



USACO 2019 DECEMBER CONTEST, PLATINUM PROBLEM 3. TREE DEPTH

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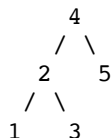
English (en) ▼

For the new year, Farmer John decided to give his cows a festive binary search tree (BST)!

To generate the BST, FJ starts with a permutation $a = \{a_1, a_2, \dots, a_N\}$ of the integers $1 \dots N$, where $N \leq 300$. He then runs the following pseudocode with arguments 1 and N .

```
generate(l,r):
  if l > r, return empty subtree;
  x = argmin_{1 <= i <= r} a_i; // index of min a_i in {a_1,...,a_r}
  return a BST with x as the root,
    generate(l,x-1) as the left subtree,
    generate(x+1,r) as the right subtree;
```

For example, the permutation $\{3, 2, 5, 1, 4\}$ generates the following BST:



Let $d_i(a)$ denote the depth of node i in the tree corresponding to a , meaning the number of nodes on the path from a_i to the root. In the above example, $d_4(a) = 1$, $d_2(a) = d_5(a) = 2$, and $d_1(a) = d_3(a) = 3$.

The number of inversions of a is equal to the number of pairs of integers (i, j) such that $1 \leq i < j \leq N$ and $a_i > a_j$. The cows know that the a that FJ will use to generate the BST has exactly K inversions ($0 \leq K \leq \frac{N(N-1)}{2}$). Over all a satisfying this condition, compute the remainder when $\sum_a d_i(a)$ is divided by M for each $1 \leq i \leq N$.

INPUT FORMAT (file treedepth.in):

The only line of input consists of three space-separated integers N , K , and M , followed by a new line. M will be a prime number in the range $[10^8, 10^9 + 9]$.

OUTPUT FORMAT (file treedepth.out):

Print N space-separated integers denoting $\sum_a d_i(a) \pmod{M}$ for each $1 \leq i \leq N$.

BATCHING:

- Test cases 3-4 satisfy $N \leq 8$.
- Test cases 5-7 satisfy $N \leq 20$.
- Test cases 8-10 satisfy $N \leq 50$.

SAMPLE INPUT:

```
3 0 192603497
```

SAMPLE OUTPUT:

```
1 2 3
```

Here, the only permutation is $a = \{1, 2, 3\}$.

SAMPLE INPUT:

3 1 144408983

SAMPLE OUTPUT:

3 4 4

Here, the two permutations are $a = \{1, 3, 2\}$ and $a = \{2, 1, 3\}$.

Problem credits: Yinzhan Xu

Contest has ended. No further submissions allowed.
