ICPC - Programming Contest
FAU Local Winter Contest 2007

27. Januar 2007

Problem Overview:

Good luck and have fun!

Login - Instructions

1. choose windowmanager
2. log in as the given user `icpc??` with given password
3. open a shell, execute `mymooshak`
4. close the shell

Memory and Time Limit

The memory limit for all problems (except *Springfield Shopper*) is set to 64 MB. The time limit depends on the problem and is given in the problem statements.

Documentation Links

- **Java5:** `http://www2.informatik.uni-erlangen.de/Dokumentation/Java5/`
- **STL:** `http://www2.informatik.uni-erlangen.de/Dokumentation/STL/`

Compiler Options

Compiling `sample.{c,cpp,java}` in

- **C++:** `g++ -Wall -Werror sample.cpp`
- **C:** `gcc -Wall -Werror -lm sample.c`
- **Java:** `javac sample.java`

Execution Commands

- **C++:** `./a.out`
- **C:** `./a.out`
- **Java:** `java -classpath . -Xmx64m sample`

Problem A
BabyTranslator

Author: Herb Simpson

Time Limit – 5 second(s)

I am Herb, the half brother of Homer. I am the product of an affair between our father and a carnival prostitute. I was put up for adoption shortly after birth, and Homer never knew me until recently. I am a successful businessperson as I founded Powell Motors, a car company based in Detroit.

But my biggest success will be my baby translator, that I invent in the episode *Brother Can You Spare Two Dimes?* It should able to analyze baby speech and translate it into comprehensible English. I work hard with Maggie to develop this product. Nevertheless, I need your help as you are working for this well known company called Chomsky Inc. At your company, the context free grammars are coded that I so desperately need.

A rule in a contextfree grammar consists of a left hand side containing one nonterminal symbol. The right hand side can contain one to four hundred symbols, nonterminal and terminal symbols can be mixed freely. Each grammar has a start symbol, in our case `S`, where a derivation begins. Rules are applied to nonterminal symbols to derivate sentences. In each step of the derivation, a nonterminal symbol is substituted with the help of a rule whose left hand side equals the chosen symbol. Derivation means that the symbol is deleted from the sentence and the right hand side is inserted instead. The derivation is finished, if a sentence contains only terminal symbols. You are given a big grammar containing up to 4000 rules.

Your task is to calculate the possible first terminal symbols of the sentences that can be derived from all nonterminals of the given grammar. E.g. having the rules $S \rightarrow aSb|ab$, every sentence derivable from S starts with a. You can assume that only symbols are used that can be derived to sentences containing only terminal symbols. All nonterminal symbols can be reached from the start symbol S.

There are no ϵ-rules in the grammar.

Input

Rules are composed of symbols. Each rule is given in one line. The first symbol of each line is the left hand side, all remaining symbols form the right hand side. There are at least two symbols per line. Terminal symbols are the letters `a` − `z`. Nonterminal symbols are the letters `A` − `Z`. There can be several rules for one nonterminal symbol. The first line of the input contains the number of rules.

Output

In each line a nonterminal symbol and the first terminal symbols of all sentences it can be derived to are given. The terminal symbols are ordered alphabetically. These lines are also ordered alphabetically according to the nonterminal symbols they describe.

Sample Input

```
6
S a S b
S a b
S c d
S B
B C
C c
```

Sample Output

```
B c
C c
S a c
```

Problem B
EmergencyPlans

Author: Bart Simpson

Time Limit – 1 second(s)

As you might know, Homer is working in a nuclear power plant. One day, during his shift suddenly the reactor alarm goes off. The temperature is rising and rising and Homer has to initiate the emergency procedures. Luckily, Homer has prepared himself a list what to do. Now, that he really needs that list, it reads quite strange:

1. Phone Marge
2. Before 1, go to the toilet
3. Check the time
4. After 2, check the time left
5. Before 1, phone the boss
6. ...

It's quite hard for Homer now, to find out the right order of the things he must do to prevent the reactor from blowing up. Therefore, he asks one of his co-workers to write a small program that brings all points into the right order.

