2022 UMW HS Programming Contest

Overview
Welcome to the UMW High School Programming Contest - 2022! This is a contest where teams from area high schools compete to solve a set of programming problems.

Problems
There are 15 problems of (approximately) increasing difficulty. The team who solves the most problems is declared the winner. In the event of a tie, the team with the best time wins. The best time includes 10 minute penalties for wrong submissions. Each problem has a general description, details on the formats for input and output, and sample input and output.

Input is from standard input and output is to standard output. Do not open any files inside of your program and do not prompt for input. Output of your program must match that of the correct output ***exactly***. You can solve the problems in Java, Python, C++, or C. Up to date versions of these languages are used to judge your entries. You must save your code using the standard extension for your language of choice (.java .py .cpp. .c respectively). In case you need a refresher, sections at the end of your packet provide a brief overview of how to perform input and output in Java, Python, and C++.

Rules
You are allowed to have any printed material such as books or printouts. You are also allowed to access standard library documentation for your language of choice. No other use of the internet is permitted. You are also not allowed to copy and paste code from any source, be it a thumb drive, or another file that you have. Since the contest is virtual, most contestants will be using a computer to participate. Each team is allowed to concurrently use two of the computers to write code. The other teammates can work on the problems, but they cannot use computers to write code.

Logging In
To log in to the contest system, direct your browser to http://35.222.131.70/~mooshak , and enter your team name and password provided. This brings up the interface for you to submit solutions to the problems, ask questions (which are broadcast to all participants), and see how your team is doing.

Submitting
To submit a solution, first make sure that you select the correct problem letter on the top of the site. Then click the "Choose File" button. Then choose the file that contains your source code (be sure it has the correct extension). After that it will be submitted for judging. It will receive an automatic judging response which is marked pending. Your solution will then be checked manually and a final response will be assigned.

Acknowledgements

Thank you Dr. Ian Finlayson for serving as the judge of our contest. Dr. Finlayson placed the problems into his Mooshak programming contest system, and he is serving as our contest judge today.

Also, thanks to Dr. Finlayson for providing me access to his previous UMW programming contests. The previous page and the last section is based upon one of Dr. Finlayson's contests, and I modified problems from some of Dr. Finlayson's previous contests to create the problems in this packet.

Thanks to NSWCDD, Dahlgren, VA for sponsoring our contest this year. NSWCDD is a premier US Navy R&D center.

Thanks to members of our CPSC department - ???, and ??? - who are volunteering their time today to help run the contest.

Thanks to the high school teachers who volunteered their time to promote the contest and enter teams.

Thanks to the high school students who are competing today.

Introduction

Welcome to the UMW CPSC High School Programming Contest in 2022. We hope that you have fun. If you have questions during the contest, please ask. There is not a specific metric for easy / hard, but the problems are generally ordered from easiest to hardest.

The scene of this year's contest is the quaint town of Maryburg, which is home of Youemdubya College. The Computer Science Department at Youemdubya is one of the best in the world. As a result, the town of Maryburg is becoming a hub with many technology companies. Jennifer the mayor of Maryburg is thrilled that Youemdubya is the center of the economic growth. Several of the technology companies in Maryburg are Huggle, a company that specializes in searching for and providing virtual hugs; Yucyborg, which used to make vacuum cleaners, but now makes robots; Banana which builds and sells old-style rotary phones that somehow are the rage of a new generation; Sahara is a virtual shopping mall in which all the cool people hang-out; and Mata, which used to be Mugtome, is transitioning from creating mugshots to answering the question, "What's the mata?" In addition to becoming a technology center, Maryburg is the home port of the famous pirate ship Jaffyboat. For the most part, Maryburg townies, Youemdubya students, Jaffyboat pirates, and the technology people get along; however, there are some problems. The problems include various tidbits about life in Maryburg.

- Yucyborg created a robot dog that tells lies.
- Old man Matt Ure is really old.
- Professors Ann E. Walt and Veena create problems for their students.
- Bitmoola may replace paper currency.
- Cora Programadora creates PassBird
- Is Matt Ure an ancient pirate?
- Covid paraphernalia can be exchanged for Bitmoola.
- You create softball and bowling teams in Maryburg.
- You can win a prize by climbing the square spiral staircase.
- You elect a new mayor of Maryburg.

Maybe the problems and tidbits will influence you to visit Maryburg and Youemdubya, which is a wonderful college with an outstanding computer science department, where all CS majors get personalized attention from the professors.

