

Problem Statement

Quora has many questions on different topics, and a common product use-case for our @mention selectors and search service is to look-up questions under a certain topic as quickly as possible.

For this problem, imagine a simplified version of Quora where each question has only one topic associated with it. In turn, the topics form a simplified ontology where each topic has a list of children, and all topics are descendants of a single root topic.

Design a system that allows for fast searches of questions under topics. There are N topics, M questions, and K queries, given in this order. Each query has a desired topic as well as a desired string prefix. For each query, return the number of questions that fall under the queried topic and begin with the desired string. When considering topics, we want to include all descendants of the queried topic as well as the queried topic itself. In other words, each query searches over the subtree of the topic.

The topic ontology is given in the form of a flattened tree of topic names, where each topic may optionally have children. If a topic has children, they are listed after it within parentheses, and those topics may have children of their own, etc. See the sample for the exact input format. The tree is guaranteed to have a single root topic.

For ease of parsing, each topic name will be composed of English alphabetical characters, and each question and query text will be composed of English alphabetical characters, spaces, and question marks. Each question and query text will be well behaved: there will be no consecutive spaces or leading/trailing spaces. All queries, however, are case sensitive.

Constraints

For 100% of the test data, $1 \leq N, M, K \leq 10^5$ and the input file is smaller than 5MB

For 50% of the test data, $1 \leq N, M, K \leq 2 \cdot 10^4$ and the input file is smaller than 1MB

Input Format

Line 1: One integer N

Line 2: N topics arranged in a flat tree (see sample)

Line 3: One integer M

Line 4...M+3: Each line contains a topic name, followed by a colon and a space, and then the question text.

Line M+4: One integer K

Line M+5...M+K+4: Each line contains a topic name, followed by a space, and then the query text.

Output Format

Line 1...K: Line i should contain the answer for the i th query.

Sample Input

```
6
Animals ( Reptiles Birds ( Eagles Pigeons Crows ) )
5
```

Reptiles: Why are many reptiles green?
Birds: How do birds fly?
Eagles: How endangered are eagles?
Pigeons: Where in the world are pigeons most densely populated?
Eagles: Where do most eagles live?
4
Eagles How en
Birds Where
Reptiles Why do
Animals Wh

Sample Output

1
2
0
3

Explanation

The first query corresponds to the green area in the diagram, since it is looking for topics under Eagles, and the query string matches just one question: "How endangered are eagles?" The second query corresponds to the blue area in the diagram, which is the subtree of Birds, and matches two questions that begin with "Where". The third corresponds to the red area, which does not have any questions that begin with "Why do". The final query corresponds to the entire tree, since Animals is the root topic, and matches three questions.

