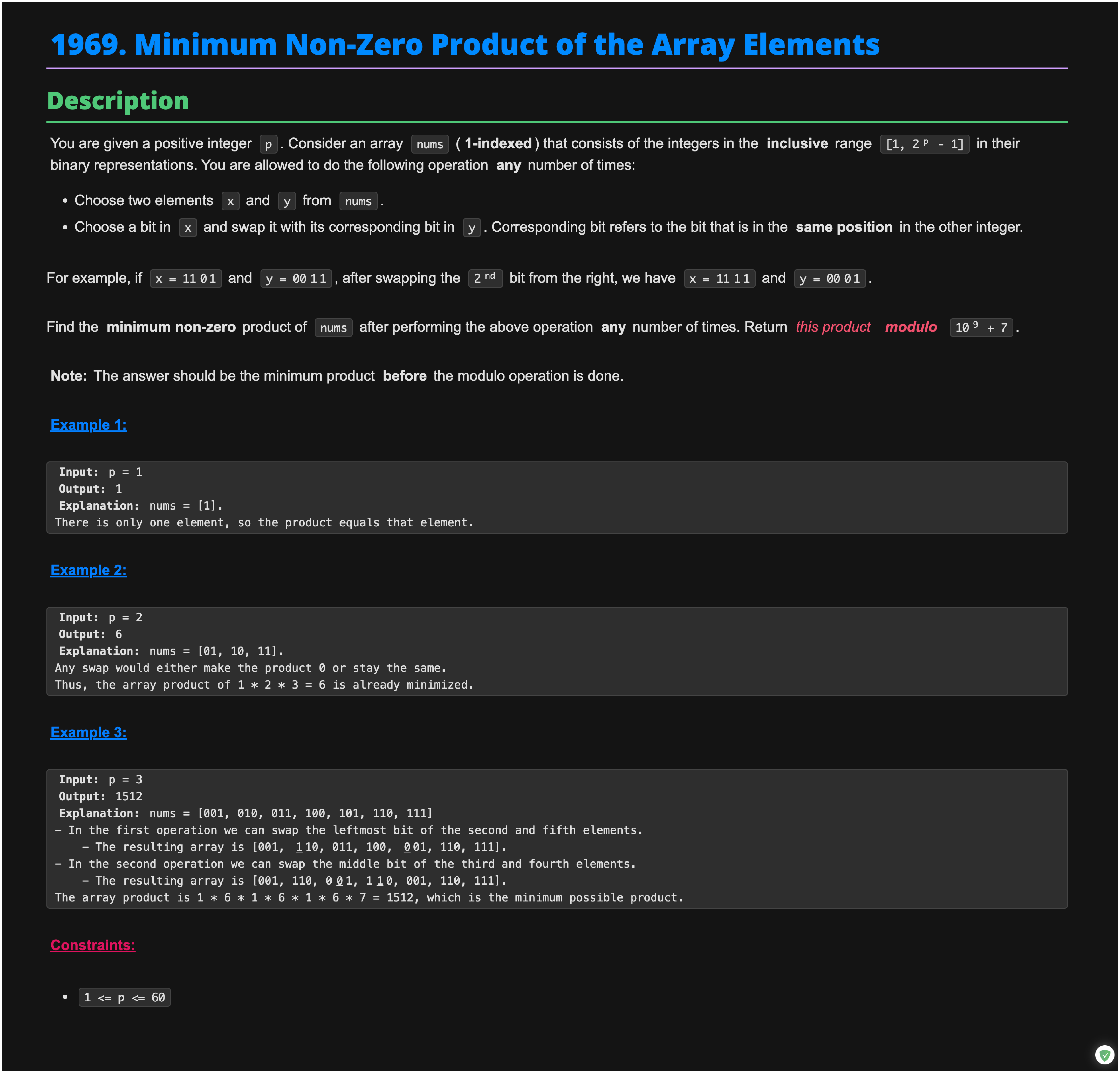

1969. Minimum Non-Zero Product of the Array Elements

Description

You are given a positive integer `p`. Consider an array `nums` (**1-indexed**) that consists of the integers in the **inclusive** range $[1, 2^p - 1]$ in their binary representations. You are allowed to do the following operation **any** number of times:

- Choose two elements `x` and `y` from `nums`.
- Choose a bit in `x` and swap it with its corresponding bit in `y`. Corresponding bit refers to the bit that is in the **same position** in the other integer.

For example, if `x = 1101` and `y = 0011`, after swapping the 2nd bit from the right, we have `x = 1111` and `y = 0001`.

Find the **minimum non-zero** product of `nums` after performing the above operation **any** number of times. Return *this product* ***modulo*** $10^9 + 7$.

Note: The answer should be the minimum product **before** the modulo operation is done.

Example 1:

```
Input: p = 1
Output: 1
Explanation: nums = [1].
There is only one element, so the product equals that element.
```

Example 2:

```
Input: p = 2
Output: 6
Explanation: nums = [01, 10, 11].
Any swap would either make the product 0 or stay the same.
Thus, the array product of 1 * 2 * 3 = 6 is already minimized.
```

Example 3:

```
Input: p = 3
Output: 1512
Explanation: nums = [001, 010, 011, 100, 101, 110, 111]
- In the first operation we can swap the leftmost bit of the second and fifth elements.
    - The resulting array is [001, 110, 011, 100, 001, 110, 111].
- In the second operation we can swap the middle bit of the third and fourth elements.
    - The resulting array is [001, 110, 001, 110, 001, 110, 111].
The array product is 1 * 6 * 1 * 6 * 1 * 6 * 7 = 1512, which is the minimum possible product.
```

Constraints:

- `1 <= p <= 60`