Input

The input consists of several emergency plans. The first line of the input gives the number of plans. Each plan has an ,,ordered" number of items that have to be done. Each item starts with its number on the list. If an action has to be performed before another one `before xxx` appears in the text. If the action must be done after another one, `after xxx` is written in the line. Actions without `before` or `after` have to be done after the preceding action. In all cases, the line contains a description of the action. References to other actions all have ids lower than the current line's. All words and numbers are separated by spaces. Each line is shorter than 1024 characters, and an emergency plan is ended by the action `done`. There are less than 10,000 items in an emergency plan.

Output

For each emergency plan output the action numbers in the order in which they must be performed, separated by spaces. If two actions can be done in parallel first output the action with the lower number. If Homer's emergency plan is so screwed up that no sensible order exists, output `You better start praying`.

Sample Input

```
3
1 phone Marge
2 before 1 go to the toilet
3 check the time
4 after 2 check the time left
5 before 1 phone the boss
6 done
1 finish eating the donut
2 clean up the desk
3 after 2 but before 1 press the emergency off button
4 done
1 drink Duff
2 ask Lenny
3 after 1 but before 2 blame Flanders
4 done
```

Sample Output

```
2 3 4 5 1 6
You better start praying
1 3 2 4
```

Problem C
Help Duffman

Author: Kent Brockman

Time Limit – 10 second(s)

Most people in Springfield know Duffman — either from the annual "How low can you go" contest where he is a member of the jury or from several Duff-sponsored events (such as the "Beer-tender" competition). As the mascot and spokesperson for the Duff Beer company, he wears red and blue tights, a red cape, dark sunglasses and a utility belt of beer cans around his waist.

Duffman is also a member of Duff's sales department where he is responsible for the process of packing beer cans into boxes. This is actually done by an old machine that does not work very well. It gets stuck quite often, so that the boxes that could hold up to m ($m \geq 1$) cans each just occasionally get filled completely. Interestingly, if there are n ($m \leq n \leq 1000000$) cans to pack, the machine never produces an empty box. Moreover, even stranger, the machine always fills up at least one box completely. This odd behaviour has stimulated Duffman's curiosity — he now wants to know the number of ways that n cans can be packed into boxes of size m by the machine (under the assumption that the machine always works as described). Note that the boxes have unique bar codes and so are distinguishable.

For example, if a box can contain up to three cans and there are five cans to send out, this could be done in exactly five ways:

$$(1, 1, 3),\ (1, 3, 1),\ (3, 1, 1),\ (2, 3),\ (3, 2).$$

Note that $(1, 1, 3)$ and $(1, 3, 1)$ are counted as different because of the bar codes. $(1, 1, 1, 2)$ would not be a valid way since there must be a box with three cans. As the number of ways might be quite large, Duffman is only interested in the last d digits of this number ($1 \leq d \leq 9$).

Since Duffman has no practice in solving problems, he needs your help.

Input

The input starts with a line containing C, the number of test cases ($1 \leq C \leq 20$). Then follow exactly C lines; each line contains the three numbers n, m and d.

Output

Output one number on a separate line for each testcase. Do not print any leading zeros.

Sample Input

```
6
5 3 9
4 2 6
77 7 7
123 50 5
124 1 5
51 51 9
```

Sample Output

```
5
4
8811889
24352
1
1
```

Problem D
Homer vs. Bart

Author: Sideshow Bob

Time Limit – 1 second(s)

Bart has broken the TV (Krusty has been canceled). Homer gets angry and wants to choke him. But Bart transforms into Bartman and flies away in a straight line. Homer has learned to cope with Bart's superpowers: he heats up his new nuclear-driven stun laser and shoots it at Bartman (the laser beam is another straight line). Has Homer a chance to stun Bartman and punish him until he is unconscious (i.e. do the two lines intersect) or will Bart escape and make fun of his dad ever after?

Input

The first line of the input holds the number of testcases. There is one testcase per line. Each line holds the equation of the two straight line formulas g_{Homer} and g_{Bart}. As Homer hopes to catch Bart, the input is formulated optimistically and therefore the two formulas are separated by white spaces and a = character. Each straight-line formula consists of a starting point $\vec{a}$ + or - the direction vector lambda $\vec{b}$. Each vector consists out of three integer values separated by ',' and a white space. See the sample input for details.

Output

For each testcase print one output line. If there is a unique intersection point for the two given straight lines print "Homer got Bart at" followed by the intersection point. The intersection vector must be given as a vector of integer numbers. If the coordinates cannot be represented as an integer, a reduced mixed fraction must be printed. If the two lines are parallel or collapse output "Fly Bart. Fly! (parallel)". In all other cases output "Fly Bart. Fly! (skew)". See the sample output for details.