Problem A - **Practice** - How Old is Jaqarue

Jiffy and Jaffy are residents of Maryburg. Jiffy, Jaffy, and all of their friends love rotary phones and recently moved to Maryburg to work for the company Banana. Also, Jaffy is intrigued because Maryburg is the home port of the pirate ship JaffyBoat. They have an uncle named Jaqarue (pronounced Jack-A-Roo). His given name is Jaque, but in college he did extensive field work in Australia studying kangaroos, where he received the nickname Jaqarue. Jaqarue's speciality is Red Giant Kangaroos. Jaffy is 19 years old. Uncle Jaqarue is 49 years old. Write a program that given Jaffy's age, the program prints Uncle Jaqarue's age.

Input

Input is a single, non-negative integer that is Jaffy's age.

Output

Output is one line that is the age of Jaqarue.

Sample Input 1

```
10
```

Sample Output 1

```
Uncle Jaqarue is 40 years old.
```

DO NOT SCROLL DOWN UNTIL THE CONTEST STARTS

Problem B - Fidōcchio

The company Yucyborg, which used to make robotic vacuum cleaners, recently completed its first robotic dog - Fidōcchio. Fidōcchio will be a wonderful companion because Fidōcchio does all of the things a living dog does and also talks. You can have a conversation with Fidōcchio.

> You, *“Fidōcchio, I do not feel like going to school today.”*
> Fidōcchio, *“I think you should stay home and play with me.”*
> You, *“What shall we play?”*
> Fidōcchio, *“Let’s play fetch. I will throw a ball, and you bring it back to me.”*
> You, *“That sounds like more fun than school.”*

During testing, the Yucyborg programmers discover that Fidōcchio tells lies. The originally created Fidōcchio has a nose that protrudes 1 inch from its face. Everytime, Fidōcchio tells a lie, its nose grows two inches. You need to write a program that determines the size of Fidōcchio’s nose based on the number of lies Fidōcchio tells.

Input

Input is a single, integer that is the number of lies Fidōcchio tells.

Output

Output is a single, non-negative integer that is the length of Fidōcchio’s nose.

Sample Input 1

```
1
```

Sample Output 1

```
Fidochio's nose is 3 inches!
```

Sample Input 2

```
10
```

Sample Output 2

```
Fidochio's nose is 21 inches!
```

Problem C - Old Man Matt Ure

Matt Ure is known in Maryburg to be the oldest pirate on the pirate ship JaffyBoat. People do not know Matt Ure's age, but they know he is old. One day in the local coffee shop, Matt Ure was talking to Susan Platano, the CEO of Banana, the company that makes rotary phones. Susan Platano is worried that the rotary phone business may soon tank. Susan Platano wants to expand Banana's business. Matt Ure casually tells Susan Platano that he is over 700 years old. Mesmerised, Susan has Matt tell his story, thinking he may have something she can use to expand Banana's business. On an ancient pirate trip, Matt discovered the Baby Boulder, a legendary stone with astonishing powers. The Baby Boulder transforms any metal into pure gold. It also produces the Elixir of Life, which will make the drinker immortal, provided the drinker continuously drinks Elixir of Life. Matt Ure uses the Baby Boulder to produce the Elixir of Life, which has kept him alive since the 14th century up until the present day. Matt is planning a trip to Disneyworld because he wants to ride the Pirates of the Caribbean. Matt does not want to take the Baby Boulder with him because he fears losing it or having it stolen. Instead he makes just enough Elixir to take with him for his trip. One liter lasts Matt 12 days.

Matt has asked you to write a program that will calculate how many liters of Elixir he needs to make for a trip lasting N days. For instance, if N is 15, then he needs 2 liters of Elixir.

Input

Input is a single positive integer N giving the number of days the trip lasts.

Output

Output is a single integer giving the number of liters of Elixir Matt Ure needs for the trip. He only ever makes the Elixir in liter quantities, so your output must be an integer.

Sample Input

15

Sample Output

2

Problem D - Cora Programadora

Cora Programadora took an introductory computer science class at Youemdubya with Professor Finlayson. Cora Programadora loved the class and decided to major in computer science. She put her new knowledge to use and created an extensive collection of firewalls surrounding her photo library. The firewalls are similar to many concentric circles with her photo library in the

middle. Cora must unlock each of the concentric circle firewalls to get to her photo library. Cora Programadora has a password for each of her firewalls. Since Cora is still learning, the password for each firewall is the same; however, Cora does not know the password and it is encrypted in a file on her laptop. In addition to computer science, Cora Programadora is studying ornithology. Cora wrote a program - PassBird - that reads the encrypted password and stores it to be used when opening a firewall. A password in PassBird can only be used to open one firewall. Once a password in PassBird is used, it is gone; however, PassBird can read the encrypted password many times, storing multiple instances of the password. With enough passwords in PassBird, Cora Programadora can open all of her firewalls and view her photo library.

