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12/13

I/O

# 1. BufferedReader

1) 1 2 3 4 — Integers

→ StringTokenizer st =

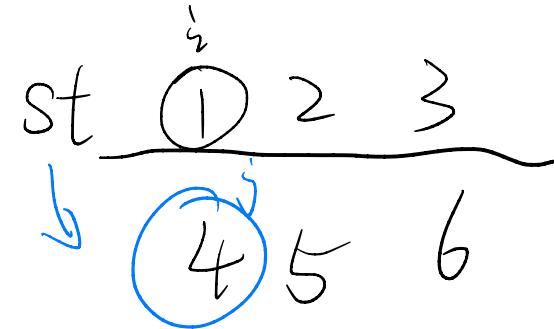
new StringTokenizer(f.readLine());

int i = Integer.parseInt(st.nextToken());

st =

→ new StringTokenizer(f.readLine());

int j = ...;



y

exe 8

→ 2) String { S = ?  
 S → abc de \n S1 = ?  
 S1 → ij ii \n

S.length() → 6 charAt()

S1.length() → 5

3) char

a b c  
 st = new S.T.(f.readLines())

char c = Character. Parsechar(st.)

## 2. PrintWriter.

BufferedWriter bw = new BufferedWriter  
(new FileWriter(" "));

PrintWriter out = new  
PrintWriter( bw );

out.print(" "); → to file.

out.close();

# ASCII

A - Z

$$\alpha = \bar{z}$$

— 9

1 2

ABC II

char A > int

(int) A → 65

int  $A - i = \underline{(\text{int})}^{\text{of}} A$   
↓  
- 4.

0, 1 2 3 4 5  
COMET Q.

65 - 90

A - Z

↓

① char At.      1 - 26.

② (int) char - 64      1 - 26.

③ Calc.

1.

1 2 3 4 | 5 6 7 8 9 10

G G H G H G H H G G

(C) (H) (G) (H) (G) (H) (H) (G) (G)

↓ ↓ ↓ ↓ ↓ ↓

1 2 3 4 5 6 7 8 9 10

H H G H G G F G G H

(H) (G) (H) (G) (G) (F) (G) (G) (H)

X

~~20000~~

1 2 3 4 5 6 > 7 9 10 11 12 13 14

→ G G G H G H H H G A A H G H G

G H G H H H G H G H G H G

~~A~~

j=4. 6. 8. 10. 12. 14.

max 24 (6) 3. 3. 2. 1.

for ( $i=0$ ;  $i < \text{len}$ ;  $i++$ )  
    for ( $j=0$ ;  $j < \text{len}$ ;  $j+=2$ )  
        reverse  
 $\text{lmax}_i$  matory. even G.

)  
,

print l<sup>'</sup>)

Time  
exceeds  
the  
req

Time →

Space.

Map < Integer, String >

map.put(k, str)

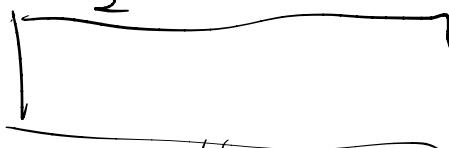
(1) str  
(2)

(3).

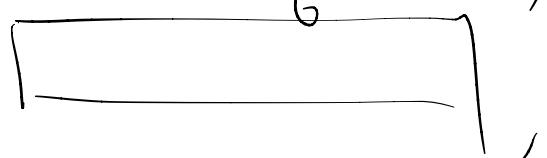
for (i = 0; i < n; i++)

    k

    Map.put(k, v)

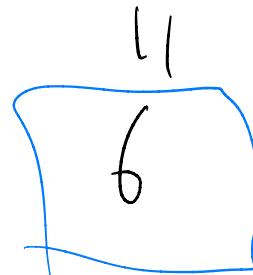


ans →



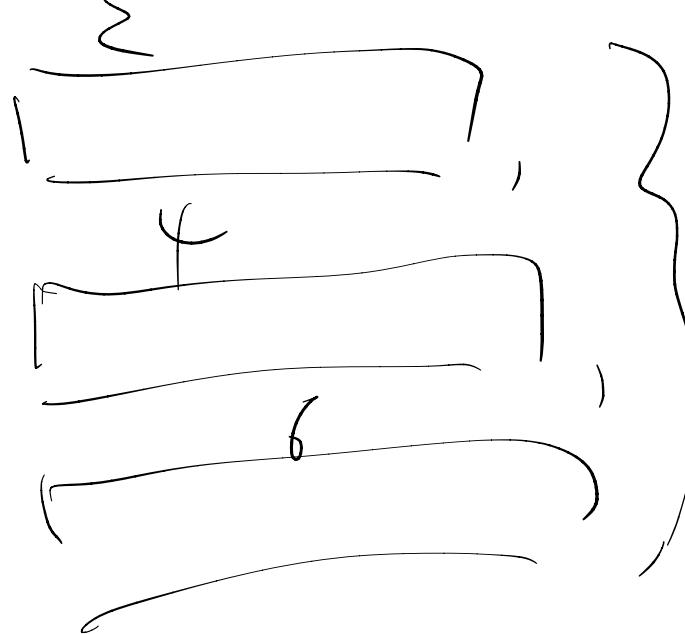
String

max-matching



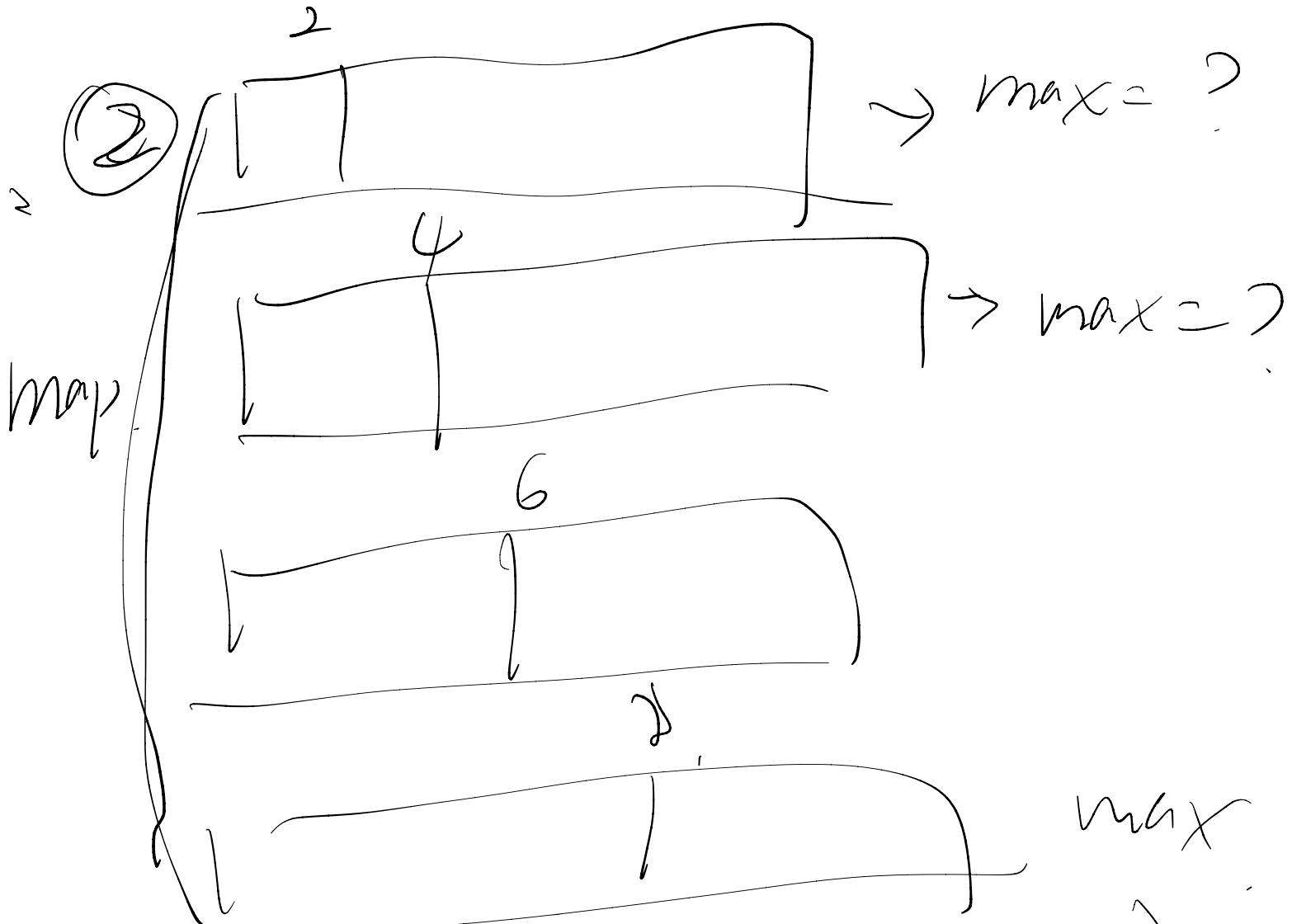
→ (2)

map.put



max-matching

```
for ( l → ∞ ) { ← 2,  
| ① max_match = 0,
```



```
| ② map.put( k, max ) .  
| } if ( max_new ≤ max_old )  
| } break ;  
| } return key.
```

~~G G G H G H G H G H G H G~~

~~G H H | G H H | G S.~~

even not G  $\rightarrow$  G (max)

ans = 2

2)

ans = 0

for(j = n-2; j >= 0; j -= 2)

(if str[j] == str[j+1]) {  
    ans++;

    str[j] == G  
    ans / 2 == 0.)

ans++; j == 1

12/14

$O(n)$   $\rightarrow$

while ( $i=0 \rightarrow n$ )  
For ( $i=0 \rightarrow n$ )

$O(n^2)$   $\rightarrow$

while ( $i=0 \rightarrow n$ )  
 $\hookrightarrow$  For ( $i=0 \rightarrow n$ )

## Data Structure

arrays.

