$\{10, 20, 30, -40, 50, -69\}$

Print : 3
↳ s
↳ e
↳ s→e : Print

All Subarrays Sum : 2
↳ s
↳ e

Maximum Sum : ??

10 : 10
10 20 : 30
10 20 30 : 60
10 20 30 -40 : 20
10 20 30 -40 50 : 70
10 20 30 -40 50 -69 : 1

X

+ve
=

20 : 20
20 30 : 50
20 30 -40 : 10
20 30 -40 50 : 60
20 30 -40 50 -69 : -9

30

10 20 30 -40 50 -70

10 20 30 -40 50 -75 : -5 | 100   50   -60   -200

100   50 : 150

100   50 -60 : 90

100   50 -60 -200 : -110

C.S.i.A Sum
-ve   +ve, -ve

Kab Rukna hai?
↳ Abhi ka sum -ve aaya ?
↳ Kuch meaningful contribution nahi dega

Kadane's Algorithm   10, 20, 30, -40, 50, -75 , 8

Max = -∞ 10 30 60 70

10   : 10

10   20 : 30

10, 20, 30 : 60

10 20 30 -40 : 20

10 20 30 -40 50 : 70

```java
public static int kadane(int[] arr) {
    int max = Integer.MIN_VALUE;
    int sum = 0;
    for (int i = 0; i < arr.length; i++) {
        sum += arr[i];
        max = Math.max(max, sum);
        if (sum < 0) {
            sum = 0;
        }
```

```
    if (sum < 0) {
        sum = 0;
    }
  }
  return max;
}
```

10 20 30 -40 : 20

10 20 30 -40 50 : 70

10 20 30 -40 50 -75 : -5

8 : 8

Linear Search

```
int  find ( int[] arr, int ele)
        ↳   for( int i=0 ; i < arr.length; i++) {
                if( arr[i] == ele){
                    return i;
              }                }

        }

            return -1; → Nahi milla
```

Binary Search
→ Homogeneous
→ Increasing / Decreasing

$$\{ \overline{10, 20, 30, 40} , 50, \overline{60, 70, 80} \}$$

indices: 0, 1, 2, 3, 4, 5, 6, 7

50 ?   increasing order ✓

$(0,7) \to 3 \Rightarrow 40 < 50$

$(4,7) \to \dfrac{4+7}{2} = 5 \Rightarrow 60 > 50$

$(4,4) \to \dfrac{4+4}{2} = 4 \qquad 50 = 50 \quad return : 4$

$l \to 0$

$r \to arr.length - 1;$

$\{1, 2, 3, 4, 5\}$

Byte Overflow??
$[-128, 127]$

$125+1 \Leftarrow \dfrac{126 + 127}{2} = 126$

$\dfrac{-128 + 125}{2} = \dfrac{-3}{2}$

$\left[\cdots\cdots - 1 \cdots \cdots \dfrac{\quad}{r=10^a -1} \right.$
$l = 0$

$int \ mid = \dfrac{l + r}{2} = l + \left(-\dfrac{l \cdot 2}{2} + \dfrac{l + r}{2} \right)$

$= l + \left(\dfrac{-2l + r}{2} \right)$

☆☆☆ $= l + \left(\dfrac{r - l}{2} \right) \checkmark$

↳ Always use this
   to calculate mid

Search Space

	n
1	n
2	n/2
3	n/4
4	n/8
⋮	⋮
(k+1)	1
k	

$R \Rightarrow \dfrac{n}{2^{k-1}} \left(\dfrac{Comparison}{Search \ Space} \right) = 1$

$n = 2^{k-1}$

$\log n = \log 2^{(k-1)}$

$a^b = c$

$\log(a^b) = \log(c)$

$b \log a = \log c$

$$\log n^{\cup} = (k-1) \log 2$$

$$\frac{\log n}{\log 2} = k-1$$

$$\sqrt{2} \quad \log_2 n$$

$$\log_2 n + 1 = k$$

$$\log_2 n + 1 \rightarrow \text{the comparisons Krange}$$

Increasing / Decreasing   ?? ✓ Sorting??

1) Bubble Sort

[(5, 2), 6 , 1 , 19 , 10]

[2 ,5 , (6, 1), 19 , 10]

[2, 5, 1, 6, 19, 10] (10, 19)

[2, 1, 5, 6, 10, 19]

[6 1   5 2 , 10, 19]

1 6   5 2   10 19

1 5 (6 2) 10 19

1 (5 2) 6 10 19

(1 2) 5 6 10 19

Har Bar jab bubble chalta
↳ toh   considered part
        ka maximum apni sahi
        jagah aajata

Kitni Baar bubble chala?
        ↳ Jitno ko sahi jagah pohochana

n

(n-1)

2) Selection Sort

Initially = 0
Select = 3

[10 , 20, 5 , 1 , 3 , 2]
    1   2   3   4   5

1 bar
run toh

[1, 20, 5, 10, 3, 2]   II
  0   2   3   4 5   i=1
                       select = 5

considered
jagah ka
sabse chota

[1, 2, 3, 10, 5, 20]
  i=2 3   4 5

i=2
select = 4

element milgya $[1, 2, 3, 10, 5, 20]$

$i=3$ 10

5

$1, 2, 3, 5, 10,$
$i=4$ 5

$i=3$
select $= 3$ 4

$i=4$
select $=4$

3) $[5, 6, 8, 9, 10, 10]$

$5, 6, 8, 9, 10, 10$ 7

$2, 3, 4, 4$ 1 Val$=1$

Val$=1$

$12, 2, 3, 4$

$2, 3$ 1