- 软件工程师：中等难度到有挑战

4 大面试考察方向：基础 + 数据结构 + 算法 +项目

70% FLAG面试来自计算机语言，数据结构和算法



课程安排 | Course Agenda

Week 01	1	【Algorithm 01】 Introduction
	2	【Algorithm 02】 ArrayList
Week 02	3	【Algorithm 03】 Recursion
	4	【Algorithm 04】 Search and Sort
Week 03	5	【Algorithm 05】 Binary Search
	6	【Algorithm 06】 Divide and Conquer I
Week 04	7	【Algorithm 07】 Divide and Conquer II
	8	【Algorithm 08】 Linked List
Week 05	9	【Algorithm 09】 Linked List II
	10	【Algorithm 10】 Stack & Queue
Week 06	11	【Algorithm 11】 Stack & Queue II
	12	【Algorithm 12】 Hashtable
Week 07	13	【Algorithm 13】 Hashtable II
	14	【Algorithm 14】 Tree
Week 08	15	【Algorithm 15】 Tree II
	16	【Algorithm 16】 Heap
Week 09	17	【Algorithm 17】 Graph
	18	【Algorithm 18】 Graph II - DFS / BFS
Week 10	19	【Algorithm 19】 Graph III - Dijkstra
	20	【Algorithm 20】 Graph IV - Union Find
Week 11	21	【Algorithm 21】 Two Pointers
	22	【Algorithm 22】 Sliding Windows
Week 12	23	【Algorithm 23】 DP I
	24	【Algorithm 24】 DP II
Week 13	25	【Algorithm 25】 DP III
	26	【Algorithm 26】 Bit Manipulate/Math
Week 14	27	【Algorithm 27】 Greedy
	28	【Algorithm 28】 String I
Week 15	29	【Algorithm 29】 String II
	30	【Algorithm 30】 Mock Interview

Summarization – Data Structure I

- Linked List （链表）
  - Basic Knowledge （基础知识）
  - Two Pointers / Runner Technique （双向指针）
  - Reverse （颠倒）
  - Sort （排序）
  - Combine with Other Data Structures （与其他数据结构合并）
- Stack, Queue and Deque （栈，队列，双端队列）
  - Basic Knowledge （基础知识）
  - Stack / Queue Construction （栈/队列的构建）
  - Stack / Queue Basic Application （栈/队列的基础应用）
  - Index Stack * （索引栈）
  - Calculator （计算器）
  - BFS, DFS （广度优先搜索，深度优先搜索）

Summarization – Data Structure II

- Hashtable （哈希表）
  - Basic Knowledge （基础知识）
    - Hash Function and Hashcode （哈希函数以及哈希编码）
    - Collision （冲突）
    - Open Addressing （开放寻址）
    - Separate Chain （独立链表）
    - equals
    - Rehash （重新配置）
    - Double Hash （双重哈希）
  - LinkedHash （哈希链表）
  - TreeMap （树状匹配）
  - Rolling Hash （滚动哈希）
  - Customized Hash Object （自定义哈希类）
  - DFS, BFS （广度优先搜索，深度优先搜索）
  - Count Sort, Array as Hash, int as Hash （计算排序，哈希数组，哈希整数）

Summarization – Data Structure III

- Tree （树）
  - Basic Knowledge （基础知识）
  - Recursion （递归）
  - Iteration （迭代）
  - Traversal （遍历）
  - DFS, BFS（广度优先搜索，深度优先搜索）
  - Stack, Queue （堆栈，队列）
  - Balanced Tree （*） （平衡树）
- Heap （堆）
  - Basic Knowledge（基础知识）
  - Top K and Counting （最大值与计数）
  - Sort （排序）
  - Streaming （流）
  - Greedy （贪婪算法）
  - Dijkstra Algorithm

Summarization – Graph

- Graph （图论）
  - Basic Knowledge（基础知识）
  - Implementation （实现）
  - DFS, BFS （广度优先搜索，深度优先搜索）
  - Recursion vs Iteration （递归和迭代）
  - Shortest Path （最短路径）
  - Topology Sort （拓扑排序）
  - Union Find （并集）
  - Minimum Spanning Tree （Greedy）
  - Maximum Flow