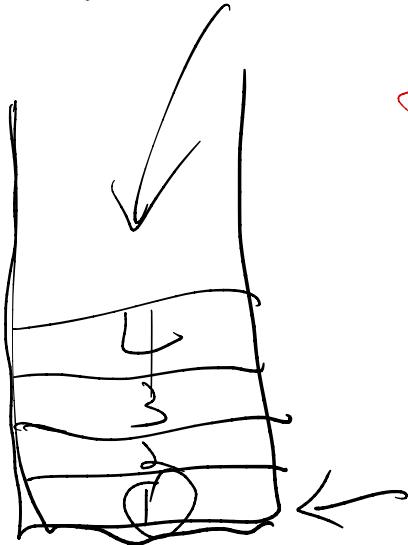
ArrayLists



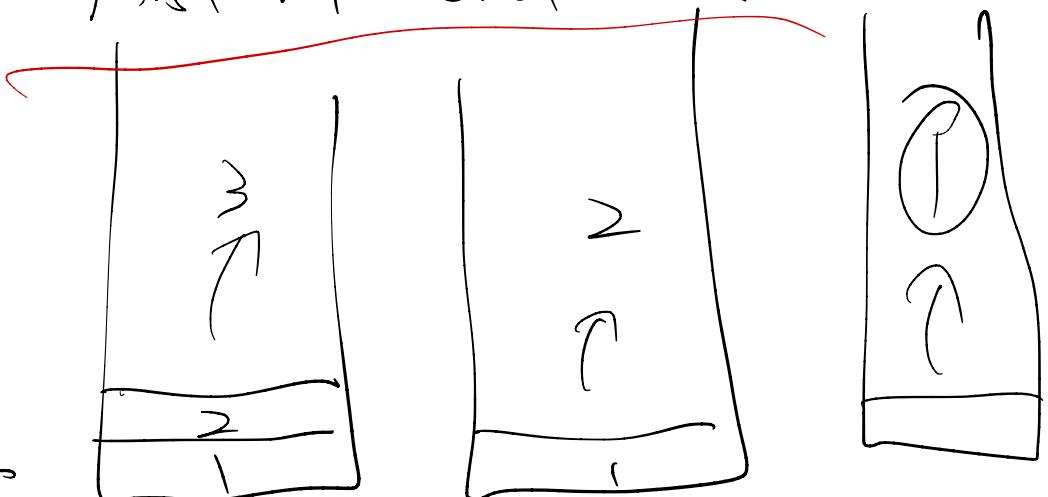
stack  
queue  
double queue  
linked list

map / set

Stack

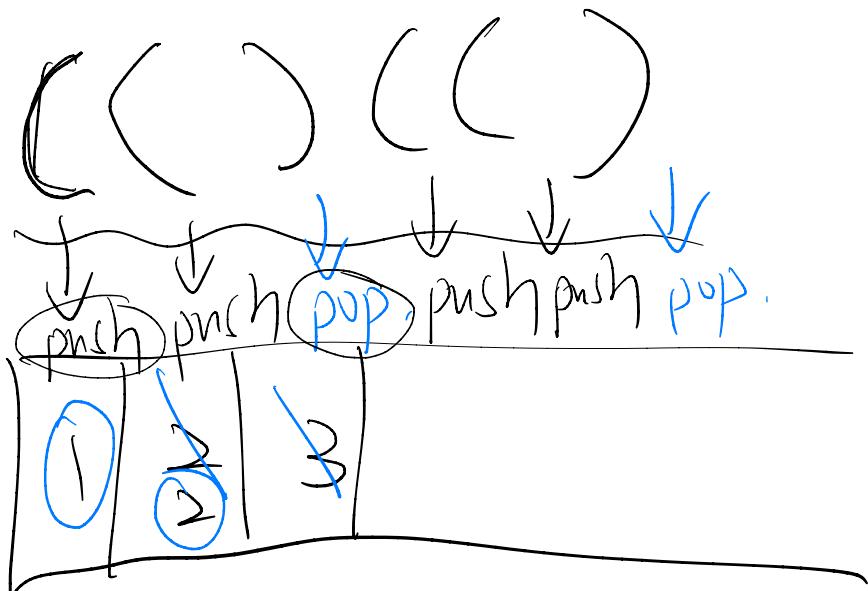


First in Last out.



Stack → pop()      push()

Stack s = new Stack();  
s.pop();      s.push();

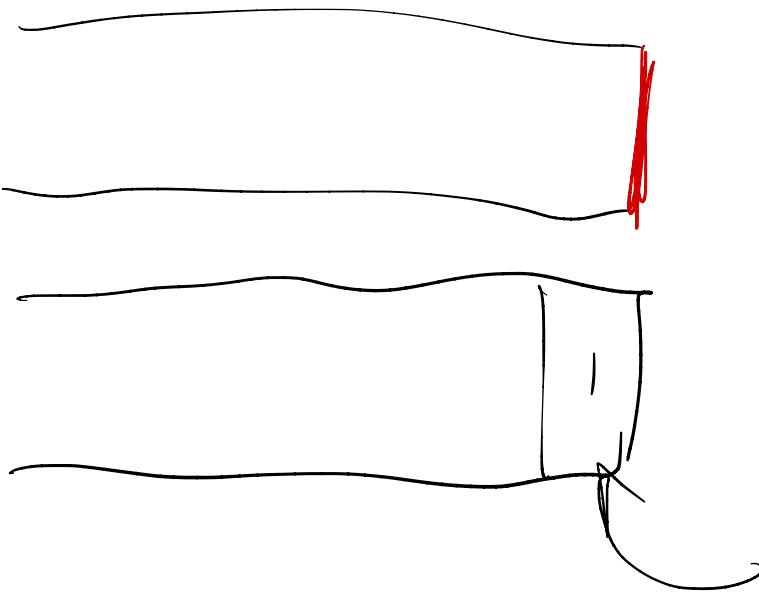


s.size()



O(n)

queue / DR

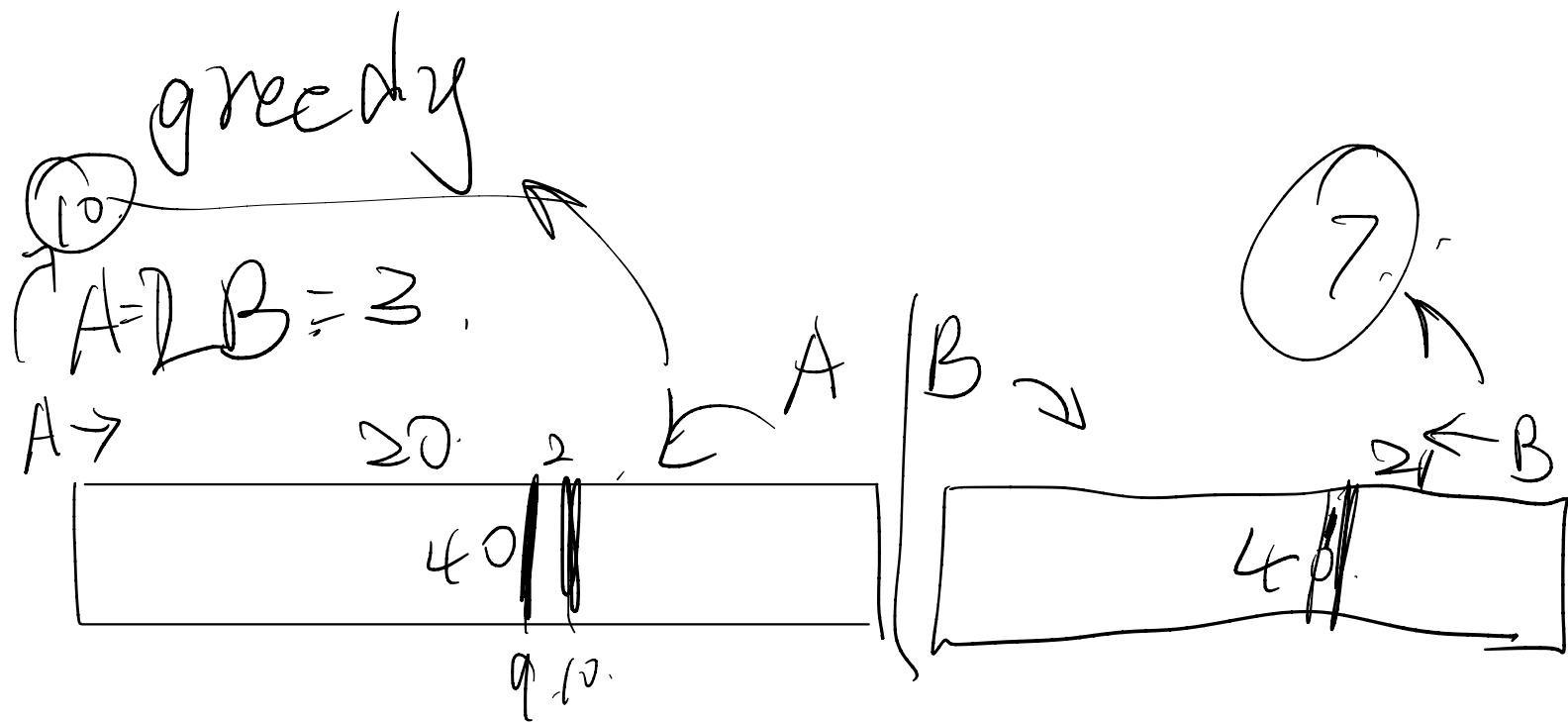


single-sided

- q.insert()  
q.delete()



Double-Ended  
queue



Map / Set → tuple

dict (key : value) → Map.

HashMap ↪ key ↪ value ↪ hm

String,  
Integer, Integer  
Character Character

= new HashMap<key, value>();

String → Integer

Dave	0
L	0
B.	0

For ↓  
⇒ L

- Dave 200 >  
L B.  
1. map.get(name)  
2. map.put(name, a)  
3. C B,

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① naive record  
max match

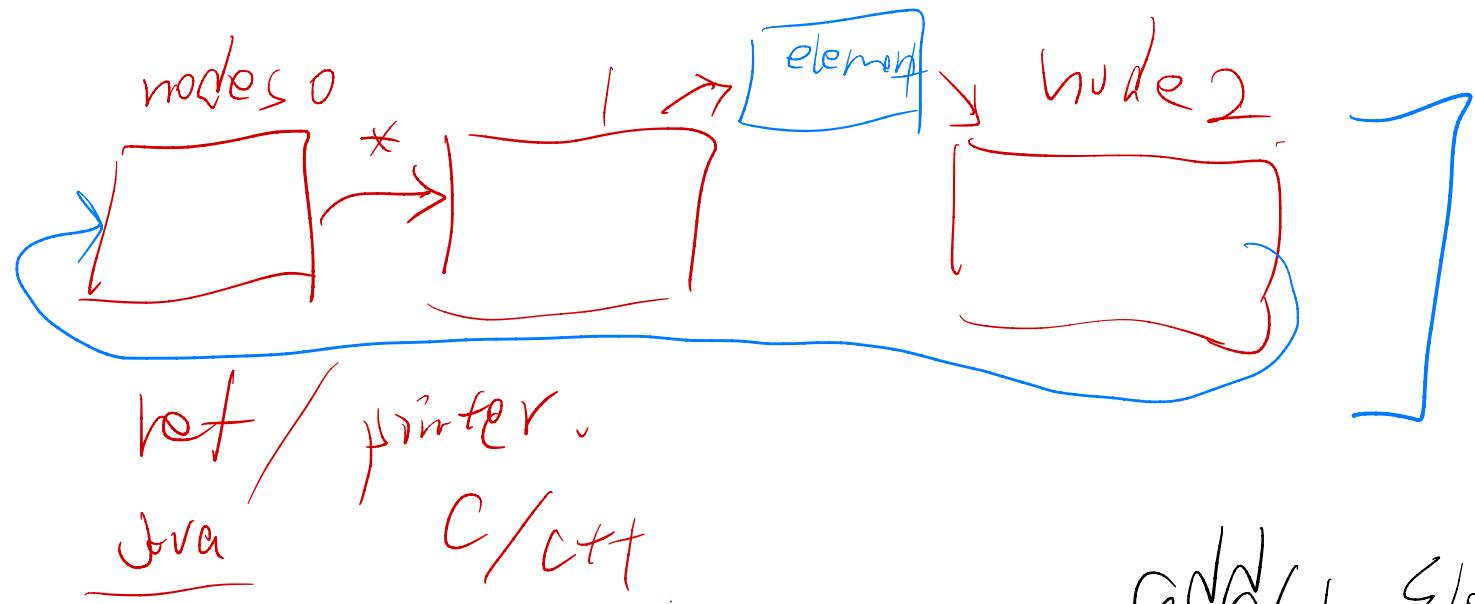
1. I/O., simple algo.  $O(n) = \underline{\text{even}}$

2. data structure.  $\rightarrow$  Map.  
① Ubiquitous  
Time  $\rightarrow$  mem.

