



My tests



Programming
Aptitude Test

A Problem A

B Problem B

C Problem C



Help

PROBLEM B

The color of a cat is primarily decided by three genes, coding for Black (Eumelanin), Red (Phaeomelanin) and Dilution (Melanophilin). The cat genetics experts among the readers will note that we are ignoring a wide range of genes, e.g., Tyrosinase and the white masking gene – we apologize in advance for the oversimplifications that are to ensue. Black is usually written as B, Red as O, Dilution as D. In general, a cat has two copies of each gene, one from each parent (except for the red gene which is sex-bound, we'll return to that later). Each copy can be either *dominant*, which we'll denote using an upper case letter, or *recessive*, which we'll denote using a lower case letter. Thus for each gene there are three possibilities: either both copies of the gene are dominant, both are recessive, or one is dominant and the other is recessive. When describing a cat we'll write this as a pair of letters, with the second one possibly being a "-" to indicate a wildcard. For example, "bb" indicates that the cat has two recessive black genes, and "B-" indicates that the cat has a dominant black gene and that we don't care about whether the other one is dominant or recessive.



Photo by Pedro Ribeiro Simões
(pedrosimoes7) on flickr

When a cat has no dominant red (O) gene, its coat will be a variation of black, according to the following four combinations:

B-D-: Black

B-dd: Blue

bbD-: Chocolate

bbdd: Lilac

Now, red (O or o) is sex bound on the X chromosome. This means a male cat, or tom, only has a single red gene, while a female has two. Red dominates black, meaning that a cat having an O gene will always have red coloring. Like black, red is also affected by the dilution gene. For male cats, we have the following two possible red colors (here, the black genes have no effect on the coat color):



depending on the dilution gene in exactly the same way as for male red cats:

D-00: Red dd00: Cream

However, a female cat with the 0o combination will have a partially black, partially red, coat. These cats are known as Torties (TortoisesHELLS), and named after both their coat colours, starting with the black. The four possible Tortie colorings are thus as follows:

B-D-0o: Black-Red Tortie

B-dd0o: Blue-Cream Tortie

bbD-0o: Chocolate-Red
Tortie

bbdd0o: Lilac-Cream
Tortie


When a pair of cats have kittens, the offspring will get a random set of genes from their parents according to the following simple process: for each gene, independently, one of the copies is selected uniformly at random from the father's two copies, and the other copy is selected uniformly at random from the mother's two copies. For the red gene, there is a 50% chance that the offspring will be female in which case it will get the father's red gene (and one of the mother's red genes at random), and a 50% chance that the offspring will be male in which case it will only get one of the mother's red genes (at random).

Write a program which, given the colors of two cats, computes the most likely color for their offspring. For cats having a color where some genes do not affect the color, assume that the corresponding genes are uniformly random (over the two choices dominant/recessive). For example, if a cat is red, you should assume that the possibilities "DD" and "Dd" for the dilution gene are equally likely, and that the four possibilities "BB", "Bb", "bB" and "bb" are equally likely for the black gene (but note that "Bb" and "bB" are equivalent).

Input

The input consists of two lines. The first line gives the color

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Output

Output a list of the possible color outcomes for the offspring of the two cats. Each line should contain a color followed by a number $0 < p \leq 1$ indicating the probability of this particular outcome.

The list should be sorted first in decreasing order by probability, then in alphabetic order by name (see sample input 3 below). You do not need to worry about the precise formatting of the probabilities (e.g., number of decimals), but the absolute error of each probability must be smaller than 10^{-9} .

Sample Input 1

```
Red
Red
```

Sample Output 1

```
Red 0.937500000
Cream 0.062500000
```

Sample Input 2

```
Lilac-Cream Tortie
Blue
```

Sample Output 2

```
Blue 0.375000000
Cream 0.250000000
Blue-Cream      Tortie
0.187500000
Lilac 0.125000000
Lilac-Cream     Tortie
0.062500000
```

Sample Input 3

```
Blue
Red
```

Sample Output 3

```
Black 0.328125000
Black-Red      Tortie
0.328125000
Blue 0.109375000
Blue-Cream     Tortie
0.109375000
Chocolate 0.046875000
Chocolate-Red  Tortie
0.046875000
Lilac 0.015625000
```



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1d 23h

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Memory limit

1024 MB

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Authors

Per Austrin and Pehr Söderman



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