

极客大学算法训练营

第二课

训练准备和复杂度分析

覃超

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目录

- 第一节 训练环境设置、编码技巧和 Code Style
- 第二节 时间复杂度、空间复杂度

第一节

训练环境设置、编码技巧和 Code Style

工欲善其事，必先利其器

电脑设置

- Google
- Mac: iTerm2 + zsh (oh my zsh)
Windows: Microsoft new terminal: (<https://github.com/microsoft/terminal>)
- VSCode; Java: IntelliJ; Python: Pycharm
- LeetCode plugin (VSCode & IntelliJ)
- <https://vscodethemes.com/>
- 骚操作:
<https://juejin.im/entry/587e0f2f570c352201113e14>
<https://juejin.im/post/5ce1365151882525ff28ed47>

main.js — careerplan [不受支持]

资源管理器

打开的编辑器

- custom.css ~/Documents
- settings.json ~/Library/... 3
- JS main.js src
- JS custom.js ~/Documents

CAREERPLAN

- JS cacheService.js
- JS index.js
- assets
- common
- mixins
- router
- store
- stylus
- util
- views
- App.vue
- JS ElementUI.js
- favicon.ico
- index.html
- JS main.js
- .babelrc
- .editorconfig
- .eslintignore
- .eslintrc.js
- .gitignore
- .postcssrc.js
- package-lock.json

大纲

master 0 3

custom.css settings.json JS main.js JS custom.js

```
14 Vue.config.productionTip = false
15
16 Vue.use(Vuex)
17
18 Vue.prototype.$toast = (msg, type = 'success') => {
19   Vue.prototype.$message({
20     showClose: true,
21     message: msg,
22     type: type
23   })
24 }
25
26 sync(store, router)
27
28 /* eslint-disable no-new */
29 new Vue({
30   el: '#app',
31   router,
32   store,
33   components: { App },
34   template: '<App/>'
35 })
36
```

行 7, 列 13 (已选择5) 空格: 2 UTF-8 LF Babel JavaScript

plan 文稿

Mac 键盘快捷键 - A...持.pdf

图像

影片

开发告

其他

屏幕快照

资源管理器

打开的编辑器

CLASSINVITATIONAL

build

JS build.js

JS check-versions.js

JS dev-client.js

JS dev-server.js

JS utils.js

JS vue-loader.conf.js

JS webpack.base.conf.js

JS webpack.dev.conf.js

JS webpack.prod.conf.js

config

JS dev.env.js

JS index.js

JS prod.env.js

dist

node_modules

src

static

audio

images

大纲

JS build.js

5 var ora = require('ora')

6 var rm = require('rimraf')

7 var path = require('path')

8 var chalk = require('chalk')

9 var webpack = require('webpack')

10 var config = require('../config')

11 var webpackConfig = require('./webpack.prod.conf')

12

13 var spinner = ora('building for production...')

14 spinner.start()

15

16 rm(path.join(config.build.assetsRoot, config.build.assetsSubDirectory), err => {

17 if (err) throw err

18 webpack(webpackConfig, function (err, stats) {

19 spinner.stop()

20 if (err) throw err

21 process.stdout.write(stats.toString({

22 colors: true,

23 modules: false,

24 children: false,

25 chunks: false,

26 chunkModules: false

27 }) + '\n\n')

28

synthwave84-noglow.css

15 .monaco-workbench

16 .activitybar>.content

17 .monaco-action-bar .badge

18 .badge-content {

19 background: linear-gradient(to bottom, #fff951 25%, #fc28a8);

20 }

21

22 /* Active tab neon */

23 .monaco-workbench

24 .part.editor>.content

25 .editor-group-container>.title

26 .tabs-container>.tab.sizing-fit.active

27 {

28 box-shadow: inset 0 -5px 25px #fc28a825;

29 position: relative;

30 }

31

32 /* Active tab stripe */

33 .monaco-workbench

34 .part.editor>.content

35 .editor-group-container>.title

36 .tabs-container>.tab.sizing-fit

37 active::after {

38 content: '';

