Problem 10: TwongTwongTwong
9 Points

Problem ID: `splitters2`
Rank: `3`

Introduction

Endfield Industries is an independent company that primarily provides pioneering industrial technologies and services. The Endfield vision is to build and expand into the frontiers of the Talos-II.

Problem Statement

Note: the first portion of `splitters` and `splitters2` are exactly the same. Problem text shared between the two problems is outlined below.

This problem deals with the notion of factories, which distribute items throughout a rectangular grid of tiles. Items in a factory move from tile to tile using conveyor tiles, which can point up, down, left, or right. Items on a conveyor tile are moved to the adjacent tile in the direction pointed by the conveyor. If a conveyor tile on the edge of the factory points out of the grid, items on that tile will be moved out of the factory and collected.

Factories can also contain destroy tiles, which cause items on it to be removed from the factory altogether. In addition to conveyor tiles and destroy tiles, there are also splitter tiles. A splitter tile evenly distributes incoming items to its valid adjacent tiles. An adjacent tile is considered valid if it is a destroy tile, or if it is a conveyor tile that is not pointing directly back at the splitter.

All items that enter a factory start on the top left tile. All factories are set up in such a way that:

- Splitter tiles will not be placed adjacent to other splitter tiles or the edge of the factory.
- If a tile is empty, it is impossible for items to reach it.
- Items in the factory will never move into the same tile twice.
- The top left tile is either a conveyor tile or a destroy tile.

Problem text unique to this problem starts here.

You are requested to create a factory collecting exactly percentage p of items in the form of $p = \frac{\mathbf{P}}{2^{\mathbf{A}}3^{\mathbf{B}}}$. Construct a factory satisfying the above constraints such that the percentage of items collected is p. The factory must be a rectangle containing less than or equal to 2000 tiles.

Input Format

The first line of the input contains a single integer $\mathbf{T}$ denoting the number of test cases that follow.

Each test case consists of a single line containing three space-separated integers $\mathbf{P}$ $\mathbf{A}$ $\mathbf{B}$ representing the requested percentage p of items collected.

Output Format

For each test case, the output a factory in the following format:

- The first line should contain two space-separated integers $\mathbf{N}$ $\mathbf{M}$, denoting the number of rows and columns in the output factory. Note it must be true that $1 \leq \mathbf{N} \times \mathbf{M} \leq 2000$.
- The next $\mathbf{N}$ lines should each contain a string of $\mathbf{M}$ characters representing a row of tiles in the factory. Each character should be one of the following:
  - A `.` character, representing an empty tile.
  - Any of the characters `<` `>` `^` or `v`, representing a conveyor tile pointing left, right, up, and down, respectively.
  - An `X` character, representing a destroy tile.
  - An `S` character, representing a splitter tile.

Constraints

$1 \leq \mathbf{T} \leq 5$

$\mathbf{A}, \mathbf{B} \geq 0$

$1 \leq \mathbf{A} + \mathbf{B} \leq 100$

$1 \leq \mathbf{P} \leq \min(10^{12}, 2^{\mathbf{A}}3^{\mathbf{B}})$

$\frac{\mathbf{P}}{2^{\mathbf{A}}3^{\mathbf{B}}}$ is guaranteed to be an irreducible fraction.

Sample Test Cases

Sample Input Download

```
3
1 2 0
5 3 0
5 1 1
```

Sample Output Download

```
6 10
v.>>>>v.^.
v.^...v.^.
>>S>S>>>S.
..X.v...v.
....>>>>X.
..........
5 9
>>>v...X.
...v...S>
..vS>>v^.
<<S...>^.
..>>>>^..
3 5
>v..X
vS>S^
>>>>v
```

Note that this is one of many possible correct outputs. If there are multiple solutions, you may output any of them.

Sample Explanations

Test Case #1:

We want to create a factory that collects percentage $p = \frac{1}{2^2 3^0} = \frac{1}{4}$ of items. One such output factory could look like the following:

Splitter tiles and destroy tiles are labeled in the image above with an "S" and a red X, respectively.

$\frac{1}{3}$ of items are removed at the destroy tile on the third column from left, $\frac{5}{12}$ of items are removed at the destroy tile on the second column from right, and $\frac{1}{4}$ of items are collected at the top edge. Therefore, this factory satisfies the test case.

Test Case #2:

We want to create a factory that collects percentage $p = \frac{5}{2^3 3^0} = \frac{5}{8}$ of items. In the factory described by the sample output, $\frac{1}{4}$ of items are collected at the left edge, $\frac{3}{8}$ of items are collected at the right edge, and $\frac{3}{8}$ of items are removed at the destroy tile. Therefore, this factory satisfies the test case. Note that this factory collects items at multiple locations around the edge.

Test Case #3: In the factory described by the sample output, $\frac{5}{6}$ of items are collected at the bottom edge and $\frac{1}{6}$ of the items are removed at the destroy tile.