Sample Input

```
5
(9, 7, 9) + lambda (31, 38, 1) = (8, 9, 2) - lambda (10, 5, 16)
(4, 7, 2) + lambda (1, 8, 18) = (8, 3, 2) + lambda (12, 6, 0)
(1, 1, 1) + lambda (-6, 15, -10) = (0, 0, 0) + lambda (0, 21, -4)
(1, 2, 3) + lambda (1, 2, 3) = (1, 2, 3) + lambda (1, 2, 3)
(0, 1, 0) + lambda (0, 1, 0) = (-1, 0, 0) + lambda (1, 0, 0)
```

Sample Output

```
Homer got Bart at (12 4/9, 11 2/9, 9 1/9)
Fly Bart. Fly! (skew)
Homer got Bart at (0, 3 1/2, -2/3)
Fly Bart. Fly! (parallel)
Homer got Bart at (0, 0, 0)
```

Problem E
How many Donuts

Author: Mr. Burns

Time Limit – 10 second(s)

Background: Homer J. Simpson works at the nuclear power plant in Springfield. As the power plant supplies the city with electricity, Homer needs food to keep up his work. Due to the fact he is the Safety Inspector in sector 7-G, it is very important that he has enough food. He prefers to eat donuts. You have to take care that there are enough donuts to keep him busy, or Homer might actually do something, which will end in a disaster, of course.

Problem: Homer works at a different time every day, depending on when he finishes breakfast and the time dinner is ready. Sometimes he even visits Moe's Tavern during the working time. But it is crucial that there are enough donuts for him during the time he is at the plant. He needs 45 seconds to eat one donut. After eating 6 donuts, he takes a nap for 7 minutes. Afterwards he continues eating donuts. Your task is to compute the minimum number of donuts you need to feed him for that day, depending on the working time given.

Input

The input consists of several testcases. The first line of the input contains the number of testcases. Each testcase consists of one single number n ($0 \leq n < 2^{31}$) giving the time how many seconds Homer will 'work' that day. Each number will be presented on a single line.

Output

For every testcase you have to print the minimum number of donuts you need to keep Homer busy all day. Print every number on a single line.

Sample Input

```
4
0
60
30
45
```

Sample Output

```
0
2
1
1
```

Problem F

How many dishes?

Author: Maggie Simpson

Time Limit – 1 second(s)

Mr. Burns, owner of an atomic plant, is looking to hire new programmers. As he is looking for the best of the best, he wants to organize a programming contest just like the ACM contests. Having never organized such a thing, he looks at how SWERCs were organized. Homer - the employee with the greatest food-consumption - was issued to organize the dinner on Saturday evening. He planned everything well: The contestants will go on a boat-trip with many three-eyed sights. Learning from past SWERCs he knows that the amount of available dishes on the boat can become a problem. Luckily, he finds out that Professor Frink is building an on-demand-dishes-production-machine. This machine is able to produce one plate, every time somebody needs one, but in order to reduce waste it cannot produce one, when it's not needed. As Professor Frink still hasn't finished the invention, Homer will have to use an unfinished version of the machine, which has a maximum rate built into it at which it can produce dishes.

From SWERC-statistics Homer knows, how many plates are in use at what time. From these statistics, he now needs to deduce the maximum rate at which his machine will have to produce new dishes.

Input

Those funny SWERC-guys gave Homer polynomials of degree 3 describing the amount of dishes in use at time t (measured in contaminated SNPP time units). Homer ignores that dishes might be returned at the same time as there are new dishes needed. If the value of the polynomial is ascending, new dishes have to be produced at the same rate at which the polynomial is ascending; if it is descending or staying at a certain value, no new dishes need to be produced. The input starts with a line containing C, the number of testcases ($1 \leq C \leq 100$). A testcase consists of 4 integers a ($-2^{28} < a < 0$), b, c and d ($-2^{28} < b, c, d < 2^{28}$) describing a polynomial of the form $at^3 + bt^2 + ct + d$. Each testcase is given on a single line containing whitespace-separated a, b, c, d. The input may contain multiple testcases.

End of input is indicated by EOF.