39 position: absolute;

40 bottom: -1px;

41 }

master*

0 0

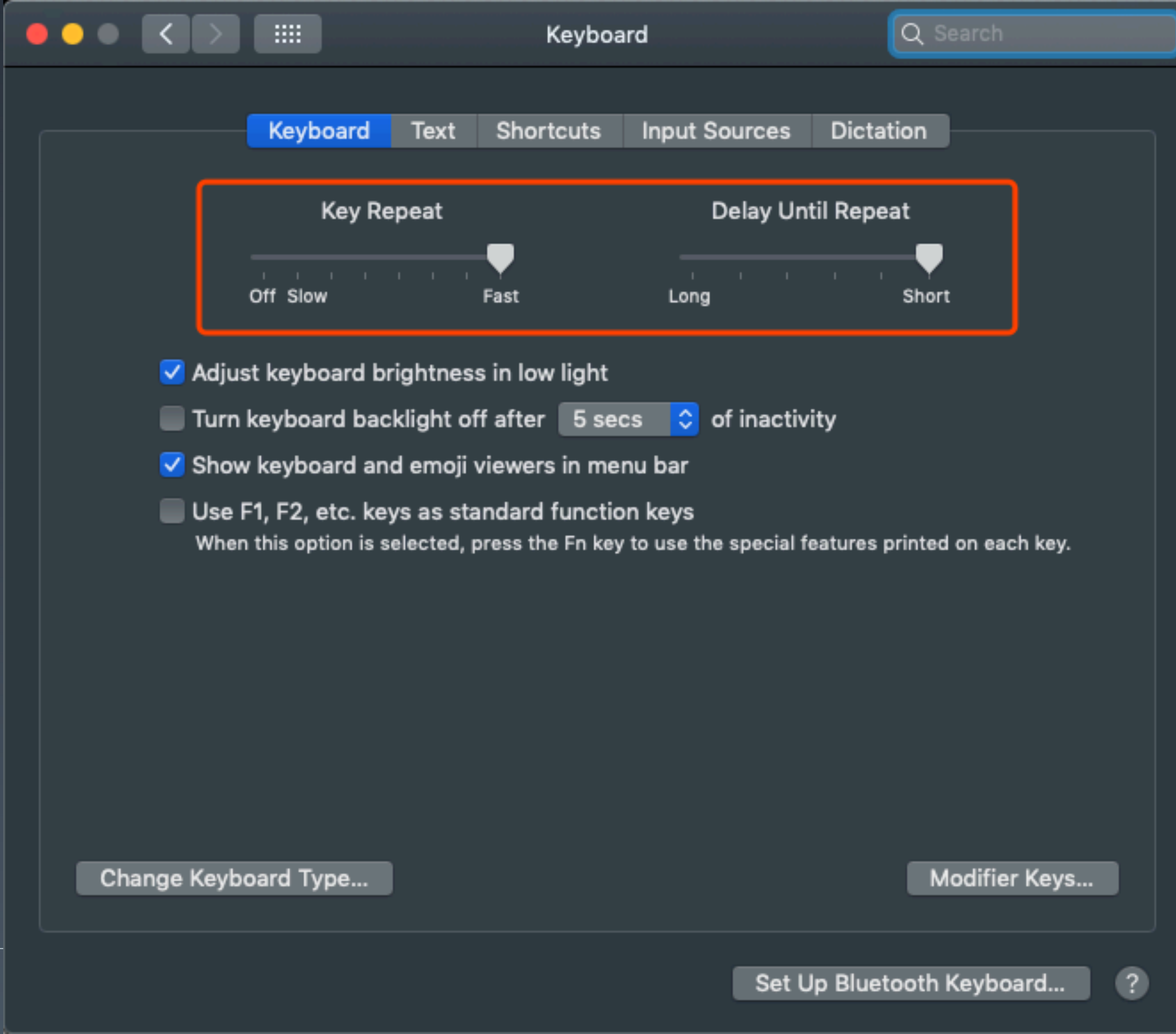
行 17, 列 2

空格: 2

UTF-8

LF

CSS



Code Style

Java、Python、...