3. array  $\leftrightarrow$  ArrayList.  
\* func. / methods.

# Array Vs. ArrayList. LinkedList.

list list = ArrayList<Integer>()



add(1, Element)

array[ ]. ① primitive,

ArrayList.

[1, 2, 3, 4]

{1, 2, 3, 4}

ArrayList

Collections

ArrayList<Integer> a1 = new ArrayList<Integer>()

< 3 , 2 , 1 >  
ascending.

Collections.sort(a1);

< 1 , 2 , 3 >

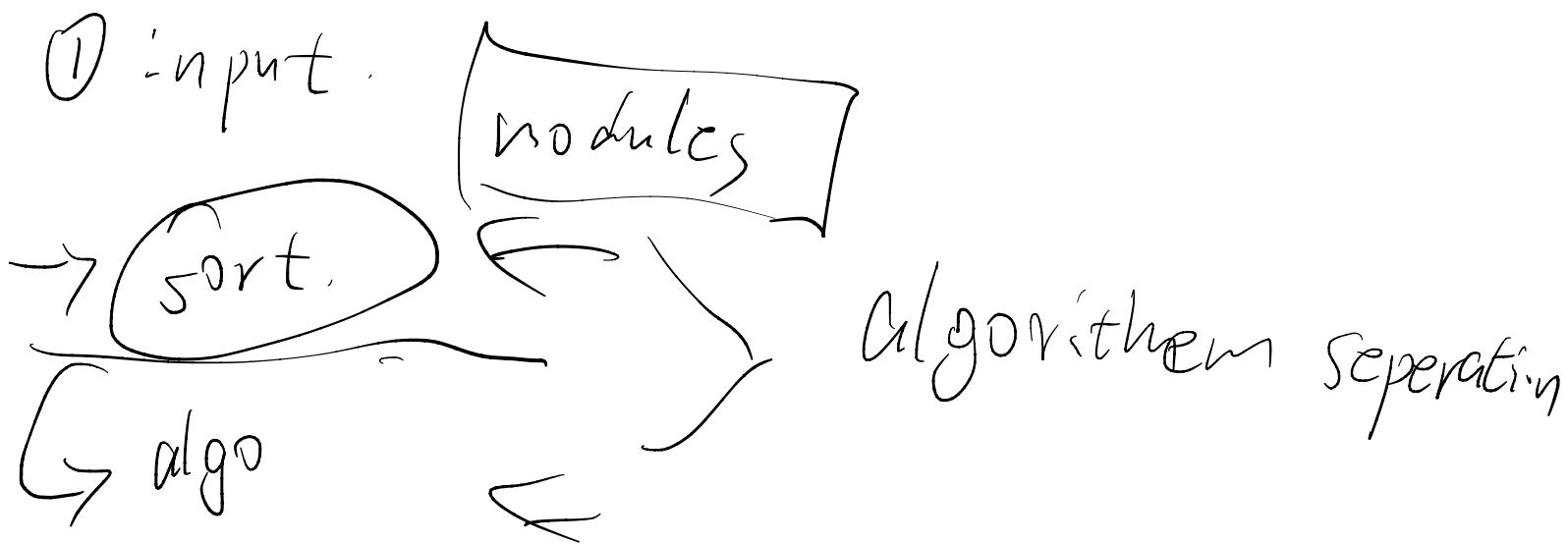
bubble sort ←  
merge sort ←

$\langle 1000, 100, 8, 9, \dots \rangle$

$10^3$ .

Collections,  $\text{sort}(\text{a1})$  ;  
↓

$O(n \log n)$ .  $A^*$



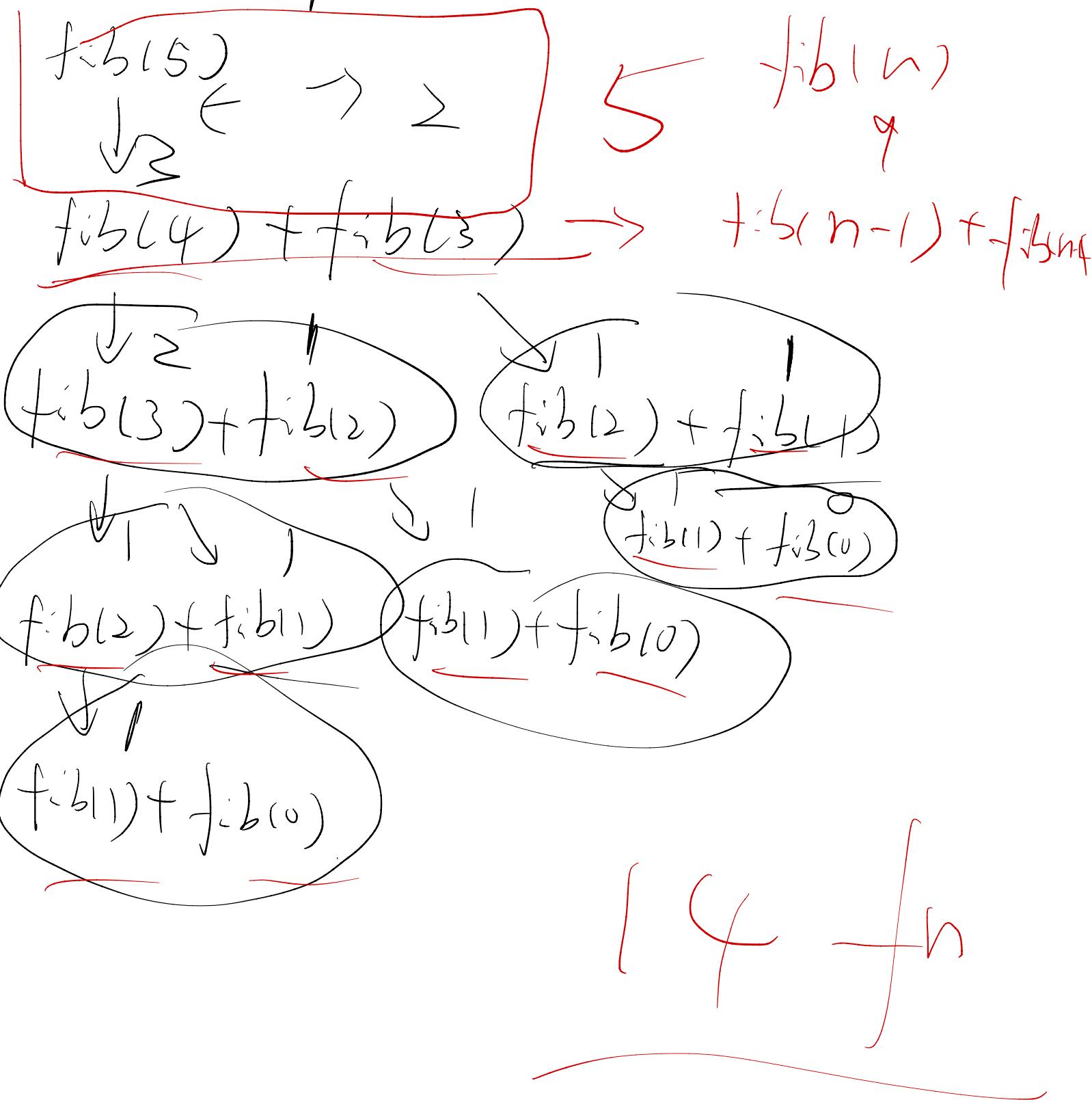
function arraylist

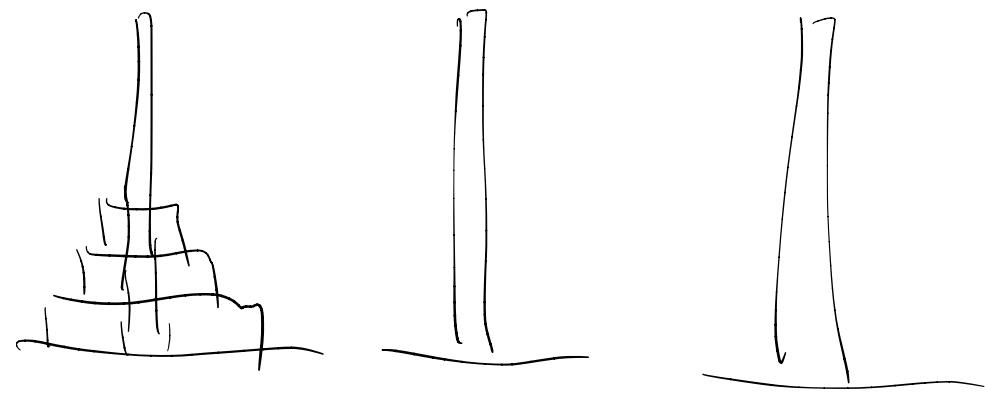
(private int func-name (int a, int b)){  
    int ans) ans 2 .  
}

}  
return ans;

