224 Kissin' Cousins

The Oxford English Dictionary defines cousin as follows:

> **cous'in** (kŭzn), n. (Also *first cousin*) child of one's uncle or aunt; *my second (third...) cousin*, my parents first (second...) cousins 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 mth 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 $p \geq 1$, they have a relationship `descendant`-p.

A relationship `cousin`-m_1-n_1 is *closer* than a relationship `cousin`-m_2-n_2 if $m_1 < m_2$ or ($m_1 = m_2$ and $n_1 < n_2$). A relationship `descendant`-p_1 is *closer* than a relationship `descendant`-p_2 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 non-negative integer, k, defining the relationship. If k is 0, then the named individuals are siblings. If k is 1, then the first named person is a child of the second. If k is 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.

There will be one '`E`' line to mark the end of the input data. 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 *bbbbb* in one of the following formats:

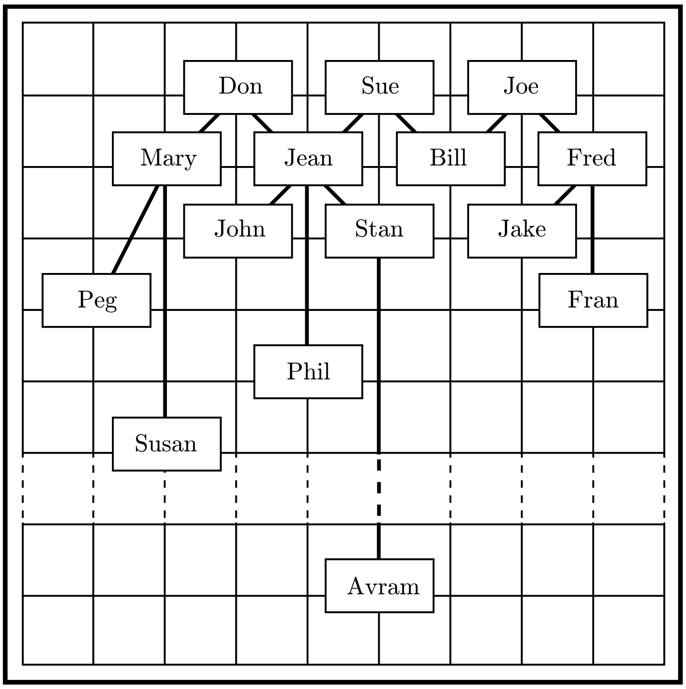
aaaaa `and` *bbbbb* `are descendant-`p`.`
aaaaa `and` *bbbbb* `are are cousin-`m`-`n`.`

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 of himself/herself.*

Note: See on the right the diagram of the Sample Input



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
E
```

Sample Output

```
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.
```