- Google code style
- Facebook
- Airbnb

LeetCode

- leetcode-cn.com 和 题解
- leetcode.com 和 Discuss board

指法和小操作

- home, end (行头、行尾)
- Word 单词、选单词、选整行
- IDE 的自动补全
- Top tips for <IDE-name>

自顶向下的编程方式

- <https://markhneedham.com/blog/2008/09/15/clean-code-book-review/>
- <https://leetcode-cn.com/problems/valid-palindrome/>

第二节

时间复杂度、空间复杂度

Big O notation

$O(1)$: Constant Complexity 常数复杂度

$O(\log n)$: Logarithmic Complexity 对数复杂度

$O(n)$: Linear Complexity 线性时间复杂度

$O(n^2)$: N square Complexity 平方

$O(n^3)$: N square Complexity 立方

$O(2^n)$: Exponential Growth 指数

$O(n!)$: Factorial 阶乘

注意：只看最高复杂度的运算

Big O notation

$O(1)$ `int n = 1000;`
`System.out.println("Hey - your input is: " + n);`

$O(?)$ `int n = 1000;`
`System.out.println("Hey - your input is: " + n);`
`System.out.println("Hmm.. I'm doing more stuff with: " + n);`
`System.out.println("And more: " + n);`

Big O notation

$O(N)$ `for (int i = 1; i <= n; i++) {
 System.out.println("Hey - I'm busy looking at: " + i);
 }`

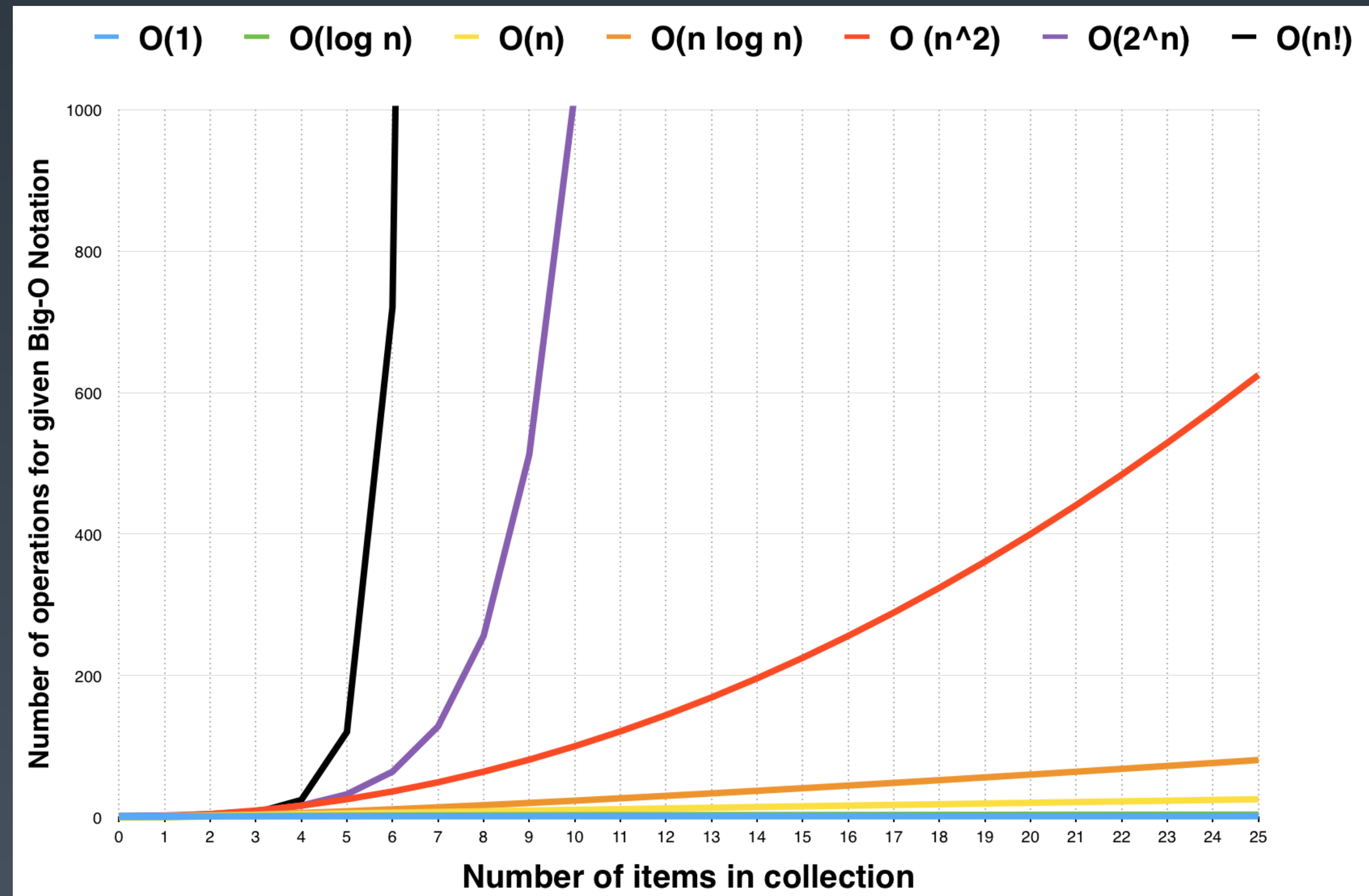
$O(N^2)$ `for (int i = 1; i <= n; i++) {
 for (int j = 1; j <= n; j++) {
 System.out.println("Hey - I'm busy looking at: " + i + " and " +
 j);
 }
 }`