Summarization – Array

- Array, ArrayList, String （数组，数列，字符串）
  - Brute Force （暴力破解）
  - Sort （排序）
  - Search （搜索）
  - Recursion （递归）
  - Binary Search （二分法搜索）
  - Divide and Conquer （分而治之）
  - Two Pointers （双向指针）
  - Sliding Windows （滑动窗口）
  - Various Data Structure （结合各式数据结构）
  - Dynamic Programming （动态规划）
  - Greedy（贪心算法）

Summarization – Algorithm

- Divide and Conquer （分而治之）
- Dynamic Programming （动态规划）
  - 1-D
  - 2-D
  - 3-D
- Greedy （贪心算法）
- Bit Manipulation （位操作）
- Multi-Solution Questions （多解决方案问题）

Continuing Studies

- Advanced Data Structures
  - Skip List
  - B Tree, Segment Tree, Binary Indexed Tree
  - Range Minimum Query
  - Trie
  - Fibonacci Heap, Binomial Heap
  - More and more…
- Parallel Programming
- Memory Management and Garbage Collection
- NP-Completeness
- Approximation
- Maximum Flow
- More and more…

如何学习数据结构和算法？

基础知识

编程语言

如何练习代码

推广和总结

软件工程师面试

- 数据结构（70%–80%）
- 系统设计
- 简历 （课程，项目，经验，等等） （10%）
- 计算机语言（不限，Java，Python，C++，等）
- 行为面试 （10%）
- 项目相关：操作系统，网络，等

数据工程师面试

- 数据结构和算法
- 编程语言
- 大数据通用处理平台
- 分布式存储与计算
- 并发程序设计
- 使用 Hadoop, Spark, Kafka, Hive 等工具
- 数据分析/数据仓库（SQL类）
- 开发ETL/数据流水线（data pipelines）
- 数据可视化

数据科学家面试

- 数学，统计
- SQL
- 数据建模
- 机器学习

Linear Regression, Logistics Regression, Clustering, Decision Tree, Time Series,

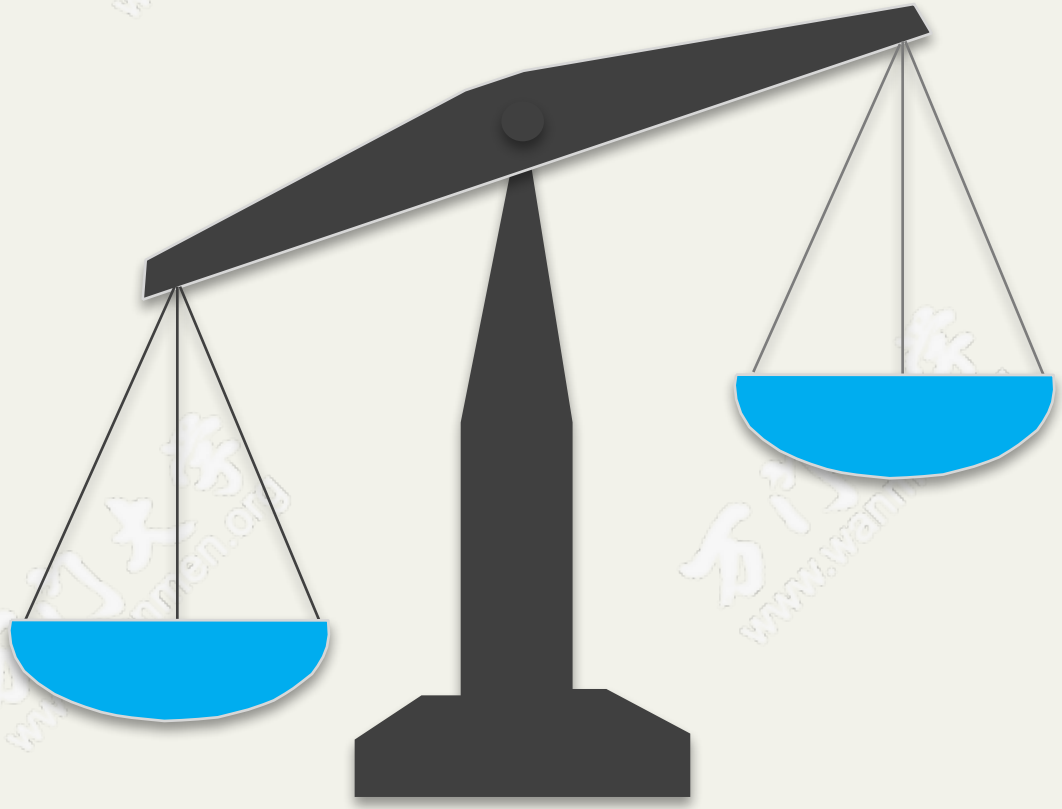
Random Number, Monte-Carlo, Bayesian, Bayes, SVM, KNN, etc.

