- Welcome to PS + DSA Module ⭐
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→ Programming constructs

→ Problem solving (efficient)

Q.1 Count of factors

24 → 1, 2, 3, 4, 6, 8, 12, 24

10 → 1, 2, 5, 10

N , factors : 1 to N

```
int countFactors(int N) {
    int count = 0;
    for (int i = 1; i <= N; i++) {
        if (N % i == 0) {
            // i is factor of N
            count++;
        }
    }
    return count;
}
```

N = 10

i → 1 2 3 4 5 6 7 8 9 10

count = ✗✗✗4

itr : N

Execution time

→ value of N

→ system configuration

Assume

10^8 iteration per second

N	iterations (N)	time
10^8	10^8	1 Sec
10^9	10^9	10 sec
10^{18}	10^{18}	10^{10} Sec = 317 years

10^8 itr → 1 Sec

1 itr → $\frac{1}{10^8}$ Sec

10^9 itr → $\frac{1}{10^8} \times 10^9$

= 10 Sec

1 itr → $\frac{1}{10^8}$ Sec

10^{18} itr → $\frac{1}{10^8} \times 10^{18}$

= 10^{10} Sec

Improvisation

$i * j = N$ (both i and j are factors of N)

$j = \frac{N}{i}$ (both i and N/i are factors of N)

N = 24

i	N/i
1	24
2	12
3	8
4	6
6	4
8	3
12	2
24	1

$i <= \frac{N}{i}$

$i * i <= N$

$i <= \sqrt{N}$

N = 100

i	N/i
1	100
2	50
4	25
5	20
10	10
20	5
25	4
50	2
100	1

Observations a) all the factor of n are present in the 1st part.

b) we are in 1st part till $i <= \sqrt{N}$.

```
int countFactors(int N) {
    int count = 0;
    for (int i = 1; i <= √N ; i++) {
        if (N%i == 0) {
            if (i == N/i) {
                count++;
            }
            else {
                // both i and N/i are factors
                count += 2;
            }
        }
    }
    return count;
}
```

iterations → $\sqrt{N}$

$N = 15$

$\sqrt{15} \approx 3$

i	count	
1	2	(1, 15)
2		
3	4	(3, 5)

$N = 4$

$\sqrt{4} = 2$

i	count	
1	2	(1, 4)
2	3	(2, 2)

N	itr ($\sqrt{N}$)	time
10^{18}	10^9	10 sec

10^8 itr → 1 sec

10^9 itr → $\frac{1}{10^8} \times 10^9$

= 10 sec

Q.2 Check if no. is prime or not.

prime no. → two factors (1 and no. itself)

{10, 11, 23, 2, 25, 22, 31}

↳ primes: 11, 23, 2, 31

```
boolean is_prime (int N) {
        if (countfactors(N) == 2) {
                return true;
        }
        else {
                return false;
        }
}
```

$\sqrt{N}$ iterations

Q.3 Given an Array, reverse it.

A = {10, 20, 30, 40}
0 1 2 3

40 30 20 10
{~~10~~, ~~20~~, ~~30~~, ~~40~~}
0 1 2 3

s	e
0	3
1	2
2	1

A = {10, 20, 30, 40, 50, 60, 70}
0 1 2 3 4 5 6

70 60 50 30 20 10
{~~10~~, ~~20~~, ~~30~~, 40, ~~50~~, ~~60~~, ~~70~~}
0 1 2 3 4 5 6
s
e

s	e
0	6
1	5
2	4
3	3

work till s < e

```
void reverse(int[] A) {
    int s = 0;
    int e = A.length - 1;
    while (s < e) {
        // swap A[s] and A[e]
        int temp = A[s];
        A[s] = A[e];
        A[e] = temp;
        s++; e--;
    }
}
```

0 1 2 3 4
~~10~~ ~~20~~ 30 ~~40~~ ~~50~~
50 40 20 10

0 1 2 3
~~10~~ ~~20~~ ~~30~~ ~~40~~
40 30 20 10

Q.4 Reverse part of an array.

