

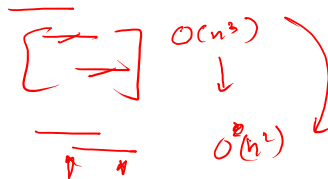
Four Sum

{
2
Ls

→ 2 four

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

$$O(n^4) \rightarrow O(n^2)$$



$[-7 \ -5 \ -5 \ -2 \ 0 \ 1 \ 3 \ 3 \ 4 \ 5 \ 5 \ 5 \ 6 \ 7 \ 8 \ 8 \ 8]$ target = 12
 $i \ j \ j \ j$

$-7 \ -5$
 $\underline{\quad} \ \underline{\quad}$
 9

$$12 - (-7) - (-5)$$

$1 \ 7$
 $2 \ 6$

24

see

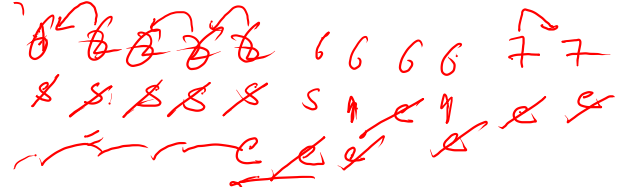
target = 8

4 sum

1 2 3 4

12

1


 6 6 6 6 7 7 target = 8.

1 2
 2 1

```

while(s < e) {
    int sum = arr[s] + arr[e];
    if(sum == rt) {
        System.out.println(arr[s] + " " + arr[e] + " " + arr[s] + " " + arr[e]);
        s ++;
        e --;
        while(s < e && arr[s] == arr[s - 1]) s++;
        while(s < e && arr[e] == arr[e + 1]) e--;
    }
    else if(sum < rt) s ++;
    else e --;
}
  
```

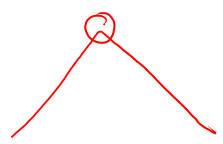
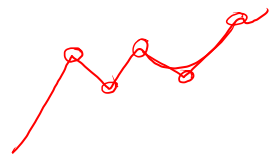
11

\downarrow \downarrow \downarrow \downarrow \downarrow
 1 2 8 4 10

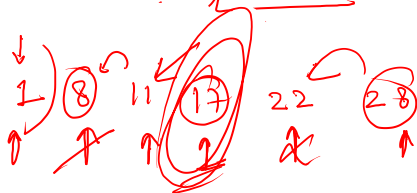
[1 3 11 15 25]
 \uparrow \uparrow \uparrow \uparrow \uparrow

$\left\{ \begin{array}{l} 1 = 1 \\ 9 = 3 \end{array} \right\}$

$\underline{\underline{=}}$



1 7 3 6 5 6



11 = 11

0
27

26

28-28

3

28-1

28-17

27

11

0

11

28-11

17

(1 7) 3 6) 5 6

3

Sum = 28

17

↓ ↓ ↓ ↘ ↘ ↓
1 8 11 17 22 28

Sum = 0 8 11 }
Sum = 27 20 17 11 }
28+28

1 1 1
= 7 7 3 { 7 7 7
6 6 6
5 5
6

28-1

28-8

Sum - prefix[i] =

6

1 2 3 4 \rightarrow

$K=2$

$K \leq n+K$
L

(3)

$J + (-2)$

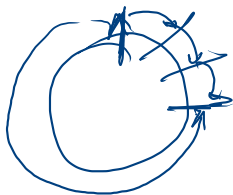
$\begin{cases} 3 & 4 & 5 & 1 & 2 \\ 4 & 5 & 1 & 2 \end{cases}$

~~$K=2$~~

$K < n$

$K=3$

$5-2 = (3)$



\rightarrow
3

\leftarrow
2

$$12(345)$$

$$K = 42 \underline{3}$$

$$n \overline{) 1000} = 345$$

$$n \overline{) 1000} = 12$$

$$\begin{array}{r}
 \text{1000} \overline{) 12345} \\
 \underline{1000} \quad \downarrow \\
 2345 \\
 \underline{2000} \\
 \hline
 345
 \end{array}$$

3^{100}

$$345 \times 100 + 12$$

$$\begin{array}{r}
 34500 \\
 12
 \end{array}$$

$$34512$$

Steps

$$2863147 \quad \text{num} = 3147286 \quad K=4$$

- ✓ 1. Find no of digits $(-n) \rightarrow (n+K)$
- ✓ 2. Find divisor
- ✓ 3. Front part $\rightarrow \text{num} / \text{div}$
- ✓ 4. Back part $\rightarrow \text{num} \% \text{div}$
- ✓ 5. Combine them $\rightarrow \text{multiph} \rightarrow 10^K$

$$\text{divisor} = 10^{n-K} = 10^3 = 1000$$

$$10^K = 10000$$

$$\text{FP } 3147286 / 1000 = 3147$$

$$\text{BP} - 3147286 \% 1000 = \boxed{286}$$

$$\begin{array}{r} 2860000 \\ 3147 \\ \hline 2863147 \end{array}$$

"a b c c d b b b d d a a a a c b c c d a" →
 ↑ ↑ ↑ ↑

→ ['a', 'b', 'c', 'd']

{
 a: 6
 b: 4
 c: 5
 d: 4

 a b c d

a: 6
 b: 4
 c: 5
 d: 4

{
 a: 8
 b: 4
 c: 5
 d: 4

$a \rightarrow 0$

$b \rightarrow 1$

$c \rightarrow 2$

Sanni

\downarrow
a a b b b c ... j
 $\uparrow \uparrow \uparrow \uparrow \uparrow$

map

$\begin{array}{cc} \checkmark & 3 \\ 2 & \\ \cancel{1} & 2 \\ \cancel{0} & \cancel{1} \end{array}$

$\begin{array}{c} 2 \\ \cancel{0} \end{array}$

$\{ a \rightarrow 0$

$j \rightarrow a$

$\left(\begin{array}{c} \rightarrow \end{array} \right)$

$0 \rightarrow a$

$a \rightarrow j$

$\begin{array}{c} 1 \\ \cancel{0} \end{array}$

$\begin{array}{cc} 0 & 1 \\ \leftarrow \uparrow & \downarrow \end{array}$

$\begin{array}{c} 2 \\ \leftarrow \end{array}$

3

4

5

6

7

8

$\begin{array}{c} 2 \\ \leftarrow \uparrow \end{array}$

$a \rightarrow 0$

$b \rightarrow 1$

...

$\left. \begin{array}{l} a: 2 \\ b: 3 \\ c: 1 \\ j: 2 \end{array} \right\}$