- 算法
- 商业智能的 dashboards
- 会读paper，会写research proposal
- R / Python / MATLAB / SAS
- 数据可视化

划重点

算法的要求

- 软件工程师：高
- 数据工程师：中
- 数据科学家：一般



语言的要求

- 软件工程师：高
- 数据工程师：高
- 数据科学家：中

Soft Skills
软 实 力

交流沟通

演讲报告

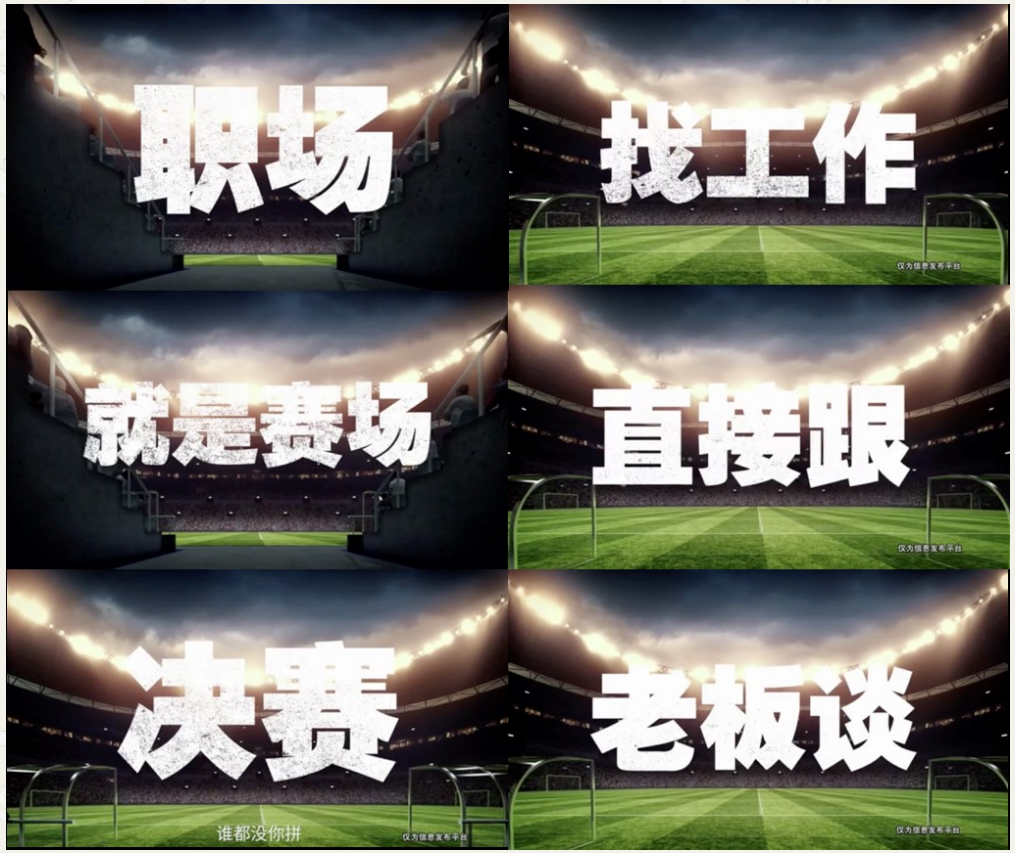
人际脉络

个人作品集

热门话题

- 如何选择方向
- 学历重要吗
- 大公司 vs. 小公司
- 语言重要吗
- 如何准备面试
- 如何突破自我

找工作



- 升职！
- 加薪！
- 找工作！
- 直接！
- 跟老板谈！

黄沙百战穿金甲 不破楼兰终不还

WHICH PROGRAMMING LANGUAGE

SHOULD I LEARN FIRST?