You must write a program that takes in the number of passwords in PassBird and the number of firewalls surrounding Cora Programadora's photo library. You must then decide if Cora has enough passwords in PassBird to view her photo library, as well as the number of extra passwords in PassBird (if any). If Cora Programadora does not have enough passwords in PassBird to view her photo library, you must print the number she needs to find.

Input

The first line of input is the number of passwords in PassBirds. The second line is the number of firewalls surrounding Cora Programadora's photo library.

Output

If Cora has exactly enough passwords to get through the firewalls, you must output "PassBird has the correct number of passwords."
If Cora has more passwords in PassBird than needed, you must output "Cora Programadora views her photo library with X extra passwords in PassBird." where X is the number of passwords left in PassBirds after opening each firewall.
If Cora does not have enough passwords in PassBird to open all firewalls, you must output "Cora Programadora needs X more passwords in PassBird to view her photo library." where X is the number of additional passwords she needs to find to open all of the firewalls.

Sample Input

```
11
8
```

Sample Output

```
Cora Programadora views her photo library with 3 extra passwords.
```

Problem E - Jaffy Destroyers

There is a pirate on the pirate ship JaffyBoat named Elongated Musketeer who has become bored with pirating. Elongated has amassed considerable wealth as a pirate. Elongated sponsors several Musketeer Scholarships at Youemdubya College. Elongated decides to form a company, Pirate Galaxy, to journey into space. Elongated convinces Jaffy Beesos, the CEO of Sahara, to join his Pirate Galaxy. You may recall that Sahara is a virtual shopping mall in which all the cool people hang-out. Jaffy Beesos' family has pirate ancestors. In fact, JaffyBoat is named after Jaffy's great-great-great grandfather.

Elongated Musketeer and Jaffy Beesos decide to build large spaceships, named Jaffy Destroyers, to patrol the galaxy, and hopefully collect some booty. Ironically there are pirate ships in space that attack the Jaffy Destroyers with lasers. The Jaffy Destroyers have powerful shield generators which protect the ship from most laser attacks.

The shield generators on Jaffy Destroyers have an adjustable strength. Laser power which is less than or equal to the strength of the shield is repelled, while higher laser power does damage. Additionally, multiple concurrent laser attacks have an additive effect. For instance, if two space pirate fighters attack a Jaffy Destroyer with lasers of magnitude 5, then the shield will need to have a strength of at least 10.

Running the shield at higher strengths uses more energy, so ideally the Jaffy Destroyer would set it at, or just over, the minimum strength needed to repel each attack. Elongated Musketeer and Jaffy Beesos ask you to write a program to determine the minimum strength needed by the shields in order to repel a Rebel attack.

Input

Line 1 - An integer, N, given the number of laser shots which is between 1 and 100
The next N lines contain N integers giving the magnitude of each shot.

Output

The output of your program must be a single line giving the minimum strength which the shields need to be in order to repel all of the shots. The format should be "The shield strength must be at least S." where S is the minimum strength of the shield.

Sample Input

```
5
5
1
5
```

```
5
2
```

Sample Output

```
The shield strength must be at least 18.
```

Problem F - Professor Ann E. Walt

Professor Ann E. Walt is teaching an introductory computer science class at Youemdubya. The problem consists of reading two files. The first file contains a list of unique words - for example, red green hello. The second file contains a sequence of words, where each word is from the first file. The initial problem has students count the occurrences of the words from the first file that are in the second file. An example output is red:10, green: 4, hello:12. The second problem examines the words in the second file one at a time. The problem is to compute the minimal number of words that must be examined before discovering a repeated word.

Input

The first line of input gives the number of words in Professor Ann E. Walt's first file. Next will be one line of input for each word giving the number of times that word appears in the second file.

Output

You must output "`You must examine X words in the second file.`", where `X` is the minimum number of words that must be examined to guarantee a repeated word.

Sample Input

```
3
7
1
9
```

Sample Output

```
You must examine 4 words in the second file.
```

Problem G - Professor Veena

Professor Veena Ravishankar likes Professor Ann E. Walt's problem, but Professor Veena's class is more advanced than Professor Ann E. Walt's. Professor Veena uses two files like Professor Ann E. Walt. The first file contains a list of unique words - for example, `red green hello`. The second file contains a sequence of words, where each word is from the first file. In addition, the second file contains reversed words from the first file. For example, the second file may contain `red green der green neerg`. The problem is to compute the minimal number of words that must be examined before discovering a pair of words where they are forward (`red`) and reversed (`der`).

