

Problem E

Kissin' Cousins

Input file: `cousins.in`
Output file: `cousins.out`

The Oxford English Dictionary defines *cousin* as follows:

cous'in ('k*zn),n. (Also *first cousin*) child of one's uncle or aunt; my second (third...) cousin, my parent's first (second...) cousin's child; my first cousin once (twice...) removed, my first cousin's child (grandchild...), also my parent's (grandparent's...) first cousin.

Put more precisely, any two persons whose closest common ancestor is $(m + 1)$ generations away from one person and $(m + 1) + n$ generations away from the other are m th cousins n ce removed. Normally, $m \geq 1$ and $n \geq 0$, but being used to computers counting from 0, in this problem we require $m \geq 0$ and $n \geq 0$. This extends the normal definition so that siblings are zeroth cousins. We write such a relationship as `cousin-m-n`.

If one of the persons is an ancestor of the other, p generations away where $p \geq 0$, they have a relationship `descendant-p`. Note that everybody has a `descendant-0` relationship with himself/herself.

A relationship `cousin-m1-n1` is closer than a relationship `cousin-m2-n2` if $m_1 < m_2$ or $(m_1 = m_2 \text{ and } n_1 < n_2)$. A relationship `descendant-p1` is closer than a relationship `descendant-p2` if $p_1 < p_2$. A `descendant-p` relationship is always closer than a `cousin-m-n` relationship.

Write a program that accepts definitions of simple relationships between individuals and displays the closest `cousin` or `descendant` relationship, if any, which exists between arbitrary pairs of individuals.

Input

Each line in the input begins with one of the characters '#', 'R', 'F' or 'E'.

lines are comments. Ignore them.

R lines direct your program to record a relationship between two different individuals.

The first 5 characters following the 'R' constitute the name of the first person; the next 5 characters constitute the name of the second. Case is significant. Following the names, possibly separated from them by blanks, is a positive integer, k , defining the relationship. If $k = 1$, then the first named person is a child of the second. If $k = 2$, then the first named person is a grandchild of the second, and so forth. Ignore anything on the line following the integer.

F lines are queries; your program is to find the closest relationship, if any, which exists between the two different persons whose 5 character names follow the 'F'. Ignore anything on the line following the second name. A query should be answered only with regard to R lines which precede the query in the input.

E lines terminate the input. Ignore anything on or after the **E** line.

Output

For each **F** line, your program is to report the closest relationship that exists between the two persons named **aaaaa** and **bbbbbb** in one of the following formats:

```
aaaaa and bbbbb are descendant-p.  
aaaaa and bbbbb are cousin-m-n.
```

with *m*, *n* and *p* replaced by integers calculated as defined above. If no relationship exists between the pair, your program is to output the following:

```
aaaaa and bbbbb are not related.
```

Assumption A person is not an ancestor (i.e., has a **descendant-n** relationship where $n > 0$) of himself/herself.

Sample input

```
# A Comment!  
RFred Joe 1 Fred is  
# Joe's son  
RFran Fred 2  
RJake Fred 1  
RBill Joe 1  
RBill Sue 1  
RJean Sue 1  
RJean Don 1  
RPhil Jean 3  
RStan Jean 1  
RJohn Jean 1  
RMary Don 1  
RSusanMary 4  
RPeg Mary 2  
FFred Joe  
FJean Jake  
FPhil Bill  
FPhil Susan  
FJake Bill  
FDon Sue  
FStan John  
FPeg John  
FJean Susan  
FFran Peg  
FJohn Avram  
RAvramStan 99  
FJohn Avram  
FAvramPhil  
FPhil Sue  
E
```

Output for sample input

```
Fred and Joe are descendant-1.  
Jean and Jake are not related.  
Phil and Bill are cousin-0-3.  
Phil and Susan are cousin-3-1.  
Jake and Bill are cousin-0-1.  
Don and Sue are not related.  
Stan and John are cousin-0-0.  
Peg and John are cousin-1-1.  
Jean and Susan are cousin-0-4.  
Fran and Peg are not related.  
John and Avram are not related.  
John and Avram are cousin-0-99.  
Avram and Phil are cousin-2-97.  
Phil and Sue are descendant-4.
```

Diagram of the sample input