WHAT IS PROGRAMMING?

Writing very specific instructions to a very dumb, yet obedient machine.

LANGUAGES

PYTHON · JAVA · C · PHP · C++

JAVASCRIPT · C# · RUBY · OBJECTIVE-C

START

WHY DO YOU WANT TO LEARN PROGRAMMING?

For my kids → Start with Scratch, then move on to...

I don't know, just pick one for me

Just for fun

I'm interested → Have a brilliant idea/platform in mind?

Improve myself

Have a brilliant idea/platform in mind? → Nope. Just want to get started / I prefer to learn things...

Nope. Just want to get started → The easy way / The best way

I prefer to learn things... → The best way / The slightly harder way

The slightly harder way → Auto or Manual car?

Auto or Manual car? → Auto / Manual

Auto → C

Manual → The really hard way (but easier to pick up other languages in the future)

Get a job → Make money

Make money → I have a startup idea!

I have a startup idea! → Which platform/field?

YES → Which platform/field?

Which platform/field? → I want to work for big tech companies / Front-end (web interface) / 3D/Gaming / Mobile / Web / Doesn't matter, I just want $$$

I want to work for big tech companies → I'm a fan! / Not Bad / Suck

Front-end (web interface) → Web → Back-end ("brain" behind a website) → I want to work for... → Corporate / Startup

Corporate → What do you think about Microsoft?

3D/Gaming → Enterprise

Mobile → Which OS? → iOS / Android

Web → Does your web app provides info in real-time, like twitter? → YES / NO

Do you want to try something new with huge potential, but less mature? → NOT SURE / NO

NOT SURE / NO → Which one is your favourite toy? → Lego / Play-Doh / I've an old & ugly toy, but i love it so much!

The Lord Of The Rings

Python
The Ent

DIFFICULTY ★☆☆☆☆

Help little Hobbits (beginners) to understand programming concepts

Help Wizards (computer scientists) to conduct researches

Widely regarded as the best programming language for beginners

Easiest to learn

Widely used in scientific, technical & academic field, i.e. Artificial Intelligence

You can build website using Django, a popular Python web framework

POPULARITY ★★★★½

USED TO BUILD YouTube, Instagram, Spotify

AVG. SALARY $107,000

Java
Gandalf

DIFFICULTY ★★★☆☆

Wants peace & works with everyone (portable)

Very popular on all platforms, OS, and devices due to its portability

One of the most in demand & highest paying programming languages

Slogan: write once, work everywhere

POPULARITY ★★★★★

USED TO BUILD Gmail, Minecraft, Most Android Apps, Enterprise applications

AVG. SALARY $102,000

C
One Ring

DIFFICULTY ★★★☆☆

The power of C is known to them all

Everyone wants to get its Power

Lingua franca of programming language

One of the oldest and most widely used language in the world

Popular language for system and hardware programming

A subset of C++ except the little details

POPULARITY ★★★★★

USED TO BUILD Operating systems and hardware

AVG. SALARY $102,000

C++
Saruman

DIFFICULTY ★★★★☆

Everyone thinks that he is the good guy

But once you get to know him, you will realize he wants the power, not good deeds

Complex version of C with a lot more features

Widely used for developing games, industrial and performance-critical applications

Learning C++ is like learning how to manufacture, assemble, and drive a car

Recommended only if you have a mentor to guide you

POPULARITY ★★★★½

USED TO BUILD Operating systems, hardware, and browsers

AVG. SALARY $104,000

JavaScript
Hobbit

DIFFICULTY ★★☆☆☆

Frequently underestimated (powerful)

Well-known for the slow, gentle life of the Shire (web browsers)

"Java and Javascript are similar like Car and Carpet are similar" - Greg Hewgill

Most popular clients-side web scripting language

A must learn for front-end web developer (HTML and CSS as well)

One of the hottest programming language now, due to its increasing popularity as server-side language (node.js)

POPULARITY ★★★★☆

USED TO BUILD Paypal, front-end of majority websites

AVG. SALARY $99,000

C#
Elf

DIFFICULTY ★★★☆☆

Beautiful creature (language), used to stay in their land, Rivendell (Microsoft Platform), but recently started to open up to their neighbours (open source)

A popular choice for enterprise to create websites and Windows application using .NET framework

