Qualification Round 2017

Ask a question

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Problem C. Bathroom Stalls

Confused? Read the quick-start guide.

Small input 1 5 points	Solve C-small-1 You may try multiple times, with penalties for wrong submissions.
Small input 2 10 points	You must solve small input 1 first. You may try multiple times, with penalties for wrong submissions.
Large input 15 points	You must solve all small inputs first. You have 8 minutes to solve 1 input file. (Judged after contest.)

Problem

A certain bathroom has **N** + 2 stalls in a single row; the stalls on the left and right ends are permanently occupied by the bathroom guards. The other **N** stalls are for users.

Whenever someone enters the bathroom, they try to choose a stall that is as far from other people as possible. To avoid confusion, they follow deterministic rules: For each empty stall S, they compute two values L_S and R_S, each of which is the number of empty stalls between S and the closest occupied stall to the left or right, respectively. Then they consider the set of stalls with the farthest closest neighbor, that is, those S for which $\min(L_S, R_S)$ is maximal. If there is only one such stall, they choose it; otherwise, they choose the one among those where $\max(L_S, R_S)$ is maximal. If there are still multiple tied stalls, they choose the leftmost stall among those.

K people are about to enter the bathroom; each one will choose their stall before the next arrives. Nobody will ever leave.

When the last person chooses their stall S, what will the values of $\max(L_S, R_S)$ and $\min(L_S, R_S)$ be?

Solving this problem

This problem has 2 Small datasets and 1 Large dataset. You must solve the first Small dataset before you can attempt the second Small dataset. You will be able to retry either of the Small datasets (with a time penalty). You will be able to make a single attempt at the Large, as usual, only after solving both Small datasets.

Input

The first line of the input gives the number of test cases, **T**. **T** lines follow. Each line describes a test case with two integers **N** and **K**, as described above.

Output

For each test case, output one line containing `Case #x: y z`, where `x` is the test case number (starting from 1), `y` is $\max(L_S, R_S)$, and `z` is $\min(L_S, R_S)$ as calculated by the last person to enter the bathroom for their chosen stall S.

Limits

$1 \le \mathbf{T} \le 100$.
$1 \le \mathbf{K} \le \mathbf{N}$.

Small dataset 1

$1 \le \mathbf{N} \le 1000$.

Small dataset 2

$1 \le \mathbf{N} \le 10^6$.

Large dataset

$1 \le \mathbf{N} \le 10^{18}$.

Sample

Input	Output
5 4 2	Case #1: 1 0 Case #2: 1 0

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5 2          Case #3: 1 1
6 2          Case #4: 0 0
1000 1000    Case #5: 500 499
1000 1
```

In Case #1, the first person occupies the leftmost of the middle two stalls, leaving the following configuration (`0` stands for an occupied stall and `.` for an empty one): `0.0..0`. Then, the second and last person occupies the stall immediately to the right, leaving 1 empty stall on one side and none on the other.

In Case #2, the first person occupies the middle stall, getting to `0..0..0`. Then, the second and last person occupies the leftmost stall.

In Case #3, the first person occupies the leftmost of the two middle stalls, leaving `0..0...0`. The second person then occupies the middle of the three consecutive empty stalls.

In Case #4, every stall is occupied at the end, no matter what the stall choices are.

In Case #5, the first and only person chooses the leftmost middle stall.