A = { 10, 19, 40, 50, 25, 64, 38, 33 }
0 1 2 3 4 5 6 7

S = 2
e = 5

{ 10, 19, 64, 25, 50, 40, 38, 33 }
0 1 2 3 4 5 6 7

```
void reversePart(int []A, int s, int e) {
    while (s < e) {
        // swap A[s] and A[e]
        int temp = A[s];
        A[s] = A[e];
        A[e] = temp;
        s++; e--;
    }
}
```

A = 10 25 24 19 30 18
0 1 2 3 4 5

s
e

S = 1
e = 3

Q.5 Given an array, rotate it from last to first k times.

Google, amazon

constraints : (i) don't use extra array
(ii) do it in efficient way

A = 10 20 30 40 50 60 K = 3

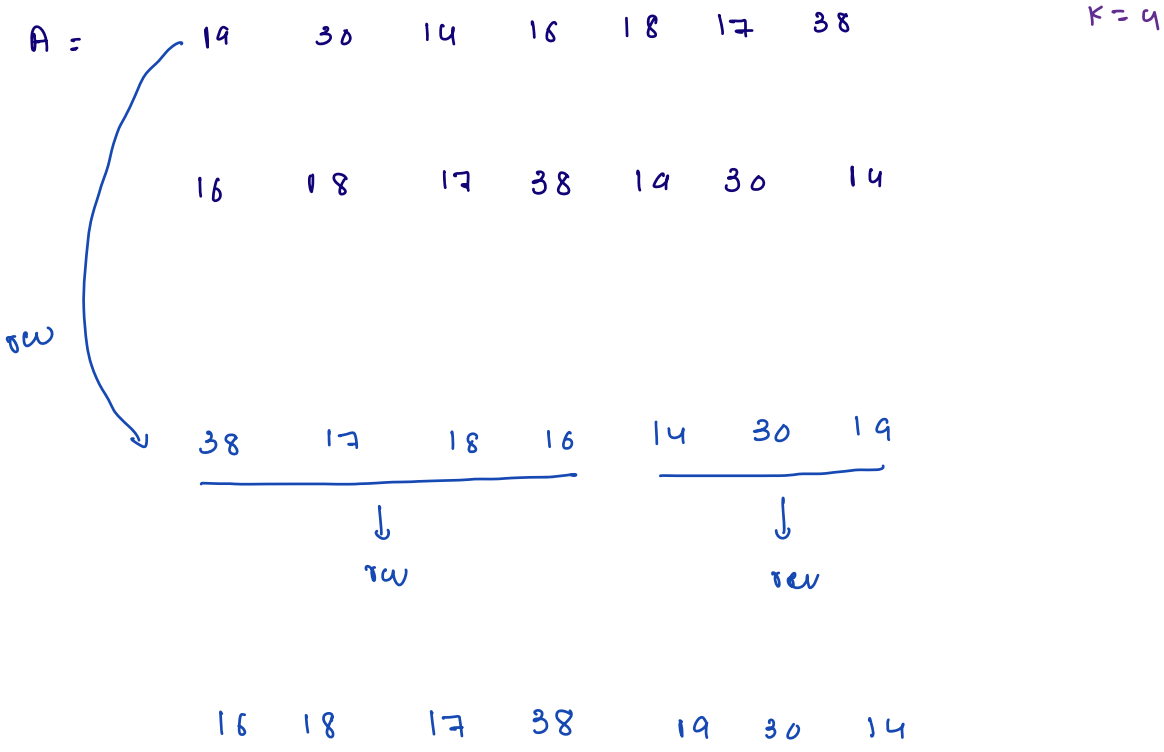
60 10 20 30 40 50

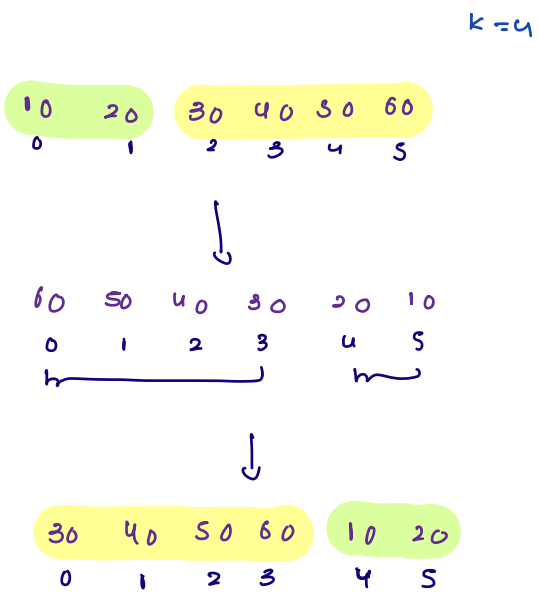
50 60 10 20 30 40

40 50 60 10 20 30

A = 19 30 14 16 18 17 38 K = 4

16 18 17 38 19 30 14





i) reverse entire array

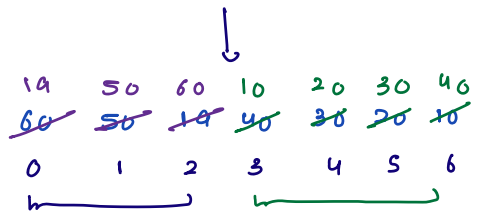
ii) reverse the first k elements

iii) rev. the remaining elements

```
void rotate (int [] A, int k) {
    int n = A.length;

    reversePart (A, 0, n-1);
    reversePart (A, 0, k-1);
    reversePart (A, k, n-1);
}
```

k = 3

A = | 10 | 20 | 30 | 40 | 19 | 50 | 60 |
    | 0 | 1 | 2 | 3 | 4 | 5 | 6 |



| 19 | 50 | 60 | 10 | 20 | 30 | 40 |

