

Max Product Subarray

152. Maximum Product Subarray

Solved

Medium Topics Companies

Given an integer array `nums`, find a `subarray` that has the largest product, and return `the product`.

The test cases are generated so that the answer will fit in a **32-bit** integer.

Example 1:

Input: `nums` = [2, 3, -2, 4]

Output: 6

Explanation: [2, 3] has the largest product 6.

Example 2:

Input: `nums` = [-2, 0, -1]

Output: 0

Explanation: The result cannot be 2, because [-2, -1] is not a subarray.

Constraints:

• $1 \leq \text{nums.length} \leq 2 * 10^4$

• $-10 \leq \text{nums}[i] \leq 10$

• The product of any prefix or suffix of `nums` is **guaranteed** to fit in a **32-bit** integer.

Question is pretty straight forward,

* Which ever subarray gives you max product return it

Observations :

what if ,

① all are +ve's

↳ product of whole array is our ans

② Even negatives , rest all are positives

↳ product of whole array is our ans

③ Odd negatives , rest all are positives

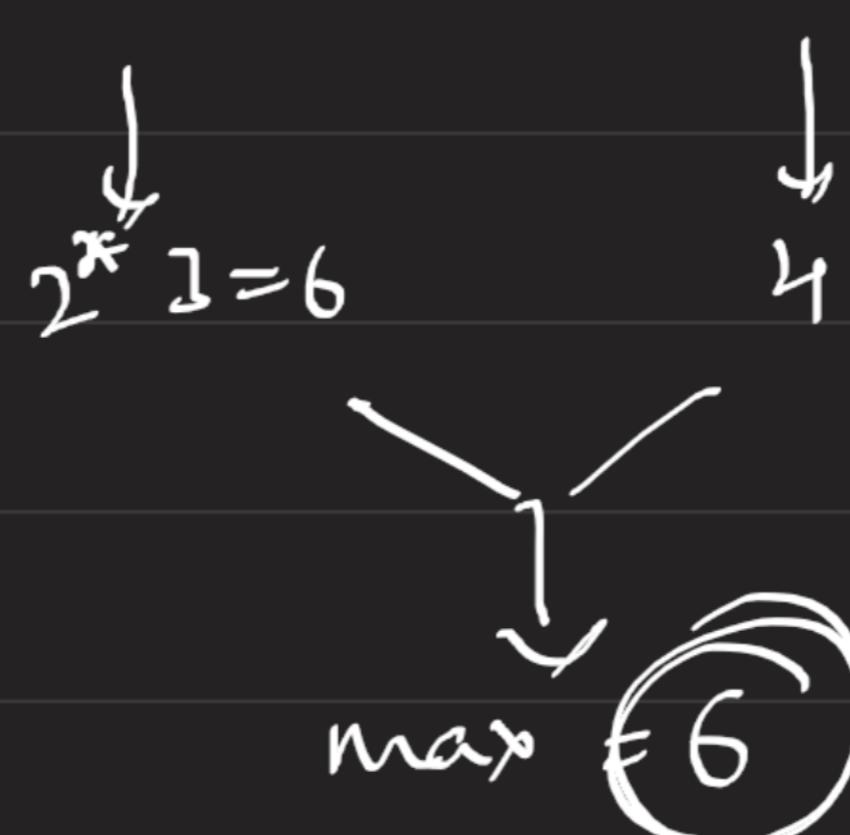
arr : (2, 3, -2, 4)

↓

The possible answer will be of left side of '-2' or right side of '-2'

We can't include -2 in our answer

So, answer can be from (2, 3) or (4)



if more negatives

Ex: $\text{arr}[] = (2, 2, 4, -5, 6, -2, 3, -1, 4, 3)$

* if we try to remove one negative \Rightarrow we can make the count of negatives as even



then, there will be no problem
will come in product

So, from which side you will remove that negative ???

- ① from front
- ② from back
- ③ from middle

① from front:

$\text{arr}[] = (2, 2, 4, \cancel{-5}, 6, \cancel{-2}, 3, \cancel{-1}, 4, 3)$

possible arrays: $(2, 3, 4) (6, -2, 3, -1, 4, 3)$
 \uparrow
max product

② from back:

$\text{arr}[] = (2, 2, 4, -5, 6, \cancel{-2}, 3, \cancel{-1}, 4, 3)$

possible arrays: $(2, 3, 4, -5, 6, -1, 3) (4, 3)$
 \uparrow
max product

③ from middle:

$\text{arr}[] = (2, 2, 4, -5, 6, \cancel{-2}, 3, \cancel{-1}, 4, 3)$

possible arrays: $(2, 3, 4, -5, 6) (3, -1, 4, 3)$

\uparrow
negative ans

\uparrow
negative ans

\rightarrow so, no use

$\text{arr}() : (1, 2, -1, -3, 4, -3, 6, 2, -3, -5, -3, 2, 4, 6)$

from middle

$\text{arr}() : (1, 2, -1, -3, 4, \cancel{-3}, 6, 2, -3, -5, -3, 2, 4, 6)$

Possible arrays : $(1, 2, -1, -3, 4)$, $(6, 2, -3, -5, -3, 2, 4, 6)$

\uparrow
+ve ans
Ok

\uparrow
-ve ans
Not Ok

So, don't prefer going for removing negative from middle

go with prefix or suffix

Observation ④

if array contains zero

↳ Split the array, don't mix 0 with answer, move on

Ex:- $\text{arr}() : (2, 1, \cancel{-2}, 4)$

from last
 \uparrow

i prefixProduct[i] SuffixProduct[n-i-1] Max

0

2

4

$-\infty^4$

1

$$2^* 3 = 6$$

$$4^* -2 = -8$$

∞^6

$$6^* -2 = -12$$

$$-8^* 3 = -24$$

6 (don't update)

$$-12^* 4 = -48$$

$$-24^* 2 = -48$$

6
↓
Come from prefix

```

public int maxProduct(int[] nums) {
    double pp = 1, sp = 1, max = Integer.MIN_VALUE;;
    int n = nums.length;
    for(int i = 0; i < n; i++){
        if(pp == 0) pp = 1;
        if(sp == 0) sp = 1;
        pp = pp * nums[i];
        sp = sp * nums[n - i - 1];
        max = Math.max(max, Math.max(pp, sp));
    }
    return (int)max;
}
  
```

if any of them becomes zero, reject

so, in this case we are neglecting Suffix