Input

The first line of input gives the number of words in Professor Veena's first file. Next will be one line of input for each word giving the number of times that the pair of words - forward and reversed - appears in the second file.

Output

You must output "`You must examine X words in the second file.`", where `X` is the minimum number of words that must be examined to guarantee a pair of forward and reversed words.

Sample Input

```
3
5
3
2
```

Sample Output

```
You must examine 11 words in the second file.
```

Problem H - Bitmoola

Huggle, the company specializing in virtual hugs, has amassed an enormous amount of customers. They decide to create their own crypto currency - Bitmoola - that customers will use to search for and purchase virtual hugs. Huggle has a wide variety of virtual hugs with an equally wide pricing range so Huggle has created three crypto coins. Câlins et Bisous, the CEO of Huggle has asked you to help her by writing a program that exchanges Bitmoola crypto coins.

Bitmoola has three types of crypto coins: Galleons, Sickles, and Knuts. The Galleon is worth the most. One Galleon is worth 17 Sickles, and one Sickle is worth 29 Knuts. So one Galleon is also worth 17×29 = 493 Knuts.

When exchanging Bitmoola crypto coins, Huggle provides the customer as many of the more valuable coins as possible. For instance, instead of giving a customer 200 Knuts, the exchange gives them 6 Sickles and 26 Knuts. Ms. Bisous has asked you to write a program that is given some number of Galleons, Sickles, and Knuts, the program computes the same total value, but using as many valuable coins as possible.

Input

Input consists of the three lines, each containing a single non-negative integer. The first line is the number of Galleons, the second line is the number of Sickles, and the third line is the number of Knuts. Taken together, they provide the total value that needs to be exchanged.

Output

Output consists of three lines, each containing a single non-negative integer. The first line is the number of Galleons, the second line is the number of Sickles, and the third line is the number of Knuts. Taken together, they should equal the same monetary value as the input, but use as many larger value coins as possible.

Sample Input

```
1
16
210
```

Sample Output

```
2
6
7
```

Problem I - Bitmoola Investing

Investing in Bitmoola can be risky. Bitmoola has three crypto coins - Galleons, Sickles, and Knuts; however, all investments are in knuts because you have to be nuts to invest in Bitmoola. Never-the-less, Mary Washington is a shrewd investment broker who has convinced many in Maryburg to invest in Bitmoola. You use a special button on your rotary phone to invest. The

button connects you directly to Mary Washington's investment computer. After pressing the button, you dial the amount of knuts you want to invest. Mary Washington's investment computer extracts the knuts from your bank account.

Investment values are computed weekly. Each week the number of knuts lost is equal to the **ceiling** of the initial investment divided by 20. Each week the number of knuts gained is equal to the **floor** of the initial investment divided by 16. At the end of the week, Mary Washington (the investment broker) takes 3 knuts for pay; however, if there are fewer than 10 knuts in the investment at that time, Mary Washington waives her fee. The **ceiling** and **floor** rules are applied to the investment at the beginning of the week, prior to Mary's fee.

Mary Washington has asked you to write a program to determine the value of an investment after a specific number of weeks. Your program's input is the initial knut investment and the number of weeks you want to invest. Your program must determine the number of knuts, if any, in the investment after that number of weeks have passed.

Terminology

The homes in Maryburg have floors and ceilings, but that is not what the terms in this problem mean.

- **floor** - the greatest integer less than or equal to a floating point number. For example, 2 is the floor of 2.13.
- **ceiling** - the smallest integer greater than or equal to a floating point number. For example, 3 is the ceiling of 2.13.

Input

Input consists of two lines. The first line is an integer giving the number of knuts invested. The second line is the number of weeks after which you must report the value of your investment.

Output

The output must report the total number of knuts after the given number of weeks. The format must be "`After Y weeks there are B knuts.`" where `Y` is the number of investment weeks, and `B` is the number knuts. If the investment has shriveled away to nothing by the time the given number of weeks have passed, you must print "`After Y weeks there are no more knuts!`".