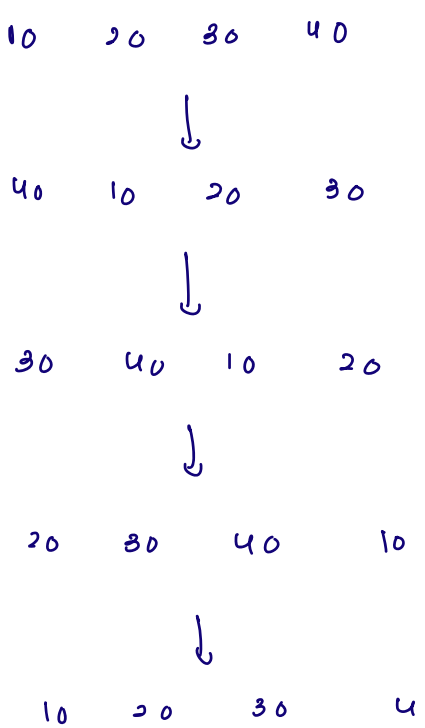
```
void rotate (int [] A, int k) {
    int n = A.length;

    reversePart (A, 0, n-1);
    reversePart (A, 0, k-1);
    reversePart (A, k, n-1);
}
```

Array index out of bound

what if k > n

A = | 10 | 20 | 30 | 40 | 50 |

k = 12



k = 4

n = 4

n = 5

k = 12

n% = 2

n = 6

k = 27

n% = 3

```
void rotate (int [] A, int K) {
    int n = A.length;
    K = K % n;
    reversePart (A, 0, n-1);
    reversePart (A, 0, K-1);
    reversePart (A, K, n-1);
}
```

log basics

$\log_b a$ — b power what is equals to a

$\log_b a = c$

$b^c = a$

$\log_2 64 = 6$

$\log_2 8 = 3$

$\log_{10} 10000 = 4$

$\log_3 81 = 4$

xxx

i) $N = 2^K$

$K = \log_2 N$

ii) $\log_b b^N = N$

Problem solving and DSA

- Time complexity
- Arrays : Prefix sum, subarrays, sliding window, 2D matrices.
- Bit manipulation
- Hashing
- Recursion
- Sorting
- Searching
- 2 pointer technique
- Strings
- Linked list
- Trees, BST, heaps
- Dynamic programming
- Graphs

52 classes

Doubts

=

$\log_b a = ?$

$b^{?} = a$

$\log_2 32 = 5$

$2^{5} = 32$

$\log_2 16 = 4$

$2^{4} = 16$

$\log_2 31 = 4.954$

↳ int : 4

$\log_3 81 = 4$

$3^{4} = 81$