Big O notation

$O(\log(n))$ `for (int i = 1; i < n; i = i * 2) {
 System.out.println("Hey - I'm busy looking at: " + i);
 }`

$O(k^n)$ `int fib(int n) {
 if (n <= 2) return n;
 return fib(n - 1) + fib(n - 2);
 }`

时间复杂度曲线



计算: $1 + 2 + 3 + \dots + n$

- 方法一: 从1到n的循环累加

```
y = 0  
for i = 1 to n:  
    y += i
```

- 方法二: 求和公式 $\text{sum} = n(n+1)/2$

```
y = n * (n + 1) / 2
```


更复杂的情况：递归

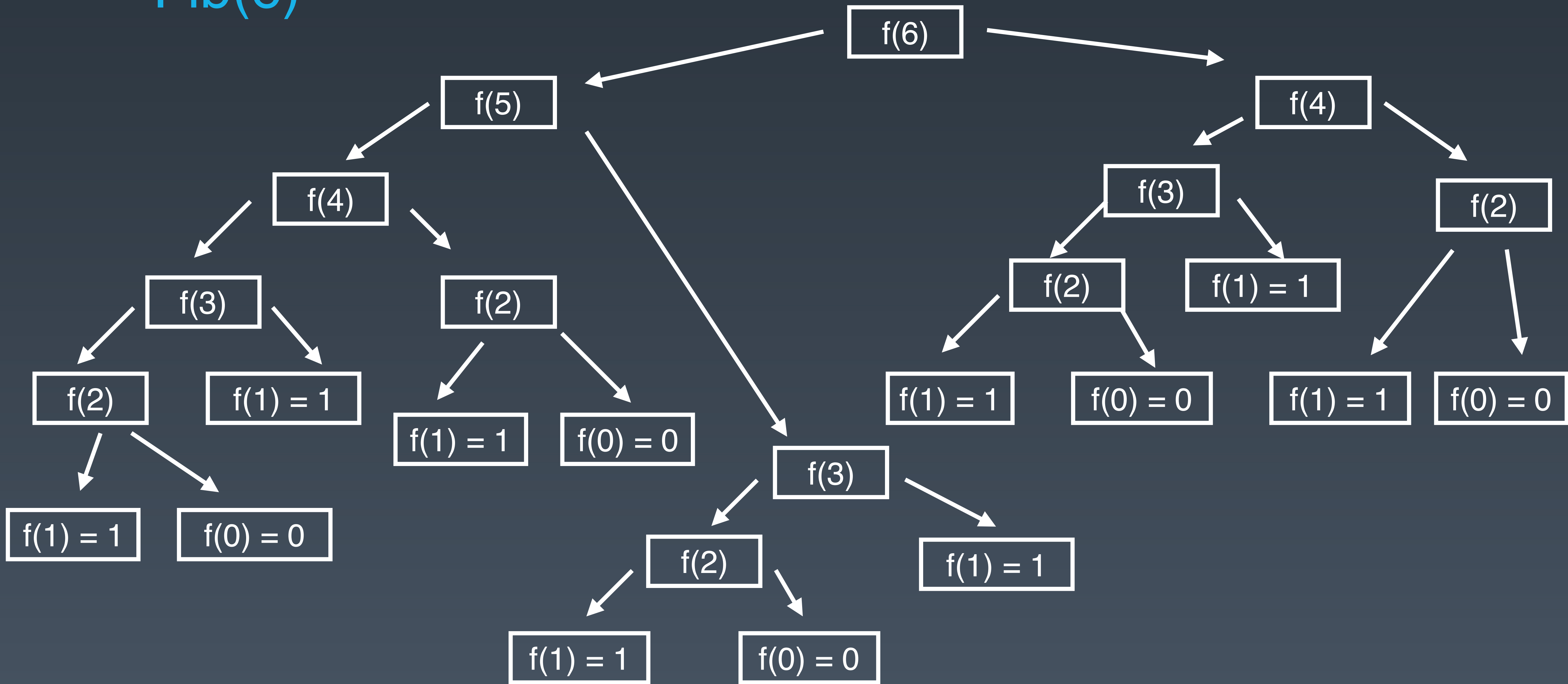
Fib: 0, 1, 1, 2, 3, 5, 8, 13, 21, ...

- $F(n) = F(n - 1) + F(n - 2)$

- 面试 （直接用递归）

```
int fib(int n) {  
    if (n <= 2) return n;  
    return fib(n - 1) + fib(n - 2);  
}
```

Fib(6)



Master Theorem

Application to common algorithms [\[edit \]](#)

Algorithm	Recurrence relationship	Run time	Comment
