CyberChallenge.IT 2024
Programming Test

Pattern Recognition [100 points]

Problem Statement

Charlie Let me get this straight: in binary exploitation, we chuck massive strings into program input fields, and if we spot our string in memory where it shouldn't be, it's a problem, right?

Alan Spot on, Charlie! And there's more: sometimes, we have to delicately craft these strings to precisely pinpoint our location within them.

Bob Can't I just smash the keyboard randomly?

Alan And what if you need thousands of characters?

Bob Easy! I'll make them all the same and randomly tweak a few at the end!

Alan You could end up in a tight spot with that, Bob... Typically, we resort to de Bruijn sequences, but that's a tale for another time!

Bob I'm not interested in that. My method always works in practice! I can prove it!

Alan Alright, Bob, let's play a game: I'll give you a string S. How many strings R exist such that you can cover all of S using only copies of R?

Bob The problem does not even make sense, what do you mean by *cover*?

Alan I mean that I can recreate the string S using copies of R, possibly overlapping them. For example, I can cover the string "*xyxyxy*" with "*xy*", "*xyxy*" and, of course, "*xyxyxy*" itself. Is it clear now?

Bob Uhm, yes, it makes sense...

Alan takes a breath, hoping this will bring a momentary pause to Bob's enthusiasm...

Problem Details

Input

The input consists of $3T + 1$ lines:

- Line 1: the number T of testcases you would need to answer
- Lines $2, \ldots, 3T + 1$: every group of 3 lines is formatted as follows
  - Line 1: two space separated integers, N and M, respectively the length of the alphabet from which the string S is sampled, and the length of the string S itself
  - Line 2: a string of length N, representing the alphabet
  - Line 3: a string of length M, the actual string S

Output

The output consists of T lines, each representing the answer to the corresponding testcase.

Scoring

Your program will be tested on a number of testcases grouped in subtasks. In order to obtain the score associated to a subtask, you need to correctly solve all its testcases.

- **Subtask 1** **[20 points]**: $1 \leq T \leq 100, N = 2, 1 \leq M \leq 12$

- **Subtask 2** [**50 points**]: $1 \leq T \leq 100, 1 \leq N \leq 12, 1 \leq M \leq 500$
- **Subtask 3** [**30 points**]: $1 \leq T \leq 100, 1 \leq N \leq 20, 1 \leq M \leq 20000$

Examples

INPUT	OUTPUT
3 2 11 SG GGGSGGSGSGG 2 4 PC CCCC 2 6 HK HKHKHK	1 4 3

Explanation

The given input contains 3 different testcases:

- The fist one, the string `GGGSGGSGSGG`, can only be covered with the full string itself
- The second one, `CCCC`, can be covered either with `C`, `CC`, `CCC` or `CCCC`
- The third one, `HKHKHK`, can be covered with `HK`, `HKHK` or `HKHKHK`.