Output

Your task is now to output the time t at which the maximum rate occurs in the statistics. For each testcase, output the time as a reduced fraction of the form q/d (q not necessarily smaller than d, but q relatively prime to d and $d > 0$) on one line. If it happens at time 0 always print 0/1. Note that t (measured in contaminated SNPP time units) can also have negative values. Homer doesn't know at what time the dinner starts or ends, so it's just fine to find the maximum rate ever appearing. The rate and the number of dishes in use at time t are both positive values.

Sample Input

```
3
-1 0 1 1
-1 1 1 1
-1 -1 -1 -1
```

Sample Output

```
0/1
1/3
-1/3
```

Problem G
Lemonade Shop

Author: Sideshow Bob

Time Limit – 1 second(s)

Lisa and her friend Ralph have opened a lemonade store. Because of Lisa's popularity and Ralph's ... ahm ... because of Lisa's popularity people from Springfield want to try the delicious lemonade they offer. As Lisa is the only person who knows how to make the perfect lemonade, she has to be in the kitchen and has to produce more and more lemonade. This leaves the selling job to Ralph. As Ralph isn't smart at all, he has great difficulties giving people the right change. He already uses a calculator to determine the amount of money he must give to the customer, but determining the number of coins is way beyond his abilities. The huge amount of different coins confuses him. There are 2 Euro, 1 Euro, 50 Cent, 20 Cent, 10 Cent, 5 Cent, 2 Cent and 1 Cent coins. You as a very good friend of Ralph have offered him to write a program that takes the amount of money Ralph must give back to the customer and calculates the number of coins Ralph must return in order to keep the number of returned coins minimal.

Input

There is one testcase per file. The testcase starts with the number n of lines on a single line. Each of the following n lines contains an amount of money, Euro and Cent separated by a '.'. You can safely assume that no one in Springfield (not even Mr. Burns) owns more than 20 Million Euros.

Output

For each of the n lines, print one line of output. Write the change for each customer (identified by its unique customer id) to a single line. See the sample output for details.

Sample Input

```
5
7.23
2.56
13.90
2.00
1.01
```

Sample Output

```
Change for customer 1: 3x200 1x100 0x50 1x20 0x10 0x5 1x2 1x1
Change for customer 2: 1x200 0x100 1x50 0x20 0x10 1x5 0x2 1x1
Change for customer 3: 6x200 1x100 1x50 2x20 0x10 0x5 0x2 0x1
Change for customer 4: 1x200 0x100 0x50 0x20 0x10 0x5 0x2 0x1
Change for customer 5: 0x200 1x100 0x50 0x20 0x10 0x5 0x2 1x1
```

Problem H

Producing Itchy and Scratchy

Author: Milhouse

Time Limit – 10 second(s)

Itchy and Scratchy are the cartoon heroes of Springfield's children, and thus also of the Simpson's offspring. Because the Itchy & Scratchy show is such a success - mainly because of the graphic violence depicting a mouse mutilating a cat, the production team is constantly working on new episodes, and trying out new bloody experiences for their audience. Once they planned to vaporize the cat - Scratchy - into sub-atomic pieces, this (obviously) would be a great end of this episode. The production officer experimented with several smaller explosions, which divide the cat into n much smaller pieces, and one final series of explosions, which finally divides each of those smaller pieces to k final sub-atomic particles, such that finally $m = k \cdot n$ parts fly around.

He showed a sketch to the visual effects manager, who insisted for geometric reasons in a more smooth subdivision of the cat - if the first explosion divides the cat into k pieces, the next series of explosions should further divide them also into k pieces each, until the sub-atomic level with $p = k^i$ parts is reached. Both agree to the following solution: They take the visual effects manager's approach, if it is possible to create a cascade of explosions such that the number of parts $p = k^i$ creates about as much pieces as the productions officers approach - not much less and not much more for principal reasons. Thus if it is possible to find a number $p = k^i$ such that $n < p \leq m = k \cdot n$ holds, the production of this episode can start.

One additional constraint of this problem is that for all variables only integral values are allowed, thus p, k, i, m and n are integral values.

Input

In the first line is a number c, the number of test cases given, $1 < c < 100$.

The following c lines contain a single test case each. One test case consists of two numbers, n and k, where $2 \leq n, k \leq 10^{500}$.

Output

For each test case, print a single line containing "yes" if it is possible to find such a number $p = k^i$, or "no" otherwise.