Binary search	$T(n) = T\left(\frac{n}{2}\right) + O(1)$	$O(\log n)$	Apply Master theorem case $c = \log_b a$, where $a = 1, b = 2, c = 0, k = 0$ ^[5]
Binary tree traversal	$T(n) = 2T\left(\frac{n}{2}\right) + O(1)$	$O(n)$	Apply Master theorem case $c < \log_b a$ where $a = 2, b = 2, c = 0$ ^[5]
Optimal sorted matrix search	$T(n) = 2T\left(\frac{n}{2}\right) + O(\log n)$	$O(n)$	Apply the Akra–Bazzi theorem for $p = 1$ and $g(u) = \log(u)$ to get $\Theta(2n - \log n)$
Merge sort	$T(n) = 2T\left(\frac{n}{2}\right) + O(n)$	$O(n \log n)$	Apply Master theorem case $c = \log_b a$, where $a = 2, b = 2, c = 1, k = 0$

思考题

二叉树遍历 - 前序、中序、后序：时间复杂度是多少？

图的遍历：时间复杂度是多少？

搜索算法：DFS、BFS 时间复杂度是多少？

二分查找：时间复杂度是多少？

思考题

二叉树遍历 - 前序、中序、后序: $O(N)$

图的遍历: $O(N)$

搜索算法: DFS、BFS - $O(N)$

二分查找: $O(\log N)$

小结

- 常用工具配置
- 基本功和编程指法
- 常见的时间、空间复杂度

THANKS! |  极客大学