779. K-th Symbol in Grammar

Difficulty:Medium

- Total Accepted:2.9K
- Total Submissions:8.6K
- Contributor:awice
-
- Subscribe to see which companies asked this question.

Related Topics String Bit Manipulation

DescriptionHintsSubmissionsDiscussSolution

On the first row, we write a `0`. Now in every subsequent row, we look at the previous row and replace each occurrence of `0` with `01`, and each occurrence of `1` with `10`.

Given row `N` and index `K`, return the `K`-th indexed symbol in row `N`. (The values of `K` are 1-indexed.) (1 indexed).

```
Examples:
Input: N = 1, K = 1
Output: 0

Input: N = 2, K = 1
Output: 0

Input: N = 2, K = 2
Output: 1

Input: N = 4, K = 5
Output: 1

Explanation:
row 1: 0
row 2: 01
row 3: 0110
row 4: 01101001
```

Note:

1. `N` will be an integer in the range `[1, 30]`.
2. `K` will be an integer in the range `[1, 2^(N-1)]`.

Seen this question in a real interview before?

The answer depends only on `K` value, which is easy to notice and prove.

```
K       =  1   2   3   4    5   6    7    8     9    10
```

```
K - 1   =  0   1  10  11  100 101  110  111  1000  1001
Output  =  0   1   1   0    1   0    0    1     1     0
```

We can observe that the answer depend on whether the number of ‘1’ in binary K-1 is odd or even.

```
string toBin(int K)
{
     int cnt=0;
     while((1<<cnt) <=K) cnt++;
     int sum = 0;
     string s(cnt,'0');
     for(int i=cnt;i>=0;i--)
     {
          if(sum + (1<<(i-1))<=K)
          {
               s[cnt-i]='1';
               sum += (1<<(i-1));
          }
          else s[cnt-i]='0';
     }
     return s;
}

int kthGrammar(int N, int K) {
     string s = toBin(K-1);
     int cnt=0;
     for(int i=0;i<(int)s.size();++i)
     {
          if(s[i]=='1') cnt++;
     }
     return cnt%2;
}
```