Can be used to build website with ASP.NET, a web framework from Microsoft

Similar to Java in basic syntax and some features

POPULARITY ★★★★½

USED TO BUILD Enterprise and Windows applications

AVG. SALARY $94,000

Ruby
Man (Middle Earth)

DIFFICULTY ★★☆☆☆

Very emotional creature

They (some Ruby developers) feel they are superior & need to rule the Middle Earth

Mostly known for its popular web framework, Ruby on Rails

Focuses on getting things done

Designed for fun and productive coding

Best for fun and personal projects, startups, and rapid development

POPULARITY ★★★½☆

USED TO BUILD Hulu, Groupon, Slideshare

AVG. SALARY $107,000

PHP
Orc

DIFFICULTY ★★☆☆☆

Ugly guy (language) and doesn't respect the rules (inconsistent and unpredictable)

Big headache to those (developers) to manage them (codes)

Yet still dominates the Middle-earth (most popular web scripting language)

Suitable for building small and simple sites within a short time frame

Supported by almost every web hosting services with lower price

POPULARITY ★★★★☆

USED TO BUILD Wordpress, Wikipedia, Flickr

AVG. SALARY $89,000

Objective-C
Smaug

DIFFICULTY ★★★☆☆

Lonely and loves gold

Primary language used by Apple for Mac OS X & iOS

Choose this if you want to focus on developing iOS or OS X apps only

Consider to learn Swift (newly introduced by Apple in 2014) as your next language

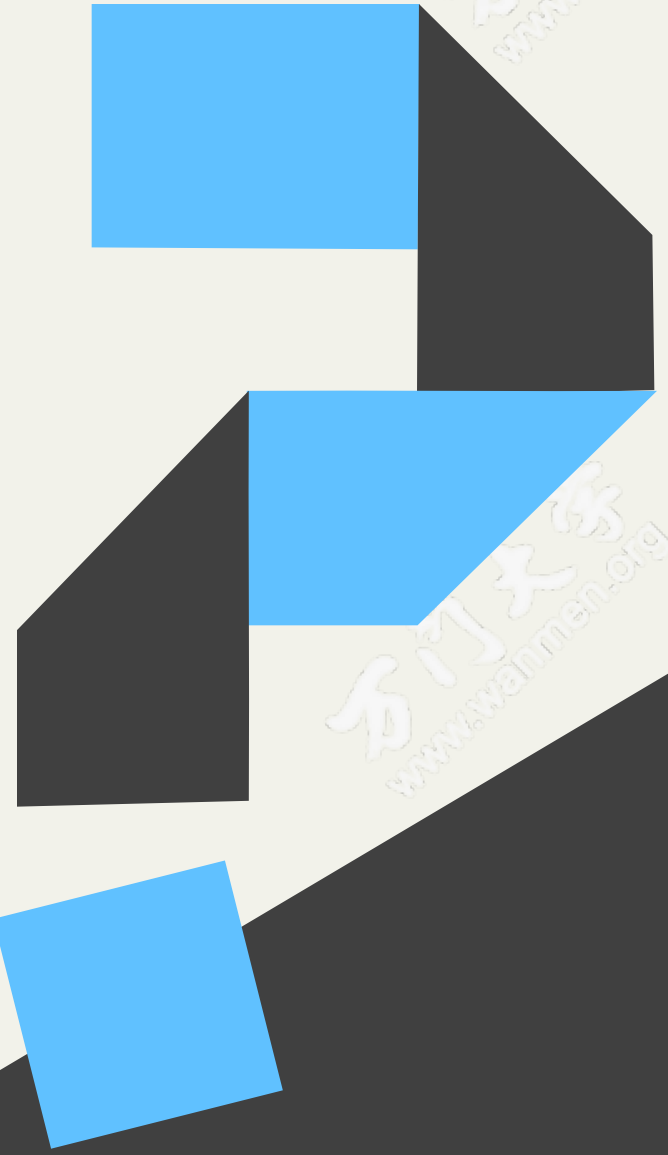
POPULARITY ★★★☆☆

USED TO BUILD Most iOS Apps and part of Mac OS X

AVG. SALARY $107,000

QUESTIONS ?

ANSWERS !



WHAT ?

江山代有才人出，各领风骚数百年

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Data Structure and Algorithm

XXX. 总结

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