# recursion

Time → Space

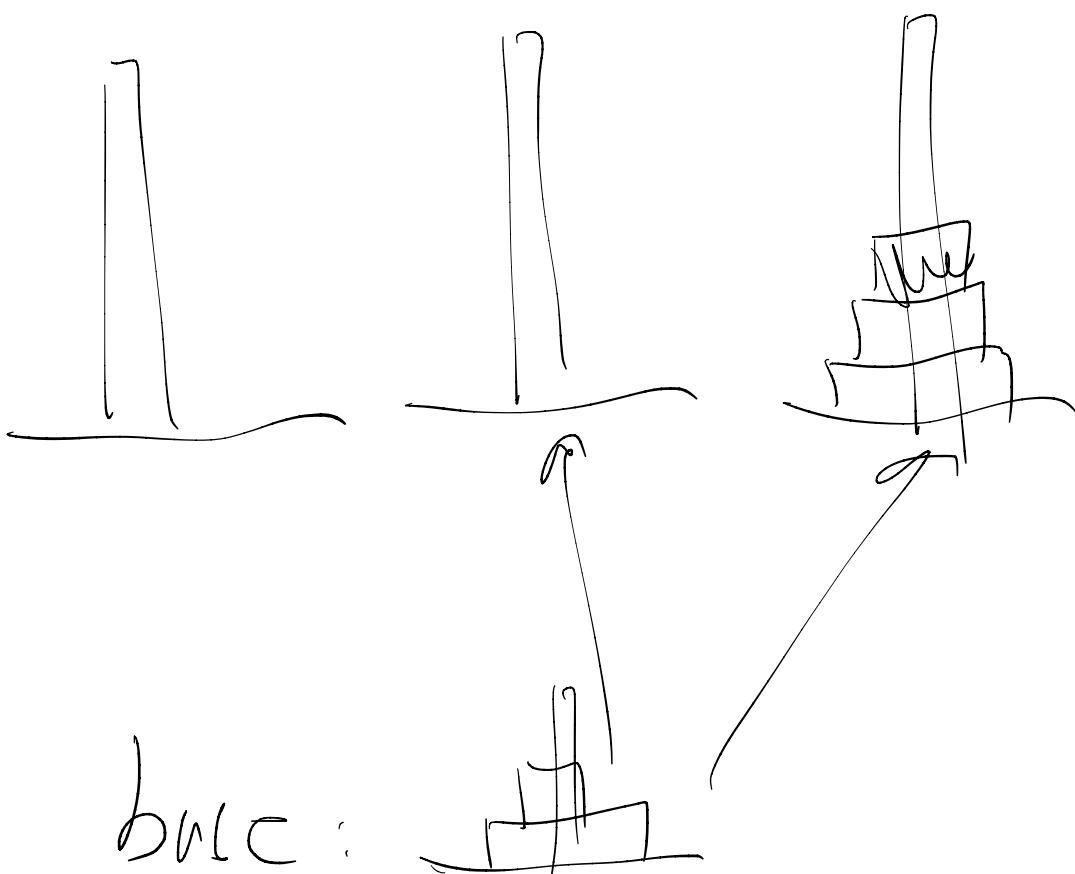




rule:



always here  
small ones on  
large ones



bwc:

$\text{rec}_f(h)$   $(n-2) \rightarrow \exists r \downarrow$   
 $(n-1) \rightarrow \exists s \downarrow$

func:

① separate.

$L \rightarrow \leq$      $G \rightarrow \geq$     less

$L \quad 3$   
 $G \quad 5$

$\times 3$      $\leftarrow$

$L \quad 5$

$2 \quad 6$

$G \quad 2$

$G-1$   
 $G_0$

$L_1$

$L_2$

$L_3$

$L_4$

$L_5$   
 $L_6$

$G_2?$

$G_3?$

$G_4$

$O$

$3$

Data Struct ?

a algo ?

ArrayList L, g

① read n,

2 → N+L; add. L or G.  
↑

② Collections. sort()

③ find out max - G  
min - L

Or if(max - G < max L)  
if(min - G < min - L)

Context

brainstorm

concepts

algo.

math / living

func

static var. ↙

Data Ptn

write

machine / program

debug

Test Cases?

\* sample ← obvious

\* Test



unit test

10.  
L 5

9 6.

{ 3

9 10.

Debug.

① Write down. ( Problem solving )

② techniques.

\* check out → System.out.println()

class test {

{ static int[] a = [0, 1, 2, 3].

st main()

{ helper1();  
helper2();

}

a[

[0, 2, 4, 3],

at void helper1() {

a[n] += 1;

}

st void helper2() {

a[n] += 2;

}

3

num

If  $(\zeta(1) = \infty)$ :



0 0 0

0 0 0 |

0 1 0

| 0 0

| 1 1  
| 0 0 |

5 2

1 2 3 4 5  
G H H G G  
1 G G G  
2 H H H H  
3 H H H H H  
4 G G G G  
5 G G G

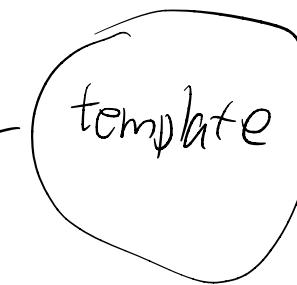
5 1

1 2 3 4 5  
G H H G G  
5 G  
1+ H H  
2 H H H  
3 G G G  
4 G G G  
5 G G G

· H H ·

Beginning - #1

I/O - Scanner



One  
two  
three  
class one

main  
Scanners

Data Structures / Basic

Stack  
queue  
DQ  
linked list  
Map.

) - ID

| C:V

Recursion ←

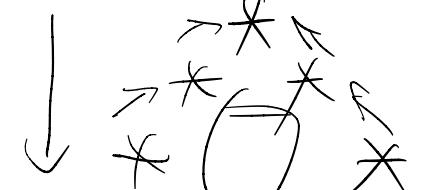
Iteration

For loops

If-else

nested - for loops

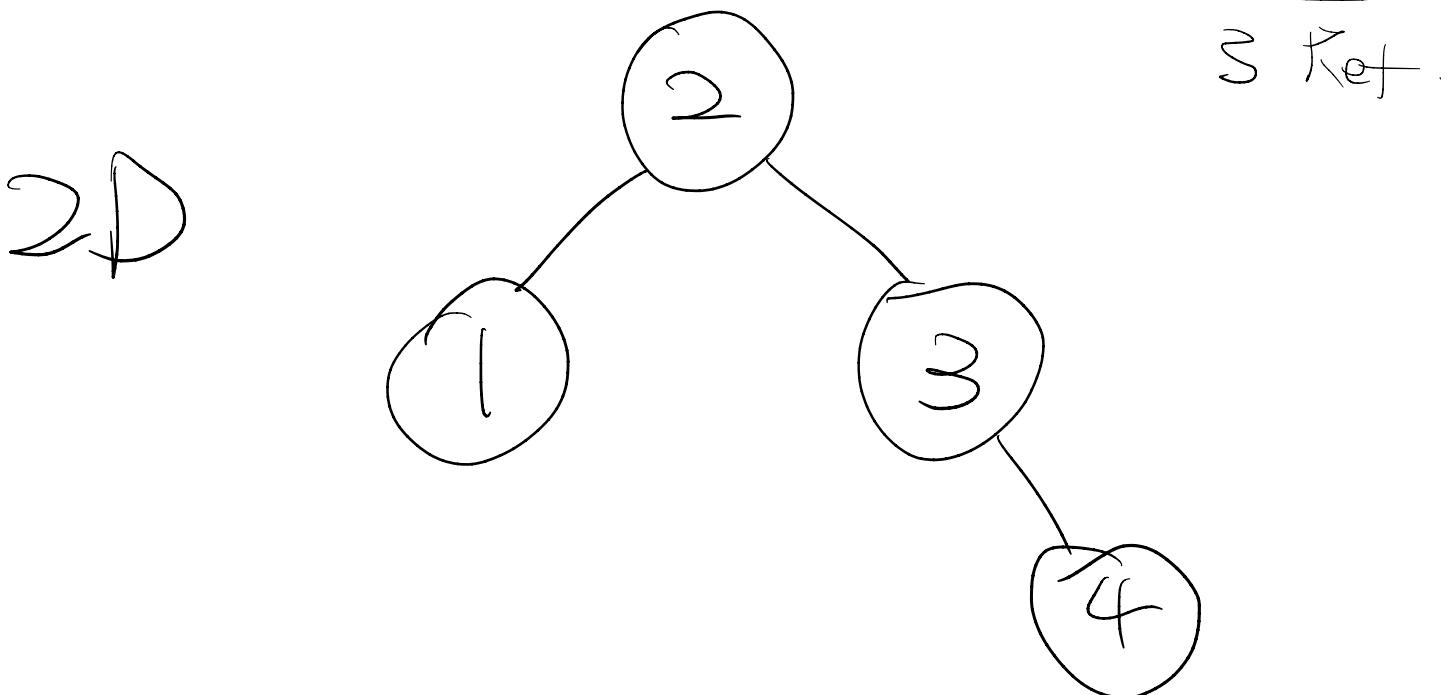
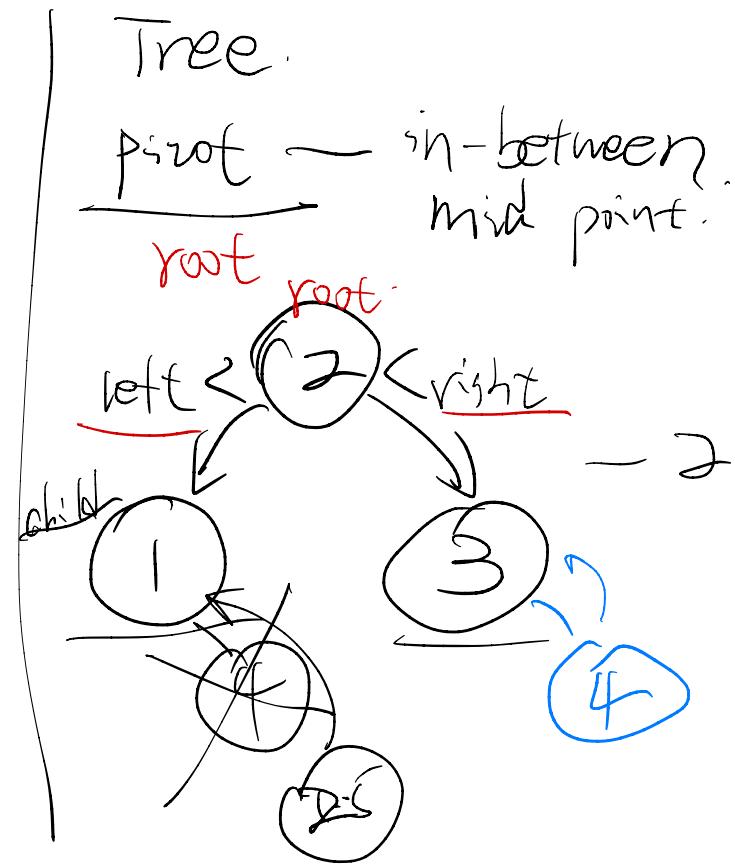
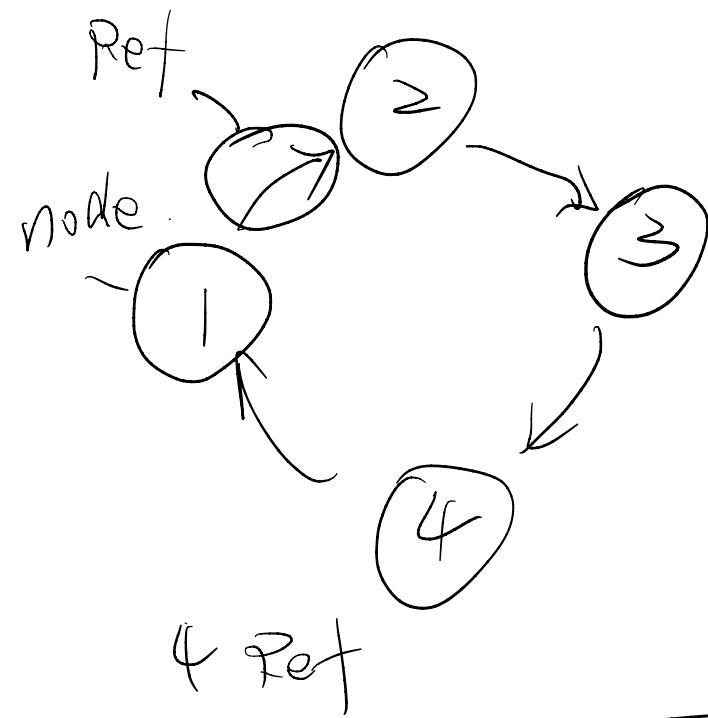
$O(n^m)$