Sample Input

```
2
3 2
2 2
```

Sample Output

```
yes
yes
```

Problem I
Springfield Shopper

Author: Homer Simpson

Time Limit – 15 second(s)

Every morning Homer reads the *Springfield Shopper*, but instead of studying the interesting news (for example an article about the largest prime less or equal to 2^{31}: 2147483647) he wants to take part in a raffle. In order to win the price in form of Duff beer and donuts he must count the occurrences of a single word in a very long text. However, Homer cannot read very fast, so the task is not an easy one for him.
Homer does not dare to ask Marge for help, because she still believes that Homer graduated from high school, which he never did. Thus, he asks you to help him.

Memory Limit

The memory limit of this problem differs. It is set to 1 **MB**, so be careful with variable declarations in your program! The problem will be judged manually – do not care about a pending Wrong Answer, it may be correct after a manual rejudgement.

Input

There is one testcase per file. The testcase starts with the number n of lines on a single line. The second line only contains the pattern that is searched for. Then n lines follow, in which Homer should count the occurrences of the pattern. Homer knows that each string in the file consists of lowercase letters, not divided by any spaces. Furthermore, the pattern is at most 20 characters long. However, — Homer feels sorry about that — he forgot the maximum length of each single line. So be prepared for very long lines with more than a million characters.

Output

For each of the n lines, print one line of output. The line should contain its number and the number of pattern occurrences in the corresponding input line. If you search for the pattern `aa` in `aaa` the number of occurrences is 2. You can safely assume that the number of occurrences is strictly less than 2^{31}. See the sample output for details.

Sample Input

```
3
donut
drinkmoreduffbeer
donutdonutdonutdonutdonutdonutdonutdonut
donoteattoomuchdonutsbecauseyouregettingsick
```

Sample Output

```
Line #1: 0 hit(s)
Line #2: 8 hit(s)
Line #3: 1 hit(s)
```

Problem J
Voice Actors

Author: Fox Network

Time Limit – 10 second(s)

Most voice actors of “The Simpsons”-show perform the voices for more than one character. The main actors are getting $8 million for a season. However, they are rarely ready to record the dialogues on time, because nobody has a list of voice actors per scene.
Nevertheless, the mapping from voice actor to character is known and the characters in each scene are known, too. *Fox Network* asks you to create a list of voice actors for each scene.

Input

The input consists only of one testcase. The number of voice actors v is given on the first line ($0 < v \leq 10$). The following v lines contain the mapping from voice actor to Simpson character. Each mapping is started by the voice actor's name followed by an integer n_i and the n_i character names on one line ($0 < n_i \leq 100$). Each name contains up to 32 upper- and lowercase letters.
The next line denotes the number of scenes s ($0 < s \leq 100$). Each of the following s lines contains the number of characters and their names on one line.

Output

For each scene in the input, write a line containing the string 'Voice actors in scene #', the scene number and the necessary voice actors divided by a single space. If there is more than one voice actor, order their names lexicographically. Each voice actor should be listed only once per scene. See the sample output for details.

Sample Input

```
6
DanCastellaneta 7 HomerSimpson AbrahamSimpson Krusty Barney Willie JoeQuimby Itchy
JulieKavner 5 MargeSimpson PattyBouvier SelmaBouvier JacquelineBouvier GladysBouvier
NancyCartwright 5 BartSimpson NelsonMuntz ToddFlanders RalphWiggum MaggieSimpson
YeardleySmith 1 LisaSimpson
HankAzaria 3 MoeSzyslak ChiefWiggum Apu
HarryShearer 5 MrBurns Smithers SeymourSkinner NedFlanders ReverendTimothyLovejoy
4
5 HomerSimpson MargeSimpson BartSimpson LisaSimpson MaggieSimpson
2 HomerSimpson MoeSzyslak
3 MargeSimpson SelmaBouvier PattyBouvier
4 BartSimpson NelsonMuntz LisaSimpson Krusty
```

Sample Output

```
Voice actors in scene #1: DanCastellaneta JulieKavner NancyCartwright YeardleySmith
Voice actors in scene #2: DanCastellaneta HankAzaria
Voice actors in scene #3: JulieKavner
Voice actors in scene #4: DanCastellaneta NancyCartwright YeardleySmith
```