Sample Input

```
75
10
```

Sample Output

```
After 10 weeks there are 43 knuts.
```

Problem J - Ancient Pirates

Coco, the captain of the pirate ship JaffyBoat, has discovered a chest full of pirate archives. In the archives are records of many pirates. Coco wants to determine how long the pirates in the archives lived to determine a way to estimate the age of Matt Ure. Unfortunately, the exact dates that these pirates were born or died are not known for sure. For instance Merlin is known to have been born sometime between the years 1050 and 1100, and to have died some time between 1225 and 1250. So Coco concludes that Merlin lived at least 125 years and at most 200 years. Coco has contacted Mickey Iceberg, the CEO of Mugtome. Coco wants Mickey Iceberg to determine the age ranges of these long forgotten pirates. Mugtome engineers are busy answering the question, “What’s the mata?” so Mickey Iceberg has contracted you to write a program that determines the minimum and maximum age of a list of pirates based on the earliest and latest dates that they are known to have been born or died.

Input

Line 1 - An integer, N, giving the number of pirates with their year ranges.
The next N lines contain the N pirates and years born and died. Each of these lines starts with the name of the pirate (containing no spaces), followed by 4 integers. The first two of these give the earliest and latest year the pirate may have been born. The second two integers give the earliest and latest year they may have died.

Output

The output must be N lines, one for each pirate. Each of these must be in the format `"NAME lived to between the ages of MIN and MAX."`, where `NAME` is the name of the pirate, and `MIN` and `MAX` are the minimum and maximum life span the pirate could have lived.

Sample Input

```
3
Merlin 1050 1100 1225 1250
Matey -25 10 72 86
Peggy -600 -575 -530 -530
```

Sample Output

```
Merlin lived to between the ages of 125 to 200.
Matey lived to between the ages of 62 to 111.
```

`Peggy lived to between the ages of 45 to 70.`

Problem K - The Covid

The residents in Maryburg are feeling much better that the Covid cases are trending downward. It is a good thing because the WHO ran out of Greek letters to name the variants. Everyone is happy that Covid appears to be waning. Unfortunately, the residents have an abundance of covid paraphernalia cluttering their homes, apartments, and dorm rooms. Fortunately, the government has created a buy-back program that allows you to return covid paraphernalia for Bitmoola. Congress has authorized a google of Sickles for the Covid Organized Overflow Paraphernalia Exchange Radeau - which on windy days is popularly known as Gusty Cooper.

The Covid paraphernalia and their corresponding Sickle values are given in the following exchange list.

Paraphernalia Returned	Sickles Given
Basic Mask	One quarter of a Sickle
Rubber Gloves	One quarter of a Sickle
Hand Sanitizer	One half of a Sickle
N95 Mask	Three quarters of a Sickle
Covid Test	One and a quarter Sickles
Toilet Paper	One and a half Sickles

The government has established an exchange site in a large building on the campus of Youemdubya. There is one government representative, Ms. Bea Crat. The government hired several students who examine the returned paraphernalia and provide the Sickles into the residents' crypto wallet. The government accepts paraphernalia that are not on the exchange list; however, these paraphernalia must be examined by Ms. Bea Crat.

Your program reads a list of Covid paraphernalia that a resident exchanges. If all of the paraphernalia are on the exchange list, your program must calculate the total value of the paraphernalia, and output it. If the resident has brought any paraphernalia that are not on the exchange list, your program must output "`Get Ms. Bea Crat`" so that Ms. Bea Crat can examine the paraphernalia to determine if it qualifies for an exchange. You must output the total Sickles using simplified fractions. For instance, instead of "`2 quarter Sickles`", you must output "`1 half Sickle`", and instead of "3 half Sickles", you must output "`1 and 1 half Sickles`". Also be sure you use correct plurality.

Input

Line 1 - An integer, N, giving the number of paraphernalia to be exchanged.
The next N lines contain the name of the paraphernalia the resident has brought. The item names may contain spaces, but will not exceed 100 characters in length.

Output

Your output is one of two lines. You must output `"Get Ms. Bea Crat"`, in the case when at least one item is not on the exchange list, or the number of Sickles the resident receives. If the resident has earned a whole number of Sickles, you should output `"X Sickles"` where X is the number of Sickles. If the resident is awarded less than one whole Sickle, you must output either `"X quarter Sickles"` or `"X half Sickles"`. In these cases, if `X` is 1, then you must not pluralize `"Sickles"`. If the number of Sickles is larger than 1, but not a whole number (i.e. a mixed number), then you must output either `"X and Y quarter Sickles"` or `"X and Y half Sickles"` where `X` is the number of whole Sickles and `Y` is the number of quarter or half Sickles.