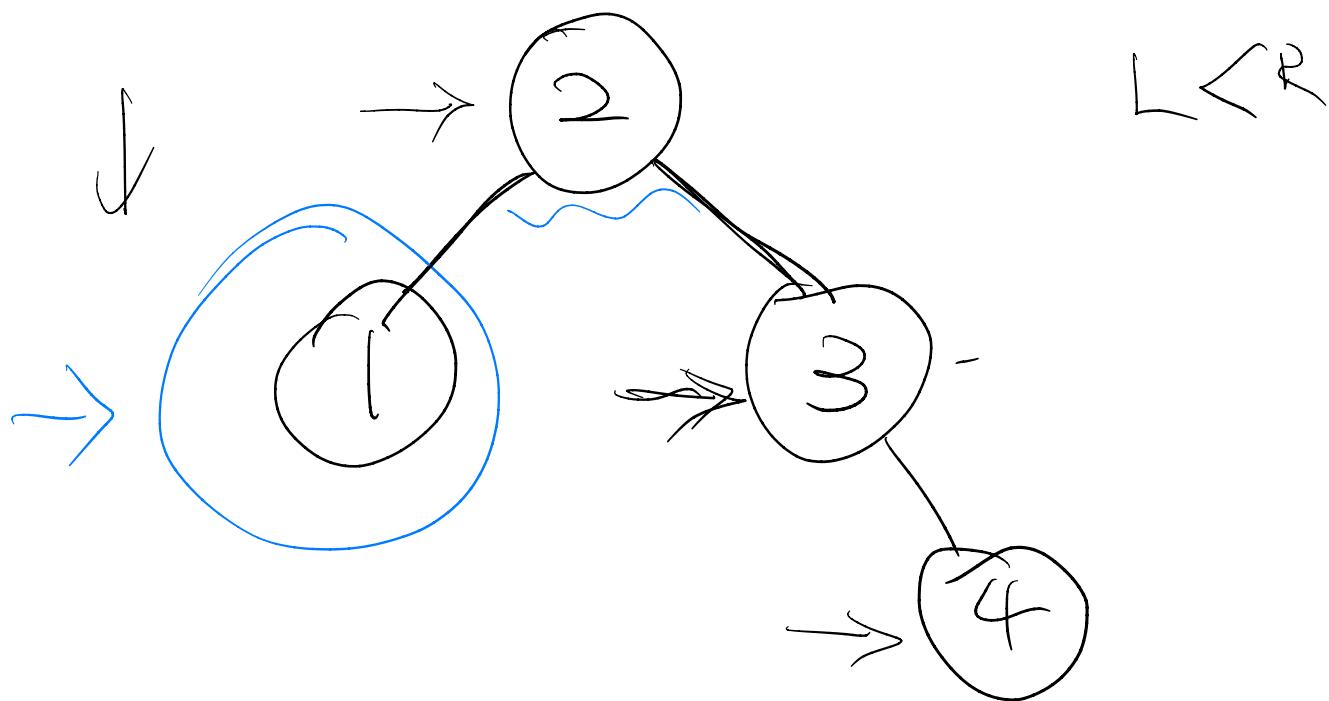


Tree - Binary Tree

○ - node.

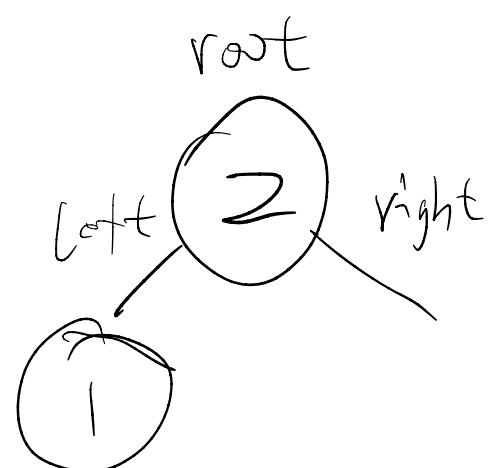
Linked List.





1. find an element.

Search — binary Search



1. addNode.

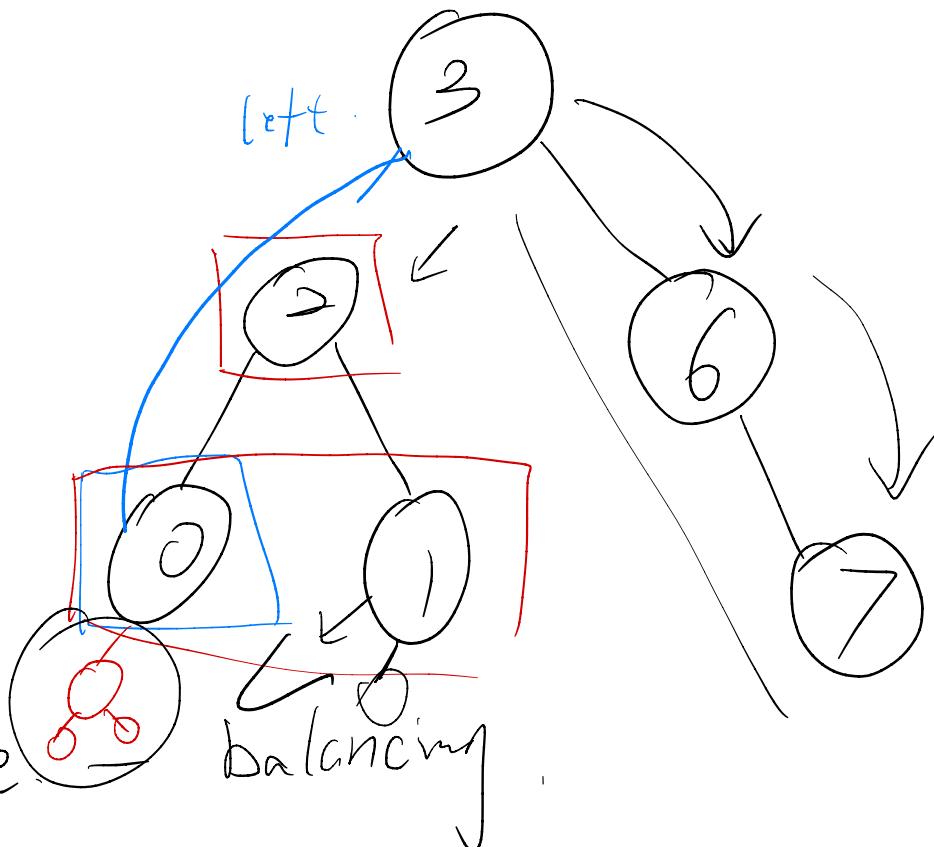
(root, 1);



2. addNode (current, 1) → 1

```
class Node {  
    int value;  
    Node left;  
    Node right;  
  
    Node(int v) {  
        this.value = v;  
        r = null; L = null;  
    }  
}
```

```
class Binary Tree {  
    Node root;  
}
```



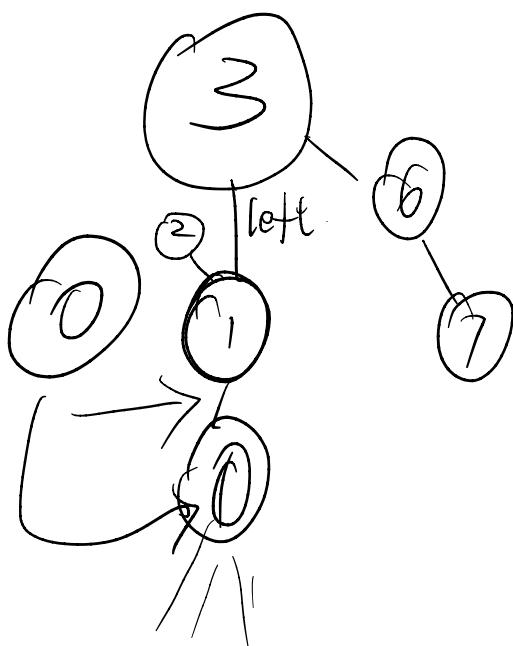
1. delete

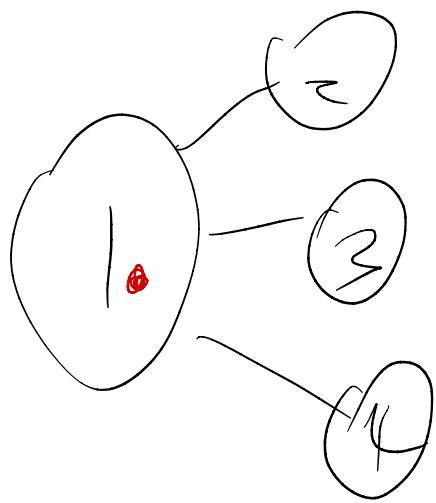
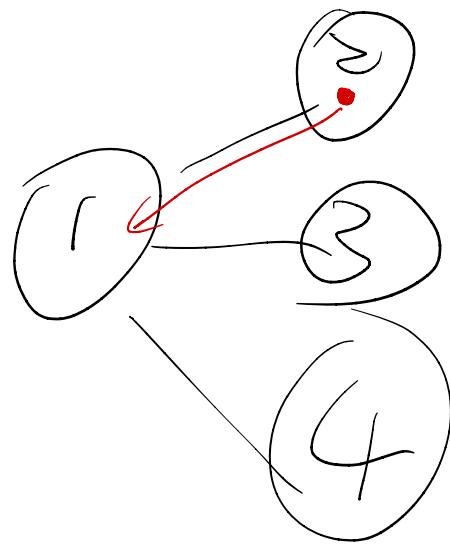
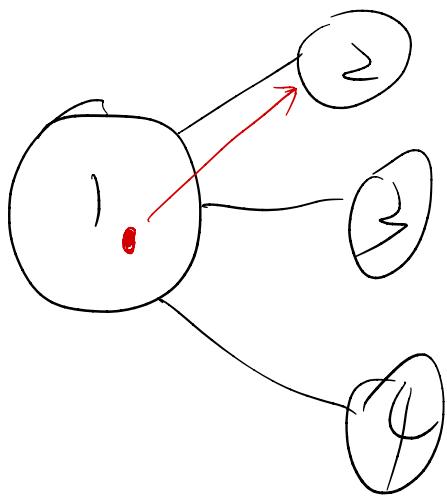
balancing

