Problem 4: Wordsearch
3+3 Point(s)

Problem ID: `wordsearch`

Rank: `1+2`

Note

This problem has a challenge version, Problem X: Wordsnake! Both problems are exactly the same except for the additional constraints in the problem statement. However, solutions to one may not necessarily also be valid solutions for the other.

Introduction

To prepare for the upcoming SAT, your English teacher Mrs. Boomer assigned you vocabulary *wordsearches* of all things to do for homework! However, you have way more important things to do with your life than boring wordsearches, so you take a picture of the puzzle and run [OCR](OCR) on it. Then, you decide to write a program to search the words for you instead!

Problem Statement

Given the hidden word as an uppercase string S and the wordsearch puzzle as an uppercase letter grid with R rows and C columns, find the hidden word in the puzzle and output a copy of the puzzle with all letters except the letters of the hidden word replaced with #.

The hidden word in the grid is a sequence of adjacent letters with the additional constraints:
- For the main test set, the word will be hidden horizontally from left to right
- For the bonus test set, the word can be hidden horizontally or vertically, and can also be reversed
  - In other words, it can be hidden horizontally rightward, horizontally leftward, vertically downward, or vertically upward

Note that these are not the only constraints. See the constraints section below for more constraints.

Input Format

The first line of input contains a positive integer T denoting the number of test cases that follow. For each test case:

- The first line contains a single string S denoting the hidden word
- The second line contains two space separated positive integers R and C denoting the number of rows and columns of the wordsearch puzzle
- The next R lines contain C uppercase letters each, denoting the puzzle itself
- The final line is blank to separate individual test cases

Output Format

For each test case, output the following:

- The first R lines should contain C symbols in each line denoting the solved wordsearch
  - All letters not part of the hidden word should be replaced with a pound sign #
- The final line should be blank to separate individual test cases

Constraints

$1 \leq |S| \leq 26$
In other words, the length of S does not exceed 26.
$1 \leq R, C \leq 300$
The sum of $R \times C$ across all test cases does not exceed 10^5.

S only contains letters from the uppercase alphabet: `ABCDEFGHIJKLMNOPQRSTUVWXYZ`.
S contains at most one of each letter.
S may not be a real English word.
There will be exactly one complete instance of the hidden word in the entire puzzle.

Main Test Set

The word in the puzzle will be hidden horizontally.

Bonus Test Set

The word in the puzzle may be hidden horizontally or vertically, and may also be reversed.

Sample Test Cases

Sample Input

```
2
UNCOPYRIGHTABLE
6 30
UNCOPYRIGHTABLYVNWVMHJMYYPUPVI
OVVJOYPOIYNRTLYVPVXZVKVXCCNFTC
BEKDGVCZAFVQSGOLBEDYEYCCGAMBHD
RLQDONTDODRUGSKIDSQXRLQGFFQFEK
NCJRUNCOPYRIGHTABLEZTPHSWWRUGJ
AQZJOYEWTBUCBERKELEYCALICOLCKC

COPYRIGHTABLE
1 13
COPYRIGHTABLE
```

Sample Output

```
##############################
##############################
##############################
##############################
####UNCOPYRIGHTABLE##########
##############################

COPYRIGHTABLE
```

Sample Explanations

For test case 1, we have a puzzle with 6 rows and 30 columns. The word UNCOPYRIGHTABLE can be found starting from row 5 column 5 going horizontally rightwards. Note that the incomplete word UNCOPYRIGHTABL can be found at row 1 column 1 but since it isn't the full word, we ignore it.

For test case 2, the entire puzzle consists of the word COPYRIGHTABLE and no other letters, so no pound signs # are added.

Sample Input

```
2
SECRET
6 3
OBS
QNE
LAC
USR
BBE
ILT

AMOGUS
7 10
IEELYLTMDA
OXSUGOMAZJ
TKLRFDNCRO
AQTCLPUFPE
HELPMEIMXX
STUCKINAXX
WORDSEARCH
```

Sample Output

```
##S
##E
##C
##R
##E
##T

##########
##SUGOMA##
##########
##########
##########
##########
##########
```

Sample Explanations

For test case 1, the word SECRET can be found starting from row 1 column 3 going vertically downwards. Note that vertical words only show up in the bonus test set, not the main test set.

For test case 2, the word AMOGUS can be found starting from row 2 column 8 going horizontally leftwards in reverse. Note that reverse words only show up in the bonus test set, not the main test set.