library

→ Next permutation
→ Monster

→ Agenda
→ Library function for applying binary search
→ Some question that we can solve using binary search.

→ binary_search (start, end, element)

bool

start end

element is not present it return false.

→ lower_bound (start, end, element)

20

2 5 7 10 15 20 25

v.end

If element is present it simply gives you the pointer or an iterator for that element.

21

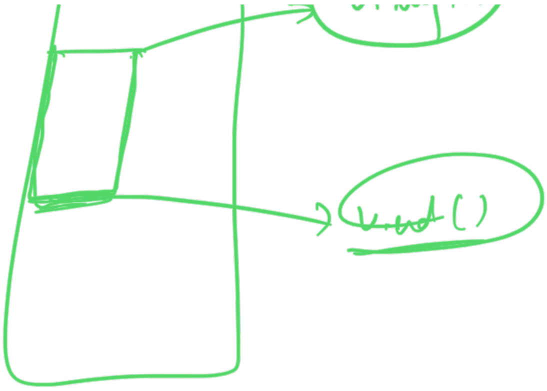
n

it − v.begin()

V. begin()

V.end()

v.begin



0

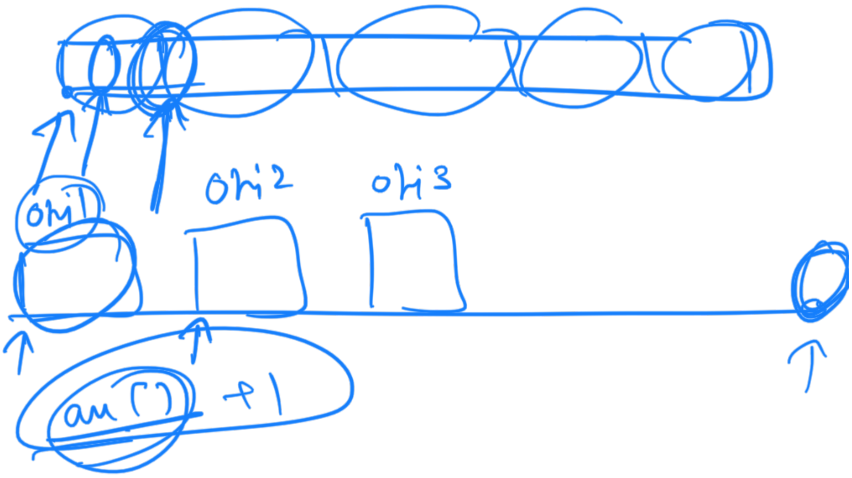
n-1 0

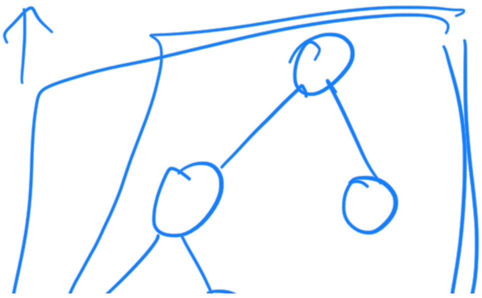
arr , arr + 1 , arr + 2

it - v.begin() = index

int* ptr = new arr[10]

+1





has Next()

int arr[] []

arr[0][0] +

arr + 1

8

10

2 3 7 10 15 120

upper bound (start, end, element) iterator

2 3 7 10 15 120

101

v.end

10 → 15

11 → 15

binary-search, lower and upper

→ 2 3 7 11 11 12 13 17 2

9 →

3 10

2

m

7 11

7, 11

3

2 3 7 11 11 11 13 14

q → l r ∵ l ≤ elmt ≤ r

i+1

6, 14

All than elements

6 15

8

lower bound

l, r

i+2 − i+1

lower

upper

7, 14

i+2 − i+1 +1 −1

1 3

3 − 1 + 1

i+2 − i+1

r − l + 1

upper, lower

→ Array is not sorted.

2 1 7 100 3 27 16

i, j, k

a[i], a[j], a[k]

$a[i] \le a[j] \le a[k]$

$i < j < k$

valid triplet

2 1 7 100 3 27 16

1 4 5

i j k

$5 > 4 > 1$ ✓

$27 > 3 > 1$ ✓

Count of all the valid triplets

i, j, k → $O(n^3)$

2 1 7 100 3 27 16

12 13 14 15

2 3 7

100

3 27 16 200 20

3 x 2

i

2

100

orig

1 3 7 100 [28] 167

original

7 16 100 200 201

duplicate Array

-1

n^3

$n^2 \log n$

10^7

$n^2 \log n$

$n \times n \log n = n^2 \log n$

pre processing

1 2 7 1 3 7 10 7 1 10 7

1

2

3 →

7, 8, 9, 10

7 →

0 →

1

10

1 2 7 1 3 7 10 7

Prefix

1	1	4
2	1	
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	
9	0	
10	0	

Suffix

1	1
2	0
3	1
4	0
5	0
6	0
7	1
8	0
9	0
10	1

5

O(n)