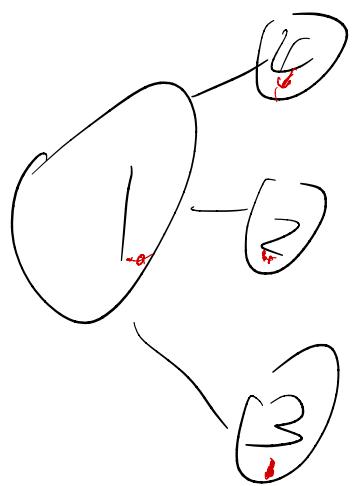
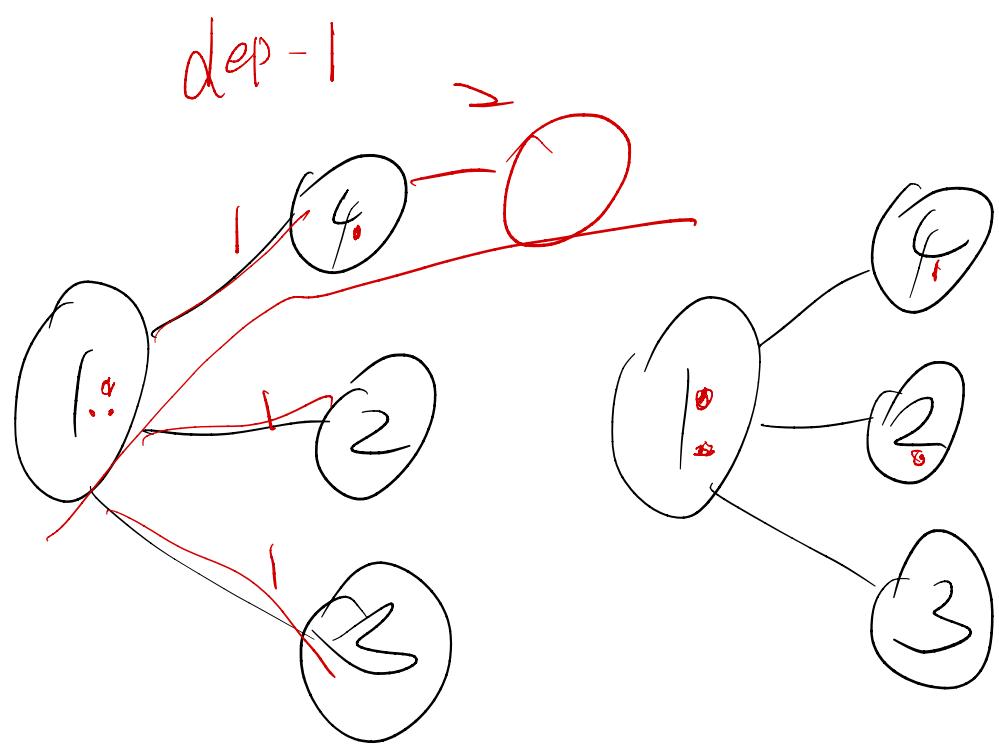
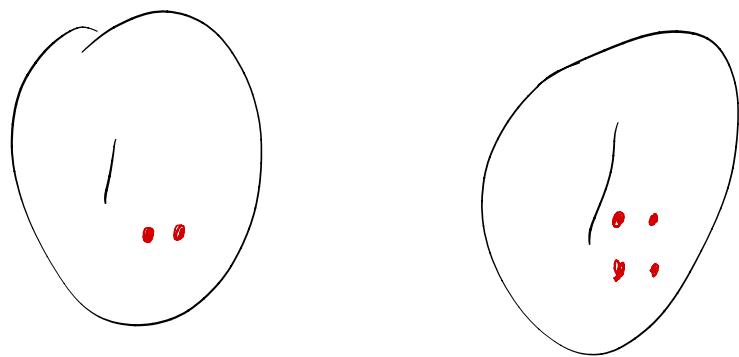
2. 1) unlink , upper

⇒ left most / right most

3. balancing ✓





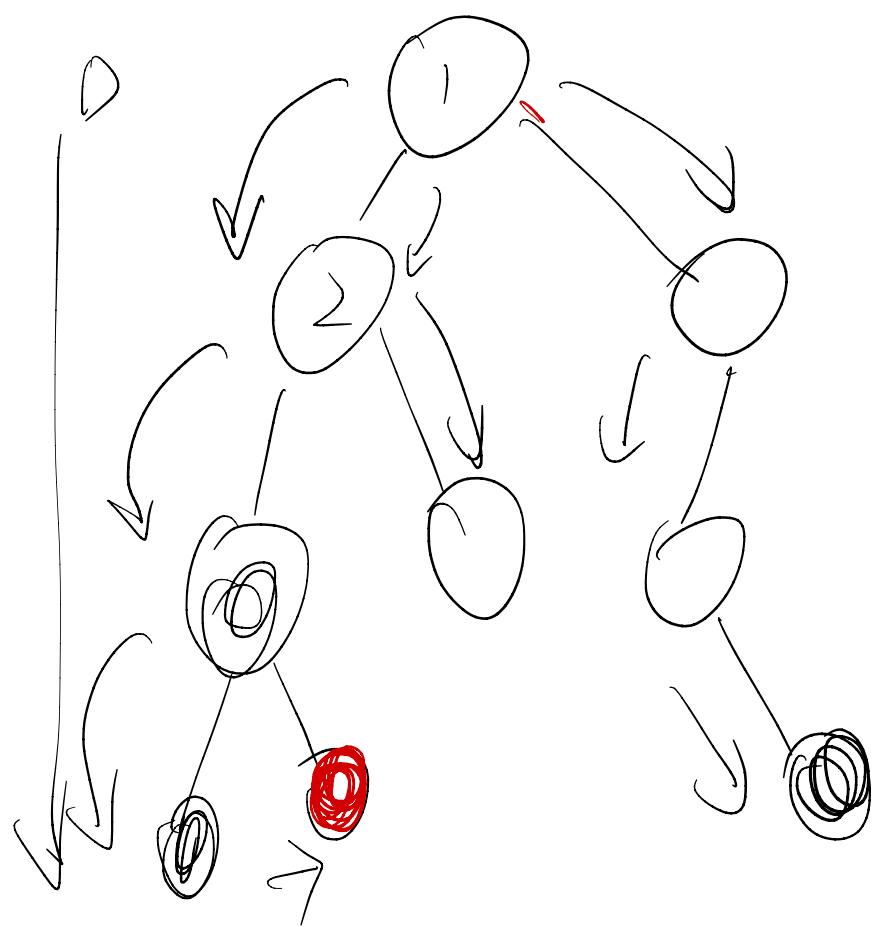


6

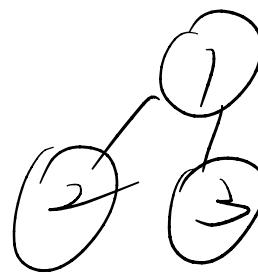
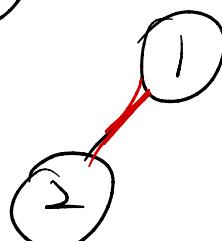
# DFS

## Depth First Search

graph node



T 0 5



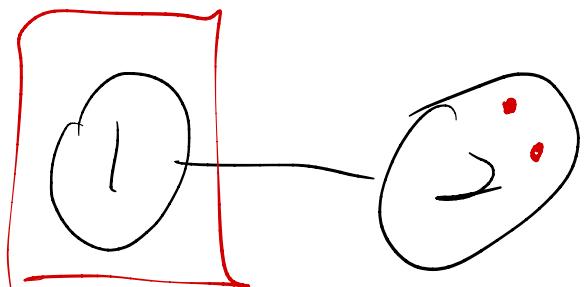
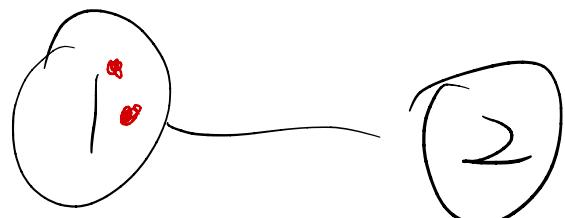
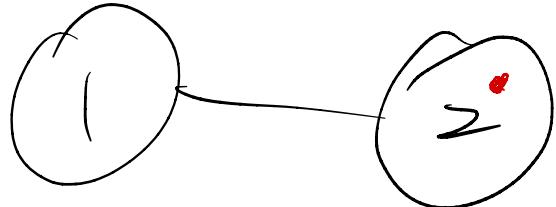
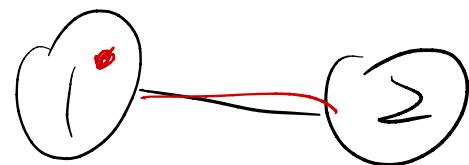
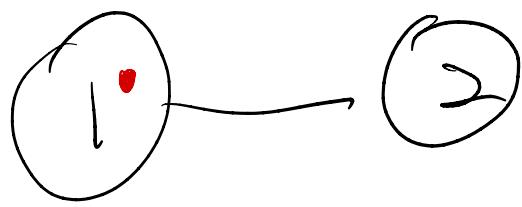
T 0 3 → 4 - 3

