06 May 2024 21:28

2 pointers

1) Need to know where to place the pointers. → Beginning, end → Begin → end

2) Need to know how to move the pointers.

Smallest sequence with given Primes

Prime

A = 2 B = 3 C = 5 D = 7

2, 3, 4, 5, 6, 8, 9

2 → 2

3 → 3

4 → 2 × 2

5 → 5

6 → 2 × 3

7 → 7

8 → 2 × 2 × 2

9 → 3 × 3

1) Take a number num = 2 and a vector<int> ans.

2) Till size of ans < D:

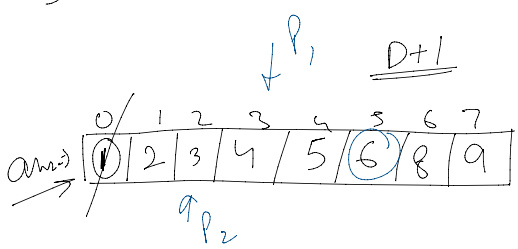
a) Prime factorize num

b) check if all prime factors are from A, B, C:

i) If yes: add to ans.

c) num++

3) Return ans.



$A = 2$ $B = 3$ $C = 5$ $D = 7$

$p_1 = 0$ $p_2 = 0$ $p_3 = 0$

a) Insert 1 into ans.

b) Loop till size of ans = D+1.

1) find min(ans[p_1]*A, ans[p_2]*B, ans[p_3]*C) → num

2) Insert num into ans.

3) If (num == ans[p_1]*A) p_1++.

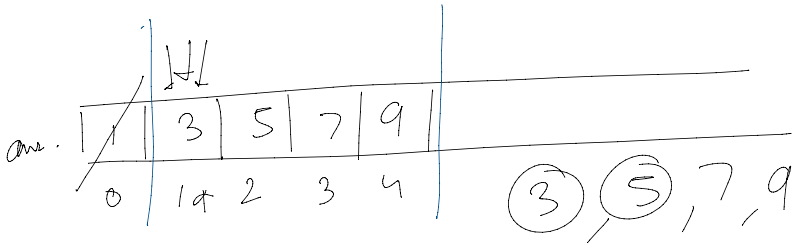
4) If (num == ans[p_2]*B) p_2++.

5) If (num == ans[p_3]*C) p_3++.

c) Remove 1st element from ans.

d) Return ans.

$A = 3$ $B = 5$ $C = 7$ $D = 9$



p_1	p_2	p_3
0	0	0
1	0	0
1	1	0
1	1	1
2	1	1

1*3 → 3*3 3*3

1*5 1*5 → 3*5

1x5
1x7

1x5 → 3x5
1x7 1x7

3x5
3x5 ← 3x5
3x7 3x7

3x3

2 1 1

Diff K

sorted

A: [1, 3, 5]
0 1 2

$i \neq j$ & $A[i] - A[j] = B$

B: 4

5 − 1 = 4

j th index

```
for(int j=0; j<A.size(); j++){
    for(int i=j+1; i<A.size(); i++){
        if(A[i]-A[j]==B){
            return true;
        }
    }
}
return false;
```

(1, 3, 5)
0 1 2
j i
0 1, 2

$O(n^2)$

3 3
3

A = [1, 3, 5, 6, 10, 25, 36]
0 1 2 3 4 5 6
P_1 P_2

B = 20

22

If I do P_1++ (difference ↓).

If I do P_2-- (difference ↓).

$P_1 = 0$

$P_2 = 1$

P_1++ → ↓

P_2++ → ↑

1) $P_1 = 0$, $P_2 = 1$.

2) while ($P_2 <$ A.size())

a) If (A[P_2] − A[P_1] == B) return true

b) else If (A[P_2] − A[P_1] > B) P_1++;

c) else if (A[P_2] − A[P_1] < B) P_2++;

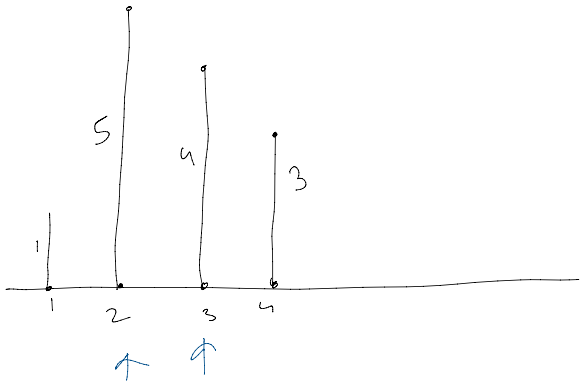
Time: O(n)

Space: O(1)

3) Return false.

Container with most water

⇒ [1, 5, 4, 3]



3 × 1 ⇒ 3

1 × 2 → 2

3 × 2 = 6

4 × 1 = 4

ans = 0;

```
ans = 0;
for (int i=0; i<A.size(); i++) {
    for (int j=i+1; j<A.size(); j++) {
        ans = max(ans, min(A[i], A[j]) * (j-i));
```

T: $O(n^2)$
S: $O(1)$

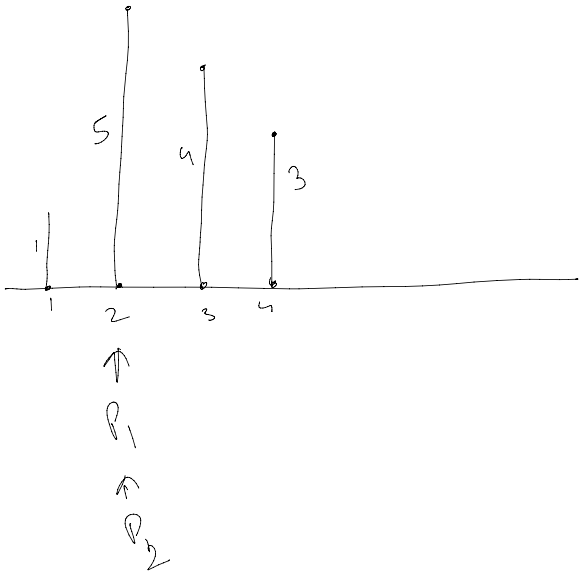
3

3

return ans;

[1, 5, 4, 3]

min(A[p1], A[p2])



ans
3
6

1) $p_1 = 0$, $p_2 = A.size() - 1$.