Sample Input 1

```
4
Basic Mask
Hand Sanitizer
Basic Mask
Covid Test
```

Sample Output 1

```
2 and 1 quarter Sickles
```

Sample Input 2

```
4
Basic Mask
Hand Sanitizer
Coupling Motivator
Covid Test
```

Sample Output 2

```
Call Ms. Bea Crat
```

Problem L - Mayor Election

Maryburg is electing a new mayor. There are many candidates. Voting will occur using a runoff voting system. In a runoff voting system, rather than selecting only one candidate, voters rank their preferred candidates in order. For example, when voting for the next Mayor of Maryburg, voters are presented with a list of candidates such as:

1. Jennifer Mayor
2. Coco Pirate
3. Jaffy Beesos
4. Elongated Musketeer
5. Fidocchio Robodog
6. Calins Bisous

A vote is cast by typing the numbers of the candidates in the preferred order. For example, if a delegate's first choice is Fidocchio Robodog, with Jennifer Mayor second, but they do not care about the other three candidates, they would vote: 5 1

Each integer corresponds to the number preceding a valid candidate on the ballot. No number should appear more than once on a single ballot. Also each number should be between 1 and the number of candidates. Ballots which do not meet these rules are called "spoiled ballots". Spoiled ballots are ignored when tabulating a winner.

When polling is complete, the outcome of the election is calculated as follows:

1. First, all the first-preference votes (on valid ballots) are counted.
2. After this count, if the number of votes for any candidate is more than half of the number of valid ballots, that candidate is declared the winner.
3. Otherwise, the candidate(s) with the fewest number of votes is (are) eliminated.
4. Ballots that contain a vote for an eliminated candidate are modified by deleting that candidate, thereby "promoting" any lower-preference non-eliminated candidates. For example, if a ballot is "1 5 3" and candidate 5 is eliminated, the ballot becomes "1 3".
5. If, after the elimination, there are any remaining candidates, the first-preference votes are counted again to determine a winner.
6. If, after the elimination, no candidates are left, the election is declared indecisive.

You must write a program to calculate the outcome of elections using this system.

Input

The first line of input contains two integers separated by a space. The first is the number of candidates, and the second is the number of ballots. There will be between 1 and 25 candidates and between 1 and 1000 ballots.

After that is the list of candidates, one on each line. Each of these lines has the candidate's number (starting at one and increasing), then a space, then the candidate's name. Each candidate's name will be at most 25 characters long.

Next comes the list of ballots. Each ballot consists of between 1 and 25 integers representing the order the voter prefers the candidates. These numbers refer to the numbers identifying each candidate in the ballot. The numbers are separated by spaces. You must check that the ballots are not spoiled before using them.

Output

As each candidate is eliminated, a message to that effect must be printed. If more than one candidate is eliminated in the same round (because they each had the minimum number of first-preference votes at that stage) then their eliminations should be output in the order in which the candidates originally were input. An elimination is recorded as "`[candidate] with [number] votes is eliminated.`"

Next your program should either declare the winner, as "`The winner of the election is [candidate].`" or declare that the election was indecisive by printing "`The election was indecisive.`"

Sample Input

```
5 11
1 Jennifer Mayor
2 Coco Pirate
3 Fidocchio Robodog
4 Calin Bisous
5 Jaffy Beesos
1 5 3
3 1 2
1 4 1
2
2 5 3
1 6
3 1 5
4 3
1 3
1 3 4 1
1
```

Sample Output

```
Jaffy Beesos with 0 votes is eliminated.
Calin Bisous with 1 votes is eliminated.
Coco Pirate with 2 votes is eliminated.
Jennifer Mayor with 3 votes is eliminated.
The winner of the election is Fidoochio Robodog.
```

Problem M - Softball Teams

Jennifer the mayor of Maryburg, Tray the president of Youemdubya, Coco the captain of the Pirate ship JaffyBoat, and Câlins et Bisous, the president of the Technology Consortium are organizing a softball game to promote harmony among the locals, Youemdubya students, the pirates, and the technology workers. The leaders have called residents to the central softball field, and are trying to organize two teams. There are lots of commotions among the participants with the better players trying to organize themselves on the same team. Several of the pirates can hit a ball a long way and they want to be on the same team. Jennifer, Tray, Coco, Câlins want the two teams to be somewhat equally competitive. They have an idea. Create a program that places the residents on two teams using the following criteria.

- Team 1 will have residents with odd-numbered ages, listed in ascending order (i.e., 1, 5, 7, 7, 9, 11, etc.) of age.
- Team 2 will have residents with even-numbered ages, listed in descending order (14, 12, 10, 10, 8, 6, etc) of age.

