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 realtionship with himself/herself.

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 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 aaaa and bbbb in one of the following formats:

    aaaa and bbbb are descendant-p.
    aaaa and bbbb 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:

    aaaa and bbbb 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  
Output for 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
R Peg Mary 2
FFred Joe
FJean Jake
FPhil Bill
FPhil Susan
FJake Bill
FDon Sue
FStan John
F Peg John
FJean Susan
F Fran Peg
FJohn Avram
RAvramStan 99
FJohn Avram
FAvramPhil
FPhil Sue
E
```

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-0-1.
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.

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Diagram of the sample input