≤ 10

First

arr 1 120 7000 10,000 320

0 1 4 5 2

Second

0 n-1

Duplicate array

temp arr

Sort the duplicate Array

2 3 3 3 4 4 4 4 5 5 5

0 1 1 1

4 4 4 4

1w

O

1w

n log n

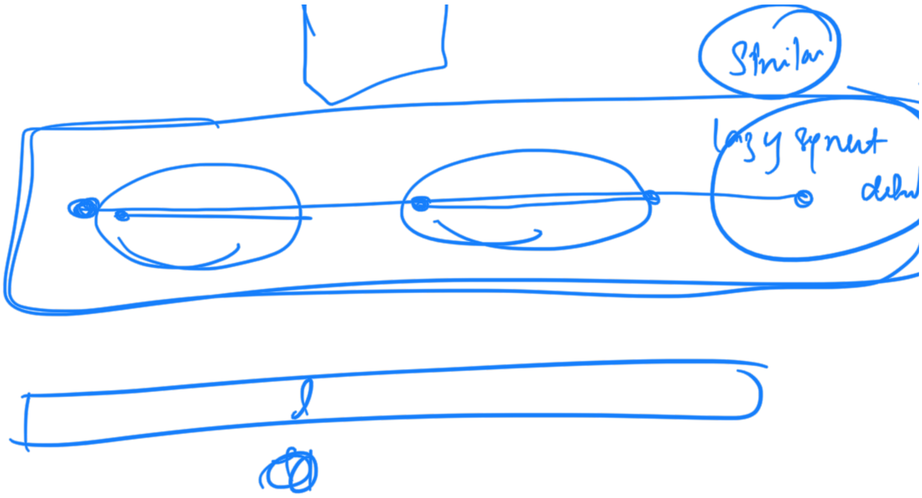
101

n-1

O(n)

~~nlogn~~ + O(n^2) = O(n^2)

O



l_1 r_1
l_2 r_2
l_3 r_3

l r

$l + r$
l r
lazy seg
l r
$\log n$
$n \log n$

~~7~~ ~~2~~ ~~1~~ 16 1 20 1 0 0 0 0 1 1 2 3 1

3

Candies

Market

n	red candies	1	7
n	blue candies	3	12
n	green candies		

11

3 Candies Red Blue Green

$x \to r$
$y \to b$
$z \to g$

$$\text{Min}\left((x-y)^2 + (y-z)^2 + (z-x)^2\right) \quad \text{Min}$$

Market

Red Candies $\to n$
Blue Can $\to n$
Green Candies $\to n$

3

Red 1	Red 2	Red 3	Blue 1	Blue 2	Blue 3
2	3	1	7	2	3

Green 1	Green 2	Green 3
4	1	6

1 Red, 1 Blue 1 Green

$x \quad y \quad z$

$$\text{Min}\left((x-y)^2 + (y-z)^2 + (z-x)^2\right) \quad 0$$

x, y, z

$x \to 1 \quad 2 \quad 3$: $1 \quad 10$ (low) $(x-y)^2$

$y \to 3 \quad 8 \quad 7$: 5

9

1 4 11 15

2 8

This should also be done so much apart

10 → 9

9 10 10

9, 10, 11

9, 10, 10

5

11, 13, 13

1 10 12 13 15

11, 12, 13

9 13 15 5

11, 12, 13

11 → 12 12.5

11 → 12.5

11, 12.5, 13

$(1)^2 \quad (1)^2 \quad 2$

$(1.5)^2 + (1.5)^2 + (0.5)^2 \quad (1.5)^2 \quad (0.5)^2$

2^2

$(1)^2 + (1.5)^2 + (0.5)^2$

11 15, 15

11, 12, 15

$(4)^2 + (4)^2$

$4^2 + (1)^2 + 3^2$

11 1

32

34

12 15

11, 15, 15

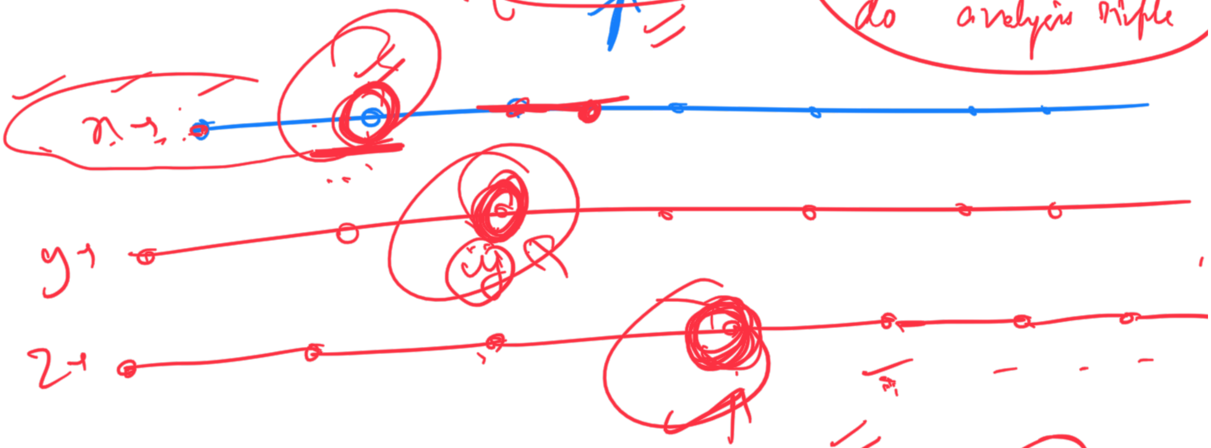
11

15

$\boxed{x \le y \le z}$

$\boxed{x \le y \le z}$

No use of difficulty order in order do analysis triple



Ans

$x \le z \le y$

$z \le x \le y$

4

$\boxed{n, K}$

3

1 2 4 5 7 8 10 11

They are not di...

5 ans

$n \le 10^{18}$

$k \le 10^{18}$