Problem 3007: Maximum Number That Sum of the Prices Is Less Than or Equal to K

Problem Information

Difficulty: Medium
Acceptance Rate: 37.93%
Paid Only: No
Tags: Math, Binary Search, Dynamic Programming, Bit Manipulation

Problem Description

You are given an integer `k` and an integer `x`. The price of a number `num` is calculated by the count of set bits at positions `x`, `2x`, `3x`, etc., in its binary representation, starting from the least significant bit. The following table contains examples of how price is calculated.

x | num | Binary Representation | Price ---|---|---|--- 1 | 13 | _0_ _0_ _0_ _0_ _0_** _1_**** _1_** _0_** _1_** | 3 2 | 13 | 0 _0_ 0 _0_ 0** _1_** 1 _0_ 1 | 1 2 | 233 | 0** _1_** 1** _1_** 0** _1_** 0 _0_ 1 | 3 3 | 13 | _0_ 00 _0_ 01** _1_** 01 | 1 3 | 362 | **_1_** 01** _1_** 01 _0_ 10 | 2 The **accumulated price** of `num` is the **total** price of numbers from `1` to `num`. `num` is considered **cheap** if its accumulated price is less than or equal to `k`.

Return the **greatest** cheap number.

Example 1:

Input: k = 9, x = 1

Output: 6

Explanation:

As shown in the table below, `6` is the greatest cheap number.

x | num | Binary Representation | Price | Accumulated Price ---|---|---|---|--- 1 | 1 | _0_ _0_** _1_** | 1 | 1 1 | 2 | _0_** _1_** _0_ | 1 | 2 1 | 3 | _0_** _1_**** _1_** | 2 | 4 1 | 4 | **_1_** _0_ _0_ | 1 | 5 1 | 5 | **_1_** _0_** _1_** | 2 | 7 1 | 6 | **_1_**** _1_** _0_ | 2 | 9 1 | 7 | **_1_****

_1_**** _1_** | 3 | 12 **Example 2:**

Input: k = 7, x = 2

Output: 9

Explanation:

As shown in the table below, `9` is the greatest cheap number.

x | num | Binary Representation | Price | Accumulated Price ---|---|---|---|--- 2 | 1 | _0_ 0 _0_ 1 | 0 | 0 2 | 2 | _0_ 0** _1_** 0 | 1 | 1 2 | 3 | _0_ 0** _1_** 1 | 1 | 2 2 | 4 | _0_ 1 _0_ 0 | 0 | 2 2 | 5 | _0_ 1 _0_ 1 | 0 | 2 2 | 6 | _0_ 1** _1_** 0 | 1 | 3 2 | 7 | _0_ 1** _1_** 1 | 1 | 4 2 | 8 | **_1_** 0 _0_ 0 | 1 | 5 2 | 9 | **_1_** 0 _0_ 1 | 1 | 6 2 | 10 | **_1_** 0** _1_** 0 | 2 | 8

Constraints:

* `1 <= k <= 1015` * `1 <= x <= 8`

Code Snippets

C++:

```
class Solution {
public:
long long findMaximumNumber(long long k, int x) {

}
};
```

Java:

```
class Solution {
public long findMaximumNumber(long k, int x) {

}
}
```

Python3:

```
class Solution:
def findMaximumNumber(self, k: int, x: int) -> int:
```