# The 29th Annual ACM International Collegiate Programming Contest ASIA Regional - Seoul

# Problem I

## Depth Order

### Input: depth.in

Taking a picture of objects gives an image. Though the image depicts the objects, some information about the object space may disappear in the image. It is interesting and sometimes challenging to reconstruct the information that has disappeared in the image.

We assume the following scenario:

[A1] We obtain an image by taking a picture of rectangles, from $z = -\infty$, whose sides are parallel to the $x$-axis or the $y$-axis and whose faces are parallel to the $xy$-plane.

[A2] The $z$-coordinates of rectangles in the object space are all different. We assume the depth order of rectangles is numbered from 1 to $n$, where the uppermost one (with the smallest $z$-coordinate) has the order of 1.

Depth information (that is, the $z$-coordinate) of each rectangle does not exist in the image but we can sometimes infer which one is above the other between two rectangles (of course sometimes we cannot conclude.) For example it is easily inferred from Figure 1 that the dotted rectangle $R_1$ is above the dark rectangle $R_2$. In this case we say that "$R_1$ is above $R_2$" and "$R_2$ is below $R_1$". Under the assumption of [A2], depth order of $R_1$ is 1 and that of $R_2$ is 2.

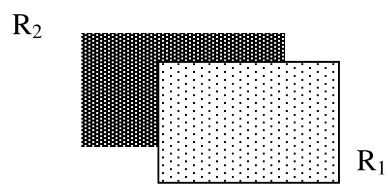


Figure 1

Because of [A1], such above/below relation is transitive (that is, if $R_1$ is above $R_2$ and $R_2$ is above $R_3$ then we can conclude $R_1$ is above $R_3$.) In the example of Figure 2, we can conclude that the dotted rectangle $R_1$ is above the dark rectangle $R_3$ because the gray rectangle $R_2$ is above $R_3$ and $R_1$ is above $R_2$. On the other hand no information is available about the lower right rectangle $R_5$. In such a case we say that the depth order between $R_5$ and any other rectangle is not inferable. Analogously, the depth order between the dark rectangle $R_3$ and the rectangle $R_4$ (filled with horizontal lines) is not inferable. Under the assumption of [A2], depth order of $R_1$ is 1 or 2; that of $R_2$ is 2 or 3; that of $R_3$ is 3, 4, or 5; that of $R_4$ is 3, 4, or 5; that of $R_5$ is from 1 to 5.

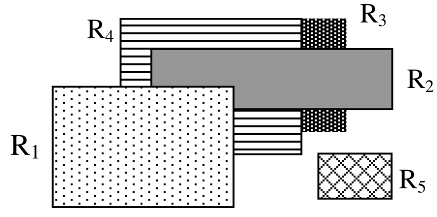


Figure 2

Notice that not all images are valid. Figure 3 shows examples of "impossible" images that we cannot obtain under the assumptions of [A1] and [A2].

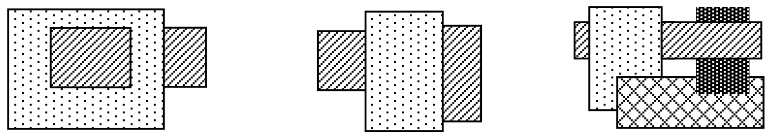

Figure 3

The problem is as follows: we are given an image and additionally a rectangle α. Your program reports `IMPOSSIBLE` in case that the image is not obtainable under the assumptions of [A1] and [A2]. Otherwise your program must output two integers β and γ (β≤γ), where the maximum possible range of depth order of α is (β, β+1, …, γ).

## Input

The input consists of $T$ test cases. The number of test cases $T$ is given in the first line of the input file. The first line of each test case contains three integers $N$, $N_X$, $N_Y$ ($2 \le N \le 52$; $2 \le N_X, N_Y \le 80$) separated by blanks, where $n$ denotes the number of rectangles and $N_X$ and $N_Y$ denote the width and the height of the image respectively. The next $N_X$ lines give $N_X \times N_Y$ pixels, separated by a blank, each of which is either the "dollar" symbol (denoted by `'$'`) representing the background or an alphabet character in {`'a', 'b', …,'z', 'A', 'B', …, 'Z'`} representing rectangles. We distinguish uppercase letters from lowercase letters. Note that the smallest rectangle can be as small as $1 \times 1$. The last line of each test case gives an alphabet letter α, which denotes the rectangle of which we want to output the maximum possible range of depth order.

## Output

For each test case, your program is to report `IMPOSSIBLE` if this image is not obtainable under the assumptions of [A1] and [A2]. Otherwise your program is to report β and γ (β≤γ), separated by a blank, where the maximum possible range of depth order of α is (β, β+1, …, γ).

The following sample input and corresponding correct output represent three test cases, each of which encodes Figure 1, Figure 2, and the leftmost one in Figure 3, respectively.

| **Sample Input (depth.in)** | **Output for the Sample Input** |
|---|---|
| 3<br>2 4 7<br>b b b b b $ $<br>b b b b b $ $<br>b b C C C C C<br>$ $ C C C C C<br>C<br>5 7 6<br>$ d d d c $<br>$ d b b b b<br>a a a b b b<br>a a a d c $<br>a a a d $ $<br>a a a $ $ e<br>a a a $ $ e<br>c<br>2 3 4<br>d d d Z<br>d Z d Z<br>d d d Z<br>d | 1 1<br>3 5<br>IMPOSSIBLE |