Input

Line 1 - An integer, N, giving the number of participants to be divided into two teams.
The next N lines contain the N participants at the softball game. Each line has the participant's name with a colon, then an empty space followed by the age, an integer.

Output

The first line must be `Team 1`. Following the `Team 1` line must be the odd-number aged participants ordered in ascending order. Following the oldest odd-number aged participant must be a blank line followed by a line with `Team 2`. Following the `Team 2` line must be the even-number aged participants ordered in descending order. Each line with a participant must contain the participant's name, a colon, a space, and then the integer age.

Sample Input 1

```
6
Anders: 9
```

```
Gwyneth: 14
Mikel: 10
Yareen: 13
Valen: 8
Doran: 5
```

Sample Output 1

```
Team 1
Doran: 5
Anders: 9
Yareen: 13

Team 2
Gwyneth: 14
Mikel: 10
Valen: 8
```

Problem N - Square Spiral Staircase

The downtown section of Maryburg has many historical buildings, restaurants, and antique stores. There is one large cuboid building, known as S^3, that stands out from the rest of the skyscrape. S^3 is the Square Spiral Staircase building. The footprint of S^3 is square, but the building is taller than it is square, which gives it the cuboid shape. The S^3 name comes from the internal square spiral staircase, where each step on the staircase has a number. The pirates on JaffyBoat are quite wealthy. They joined forces with the technology companies to create a prize for anyone who can mentally create a total from the values written on the steps of the square spiral staircase.

- Each step on the square spiral staircase has a step number and a value. The value is written on the step. You count the step number in your head as you step on them. The first step on which you step is number 1, the second is number 2, and so on.
- As you step on steps you create a running sum using the value written on the step. For odd numbered steps, you negate the value on the step before adding it to your sum. For even numbered steps, you use the value on the step as is and add it to your sum.
- Given that the last step is number N. If the value on the last step is equal to the total for steps 1 through N-1, you win a prize.

Input

Line 1 - An integer, N, giving the length of the side of the square spiral staircase. N will be less than or equal to 20.

The next N lines contain N integers separated by spaces, giving the numbers on the steps on the square spiral staircase.

Output

Your program must print `Prize` if the value on step N is equal to the total sum computed on steps 1 through N-1; otherwise, your program must print `No Prize`.

Sample Input 1

```
3
1 2 3
4 0 6
7 8 9
```

Sample Output 1

```
Prize!
```

Sample Input 2

```
4
1 2 3 4
5 7 6 8
9 10 11 12
13 14 15 16
```

Sample Output 2

```
No Prize!
```

Sample Input 2

```
4
1 2 3 4
5 7 6 8
9 -12 11 12
13 14 15 16
```

Sample Output 2

```
Prize!
```

Problem O - Four Teams

After the softball game was such a success, the leaders in Maryburg decide to create four teams for a bowling league. The leaders selecting the teams are (1) Jennifer - the mayor of Maryburg, (2) Tray - the president of Youemdubya, (3) Coco - the captain of the Pirate ship JaffyBoat, and (4) Câlins et Bisous - the president of the Technology Consortium.

The bowling league participants are “sorted” into one of the four teams using an algorithm created by Al Gore Rhythm, formerly a pirate but has recently graduated from Youemdubya with a computer science degree. The technology company Yucyborg sponsors a scholarship program for pirates who want to change their pirating ways. Each of the four leaders selected a trait which they want their bowling team members to have in common so that their teammates get along better. For Jennifer, the trait is bravery, for Tray the trait is dedication, for Coco the trait is intelligence, and for Câlins the trait is ambition. Al Gore Rhythm’s algorithm judges which trait the participant best exhibits and places them on a bowling team based on that.

The technology companies Banana, Huggle, and Mugtome have been collecting data on everyone in Maryburg. This data has been used to assign a score for each trait from 0 to 100. Al Gore Rhythm’s algorithm uses the data for each participant in several steps.

1. First, the participant scores on traits are normalized as a percentage of their total points. For instance, if the participant has a 60 for bravery, 45 for dedication, 55 for intelligence, and 40 for ambition, each value is divided by the participants' total points (200 in this case). This normalizes the trait scores to be .3, .225, .275 and .2.
2. Next, each leader takes turns in a round-robin fashion, selecting the remaining participant with the highest normalized score in that team's preferred trait. For instance Jennifer selects the participant with the highest score for bravery, while Tray selects the participant with the highest score for dedication.
3. The leaders drew straws to determine the order of selecting participants, which is Jennifer, Tray, Coco, and Câlins. After each round, it goes back to Jennifer’s turn again. This process repeats until all of the participants have been selected.
4. In the event of a tie - where two participants have an identical score in some category - the one whose name comes first alphabetically must be chosen.

