# Problem I. Lyndon Substring

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|---|---|
| Input file: | *standard input* |
| Output file: | *standard output* |
| Time limit: | 3 seconds |
| Memory limit: | 256 mebibytes |

A string $w$ is said to be a Lyndon word if $w$ is lexicographically smaller than any of its cyclic rotations.

The longest Lyndon substring of a string $s$ is the longest substring of $s$ which is a Lyndon word.

Chiaki has $n$ strings $s_1, s_2, \ldots, s_n$. She has some queries: for some pair $(i, j)$, find the length of the longest Lyndon substring of string $s_i s_j$.

## Input

There are multiple test cases. The first line of input contains an integer $T$, indicating the number of test cases. For each test case:

The first line contains two integers $n$ and $m$ ($1 \le n, m \le 10^5$) – the number of strings and the number of queries.

Each of the next $n$ lines contains a nonempty string $s_i$ ($1 \le s_i \le 10^5$) consisting of lowercase English letters.

Each of the next $m$ lines contains two integers $i$ and $j$ ($1 \le i, j \le n$) denoting a query.

It is guaranteed that in one test case the sum of all $|s|$ does not exceed $5 \times 10^5$ and that in all cases the sum of all $|s|$ does not exceed $5 \times 10^6$.

It is guaranteed that neither the sum of all $n$ nor the sum of all $m$ exceeds $10^6$.

## Output

For each query, output an integer denoting the answer.

## Example

| standard input | standard output |
|---|---|
| 1<br>2 1<br>aa<br>bb<br>1 2 | 4 |