$$1 \times 2 \times 2$$

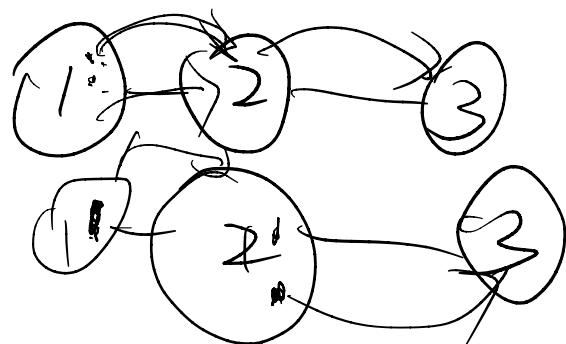
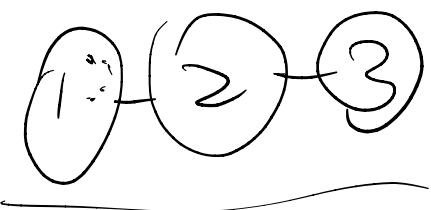
$$1 + 1 = 2$$

$$3 + 2 = 5$$



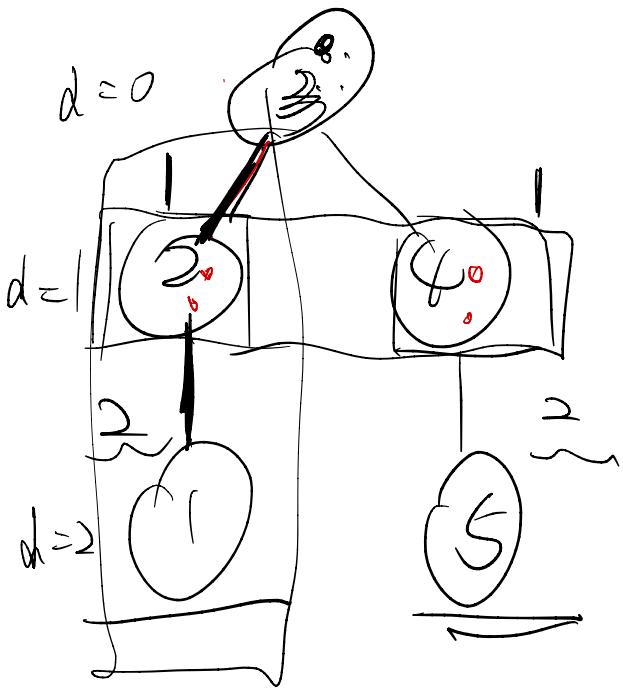


3

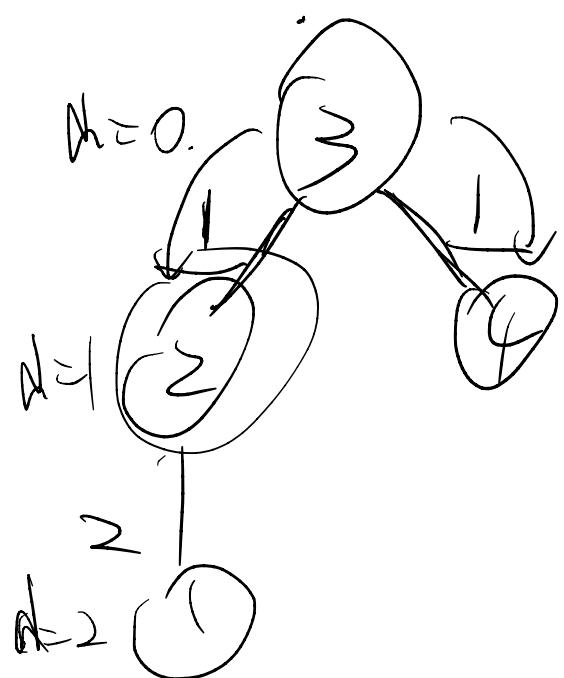


$$\underbrace{2 + 1 + 1 + 1}_{= 4}$$

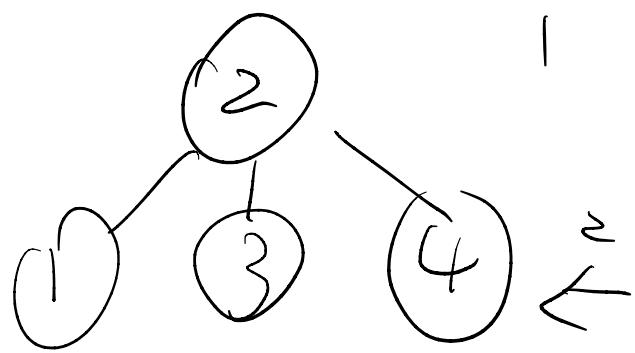
$$1 + 1 + 1 + 1 = 4$$



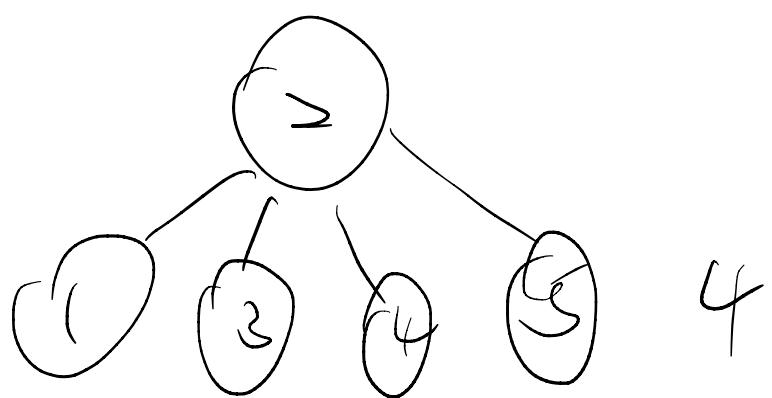
$$\begin{array}{r}
 \text{child} \\
 \text{Steps. } 1 + 2 + 1 + 2 \\
 4 + 4 \\
 8
 \end{array}$$

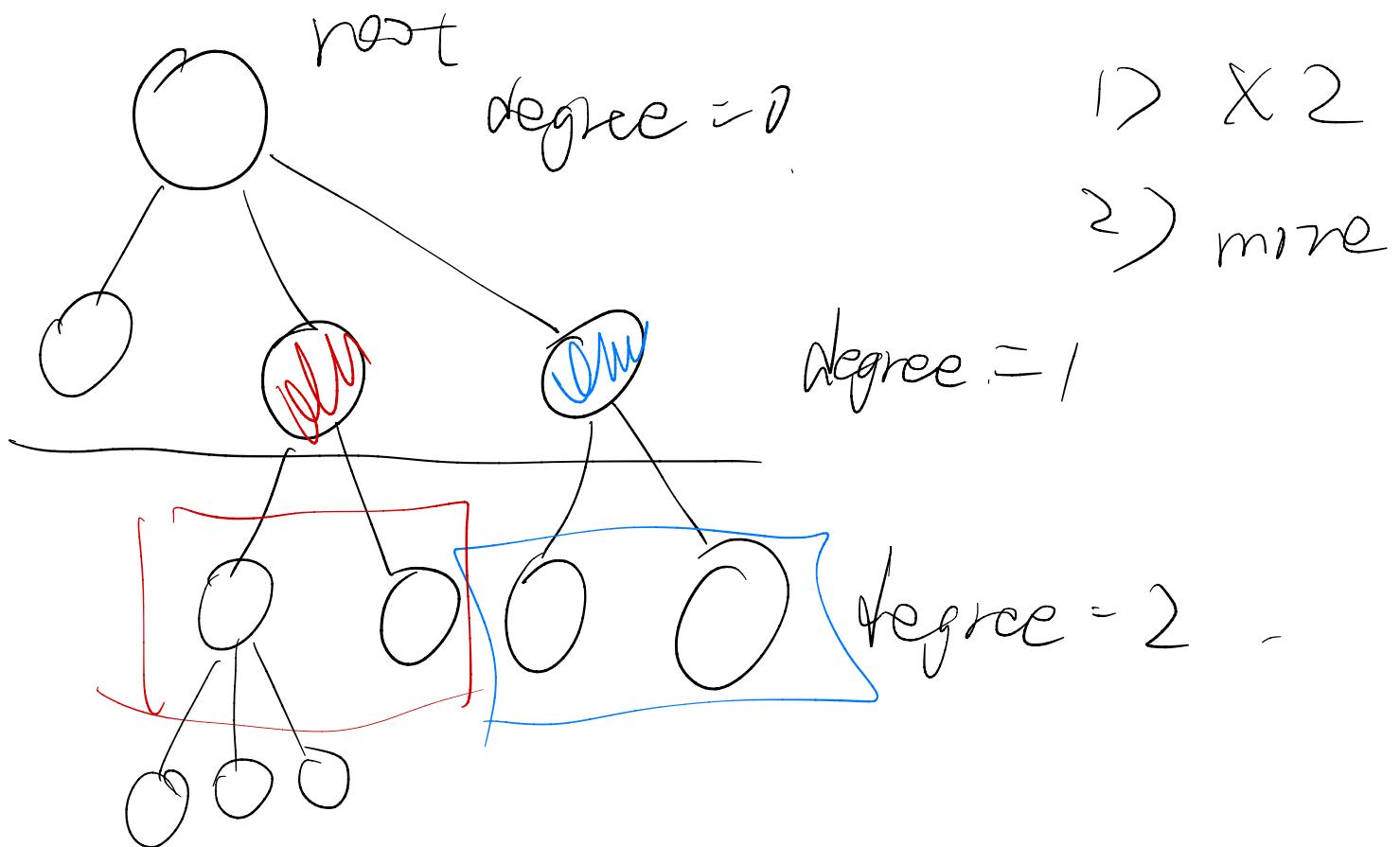


$$\begin{array}{r}
 \text{child} \\
 \text{Steps. } 1 + 2 \\
 4 + 2 \\
 6
 \end{array}$$



3 + 2 .

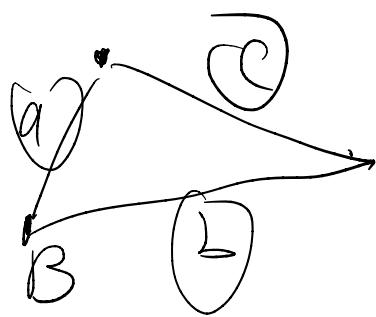




① child = 3.       $2 + 3$

② (rec)      child = 2       $2 + 2$ .  
 child = 2       $2 + 2$ .