2) ans = 0

3) while ($p_1 < p_2$)

T: $O(N)$
S: $O(1)$

a) ans = max(ans, min(A[p1], A[p2]) * (p2 - p1));

b) if (A[p1] < A[p2]) p1++;

b) if(A[p1] < A[p2]) p1++;

c) else p2--;

4) Return ans.

Minimize the absolute difference

A: [1, 4, 5, 8, 10]

B: [6, 9, 15]

C: [2, 3, 6, 6]

minimize |max(a,b,c) − min(a,b,c)|

```
ans = INT_MAX;
for(int i=0; i<A.size(); i++) {          T: O(n^3)
    for(int j=0; j<B.size(); j++) {      S: O(1)
        for(int k=0; k<C.size(); k++) {
            ans = min((max(A[i], B[j], C[k]) - min(A[i],
                                                   B[j],
                                                   C[k])),
                      ans);
        }
    }
}
return ans;
```

	i	j	k	
A: [1, 4]	0	0	0, 1	(1, 6, 2), (1, 6, 3)
B: [6, 9]				

A : [1, 4)
: [6, 9]
B
C : (2, 3]

0	0	0, 1	(1, 6, 2), (1, 6, 3)
	1	0, 1	(1, 9, 2), (1, 9, 3)
1	0	0, 1	(4, 6, 2), (4, 6, 3)
	1	0, 1	(4, 9, 2), (4, 9, 3)

A [1, 4, 5, 8, 10] (0 1 2 3 4) ↓P1 ↓P1

B [6, 9, 15] (0 1 2) ↓P2

C [2, 3, 6, 6] (0 1 2 3) ↓P3

$|max(a,b,c) - min(a,b,c)|$

A↓ - B↑

6 − 1 → 5

6 − 2 → 4

6 − 3 → 3

1) Put $P_1=0$, $P_2=0$, $P_3=0$
2) Move the pointer pointing to the minimum value.
3) Optimize the given function.

Count pairs in array divisible by K

[2, 2, 1, 7, 5, 3] K = 4 → [1, 2, 2, 3, 5, 7] (1, 3)

P1 → 2, P2 → 3

(2, 2)

(2,2)
(7,1)
(5,3)
(7,5)
(3,1)

Spaise

```
ans=0;
for(int i=0; i<A.size(); i++) {
    for(int j=i+1; j<A.size(); j++) {
        if((A[i]+A[j])%K==0) {
            ans++;
        }
    }
}
return ans;
```

T : O(n²)
S : O(1)

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

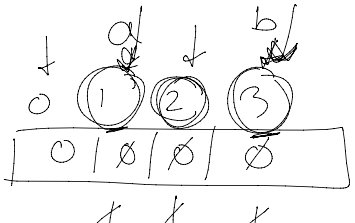
(5), 5, (3)

0	1	2	3
0	(2)	0	(1)

K = 4

n % 4 → 0, 1, 2, 3

2



2C2

ab

$(a\%x + b\%x)\%x = (a+b)\%x$

$(i + j)\%x$

$a\%x = i \qquad b\%x = j$

$a = (px + i) \qquad b = (qx + j)$

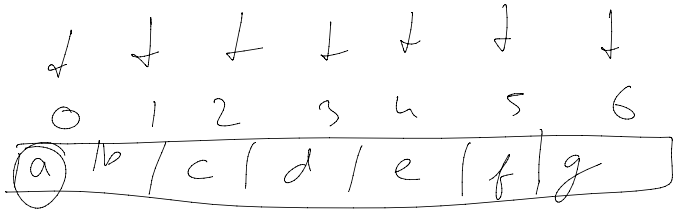
$((px+i)\%x + (qx+j)\%x)\%x = (px+i+qx+j)\%x$

$$\left((px+i)\%x + (qx+j)\%x\right)\%x = (px+i+qx+j)\%x$$

$$(i + j)\%x = ((p+q)x + i + j)\%x$$

$$(i+j)\%x = (i+j)\%x$$

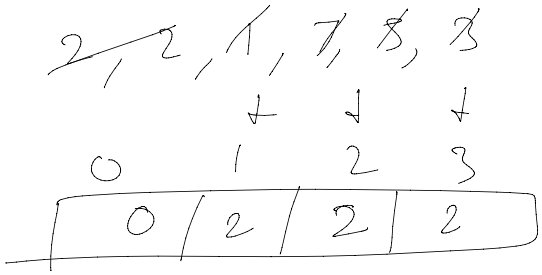
LHS = RHS



$k = 7$

7, 21 → 28

$bg + cf + de + aC_2$

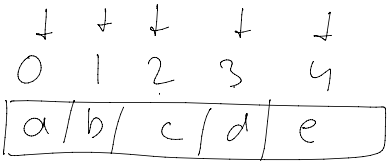


$2 \times 2 \Rightarrow 4$

$\Rightarrow 1$

2×1

5



$k = 5$

$\Rightarrow cd + be + \frac{a(a-1)}{2}$