

[A] Managing Marriages and Divorces

Time limit: 3 seconds
Memory limit: 65535 kBytes

Description

The secret service of Landia decided to process all marriage and divorce requests to eliminate any possible errors.

Input

The input is structured as follows:

- The first line contains the number of persons, $1 \leq np \leq 250,000$.
- Each of the following np lines contains information about one person: a personal code (a 31-bit positive integer) and their sex (M or F).
- The remaining lines (an unspecified number) contain requests in one of the following formats: M `code1 code2` – a marriage request; D `code1 code2` – a divorce request.

It is guaranteed that `code1` and `code2` are valid, meaning they correspond to existing persons in the input list.

General rules (applied to every request in this strict order):

- if `code1` does not belong to a man, error code 1 is returned
- if `code2` does not belong to a woman, error code 2 is returned

If a marriage request is accepted, the two persons become married. Record the partner code for each spouse

Marriage requests:

- if `code1` belongs to a married man, error code 3 is returned
- if `code2` belongs to a married woman, error code 4 is returned

Divorce requests:

- if the two codes do not correspond to a married couple, error code 5 is returned
- if a divorce request is accepted, the two persons become unmarried. Erase the partner information for both.

At the start, every person is unmarried. The number of marriage and divorce requests does not exceed 200,000.

Output

Display the number of valid marriage (M) requests, the number of valid divorce (D) requests, and the number of error codes 1 through 5. All five error counts must be displayed, even if the corresponding count is zero.

Example

Input

```
6
101 M
201 F
121 M
221 F
301 M
311 F
M 101 201
M 121 301
M 121 221
M 201 101
M 301 221
M 121 201
D 101 201
D 101 221
D 101 201
M 101 311
```

Output

```
Valid M: 3
Valid D: 1
Error code 1: 1
Error code 2: 1
Error code 3: 1
Error code 4: 1
Error code 5: 2
```