A



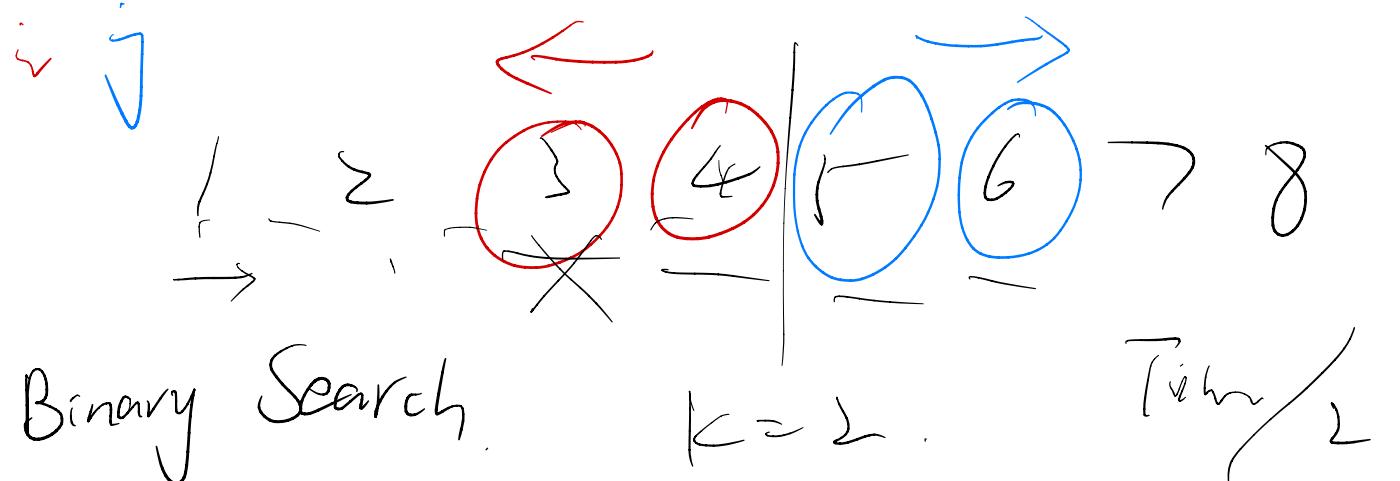
3 N

$x_3$	321	-15	-525
$y_3$	404	373	990

$$d = \sqrt{dx^2 + dy^2}$$

$$a \quad c \quad b = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$$

N points search.



count = 3

For (i ---)  
For (j ---)



while (i > 0 & j < 8)

(① i--;  
② j++;

)

4  
1 0 0 2 3

[1, 2] ✓  
[1, 3]  
[1, 4]

4  
+ /  
j j

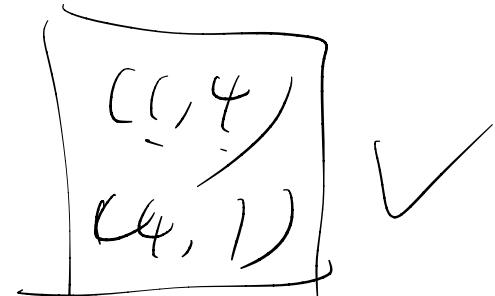
[2, 3] ✓

[2, 4] ✓ + /

[3, 4] / /

for (int i = 0; i < len; i++)  
{  
 for (int j = i + 1; j < len; j++)  
 {  
 if (sum / num\_of\_ele == avg)  
 if (contains(

K      N  
 3      4  
 ArrayList  
 4      1      2      3      -int[ ]<sup>K</sup>  
 4      1      3      2      int[ ]  
 4      2      1      3      int[ ]  
 =  
 for (int k=0; k < ArrayList.length; k++)  
 ① ArrayList.get(k) → int arrg at k



② int[ ] → i  
 j  
 if i always b4 j - ✓  
 or if j always b4 i - ✓

cont +  
 )

for(i: 0 → ()

for(j: i+1 → ()

(i, j)

412  
s  
Array

// Tuple / pairs → <Integ, Integer>  
// for each (i, j)      [i] [j]  
tests its consistency

[i] [j]  
<Integ, >

)

test (i, j)

((1, 2) → false  
                        → true  
)

$a[i]$

$a[j]$ .

+1

1	2	3	4	5	6	7	8
A	A	T	C	C	C	A	T
G	A	T	T	G	C	A	A
G	G	T	C	G	C	A	A
A	C	T	C	C	C	A	G
A	C	T	C	G	C	A	T
A	C	T	T	C	C	A	T

Count = 1

# Sorting

- calculate best time for exe/schedule
- arrangement / combination,  
(position) (a, b)

bubble sort.

$$5 \quad 1 \quad 3 \quad 2 \quad 4 \rightarrow 1 \quad 2 \quad 3 \quad 4 \quad 5$$

$i > j$ .

$$\begin{array}{c} 5 \quad 1 \quad 3 \quad 2 \quad 4 \\ \hline 1 \quad 5 \quad 3 \quad 2 \quad 4 \end{array} \quad \left. \begin{array}{c} 1 \quad 3 \quad 2 \quad 4 \quad 5 \\ 1 \quad 2 \quad 3 \quad 4 \quad 5 \end{array} \right\}$$

$$\begin{array}{c} 1 \quad 3 \quad 5 \quad 2 \quad 4 \\ \hline \end{array}$$

$$\begin{array}{c} 1 \quad 3 \quad 2 \quad 5 \quad 4 \\ \hline 1 \quad 3 \quad 2 \quad 4 \quad 5 \end{array}$$

Merge Sort.

5 1 3 2 4

5 1 3 = a

2 4 = b

$$c = \begin{bmatrix} (2 5) \\ \hline (1 4) \\ \hline (3 . ) \end{bmatrix}$$

$$= \begin{bmatrix} (1 2 5) \\ (4) \\ (3) \end{bmatrix}$$

$$\begin{aligned} &= \begin{bmatrix} 1 2 4 5 \\ 3 \end{bmatrix} \\ &= \begin{bmatrix} 1 2 3 4 5 \end{bmatrix} \end{aligned}$$

3

Time arr

Time req

2

)

1

—

8

{3}

1

—

5

7

—

I/O

$$\left[ \begin{array}{l} (C_2, 1), \\ (S_1, 7), \\ (C_3, 3) \end{array} \right]$$

finish-T

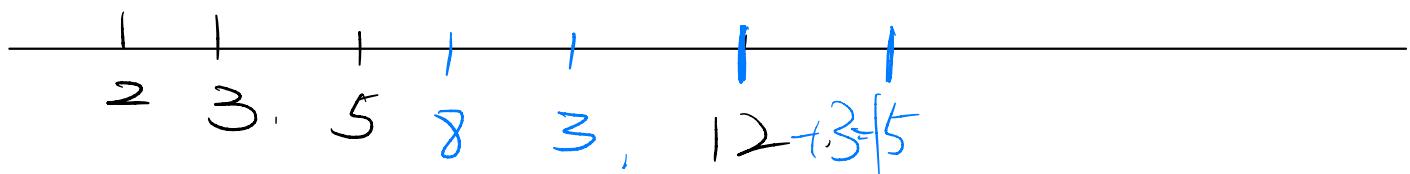
k+V

k+V &lt; next-T

countf = next-K

+ next/V

for (int o → len).



①  $\text{finish\_T} = \text{this\_arrival\_T} + \text{this\_req\_T}$

$\text{finish\_T} \leq \text{next\_arrival\_T}$

→ ①,

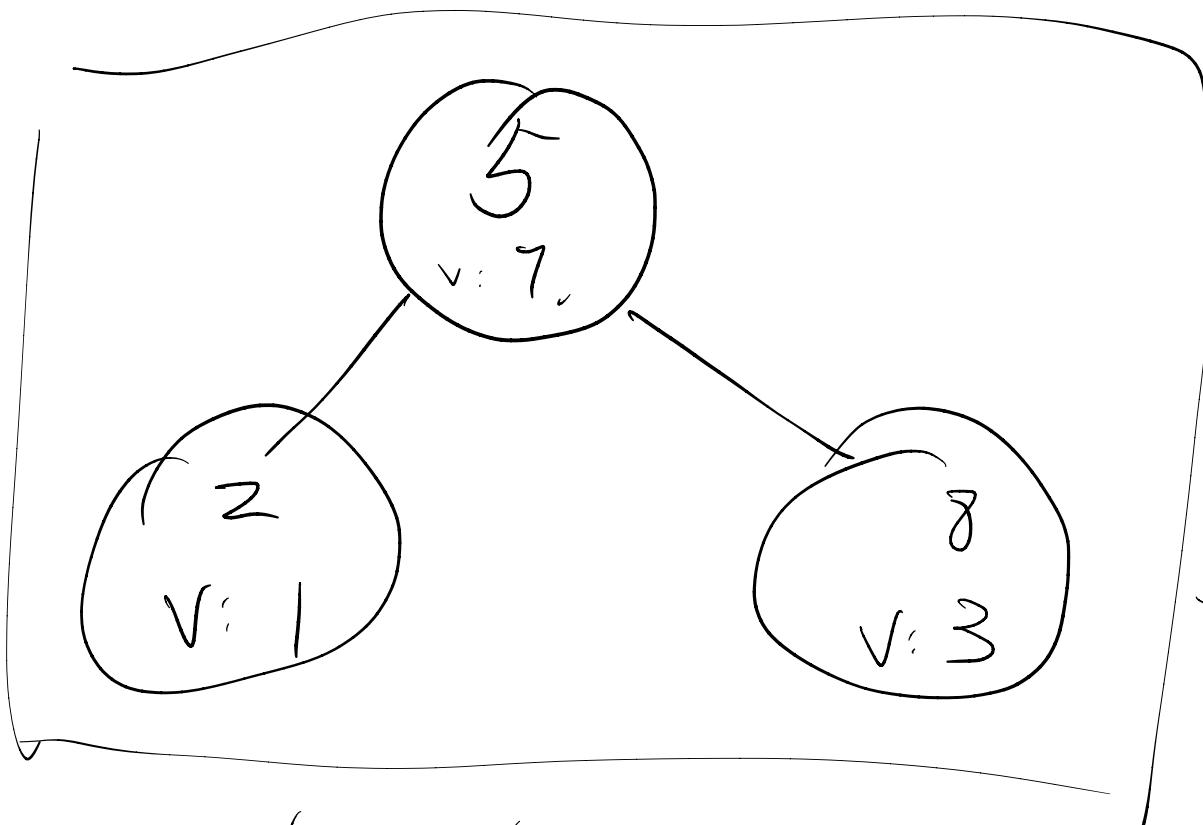
$\text{t\_T} > \text{next\_arr\_T} \rightarrow \text{next\_arrival\_T} = \text{t\_T}$ .

③ return  $t\_T$ .

$\left\{ \begin{array}{l} (2, 1), \\ (8, 3), \\ (5, 7), \end{array} \right\}$  Map  $\underline{\text{map}} = \text{HashMap}\langle \text{?, ?} \rangle$   
↓ ,

$\text{TreeMap} \quad t_{\text{map}} = \text{new } \text{TM}\langle \text{?, ?} \rangle$

( $\text{map}$ ) ;



[2, 1]  
[5, 7]  
[8, 3]

$\text{map}[\text{t}. \text{get}(0)]$