You must write Al Gore Rhythm’s algorithm.

Input

Line 1 - An integer, N, giving the number of participants to be sorted onto teams.
The next N lines contain the N participants to be sorted onto teams. Each of these lines begin with a string that is the name of the participant. After that will be four integers (in the range 0 through 100), giving the participants scores for bravery, dedication, intelligence and ambition, in that order.

Output

The output must consist of the list of participants assigned to each bowling team. Each bowling team is identified by the name of the leader. Each bowling team's name followed by a colon must be printed on a line by itself. Then each participant in that bowling team must be printed in alphabetical order. There must be a blank line between each bowling team, and the bowling teams must be listed in the order Jennifer, Tray, Coco, and Câlins.

Sample Input

```
8
Potter 95 90 80 70
Malfoy 50 40 80 90
Abbot 55 90 60 35
Goyle 25 15 20 60
Granger 90 85 90 80
Lovegood 70 70 85 25
Diggory 80 100 75 60
Chang 65 70 90 60
```

Sample Output

```
Jennifer:
Granger
Potter

Tray:
Abbot
Diggory

Coco:
Chang
Lovegood

Calins:
Goyle
Malfoy
```

Problem P - HowsApp

The pirates on the pirate ship JaffyBoat are secretive people. When sending messages to one-another, even over relatively mundane topics, the pirates use HowsApp to encrypt their messages to prevent others from reading their messages. After some research, the computer science students at Youemdubya discovered the pirates use an XOR cipher, which is based on the XOR binary operation defined in the following table.

A	B	A XOR B
0	0	0
0	1	1
1	0	1
1	1	0

With an XOR cipher, each character in the plain text message to be encoded is XOR'ed with a value called the key to produce the cipher text message. Then, when it is time for the other party to decode the message, each character in the encoded text is also XOR'ed with the key producing the original plain text message. The symbol **^** is the XOR operator[1]. For example, 1 **^** 1 is 0. The characters in the message and the key are ASCII. ASCII is a 7-bit encoding, which is often represented with 8-bits. The ASCII encoding for the letters A to Z are the numbers 65 (binary 01000001) through 90 (binary 01011010). The ASCII encoding for the letters a through z are the numbers 97 (binary 01100001) through 122 (binary 01111010). For an example encryption, the text "Ewok" is encoded and then decoded with the key 'G' (ASCII code 71 (binary 01000111) as follows:

```
     E         w         o         k
  01000101  01110111  01101111  01101011
^ 01000111  01000111  01000111  01000111
  00000010  00110000  00101000  00101100

  00000010  00110000  00101000  00101100
^ 01000111  01000111  01000111  01000111
  01000101  01110111  01101111  01101011
     E         w         o         k
```

Because using only one character for the key is very easily broken, the key can be as many as 8 characters long. When a longer key is used, the first character of the key is used to XOR the

[1] Java, Python, C, and C++ have ^ as a bitwise XOR operator.

first character of the message, then the second for the second and so on. If the key is shorter than the message, then the key repeats when it runs out.

For example if “Ewok” was encoded with a key of “Han”, then the E would be XOR’d by the H, the ‘w’ by the ‘a’, the ‘o’ by the ‘n’, and the ‘k’ by the ‘H’ again. You write a program that decodes text that Pirates have encrypted using this XOR cipher.

Input

The first line of input is the key that should be used for the decoding. If there are multiple letters, they will be separated with spaces. The second line is the message to be decoded, again each letter will be separated by spaces. The message will consist of fewer than 1000 characters.

Because some characters may not be printable once they have been encoded, each character of the input (the key and message) will be given as a decimal value for its ASCII code.

Output

The output must consist of one line giving the decoded message.

Sample Input

```
72 97 110
5 0 23 104 21 6 45 65 40 39 19 13 45 65 12 45 65 25 33 21 6 104 24 1 61 64
```

Sample Output

```
May the Force be with you!
```

Contest Input/Output

This guide contains the basic way of doing input and output in Java, Python, and C++. In programming contests, you perform I/O from/to the terminal screen. Do not open any files for input or output. Do not output any prompts. If a problem instructs you to read a line containing a number, just read the number - it will be there. Do not print a prompt like “Enter a number”.

Java Input

Input in Java can be done with the `Scanner` class which must be imported first:
`import java.util.Scanner;`
Then a `Scanner` object must be created:
`java.util.Scanner in = new java.util.Scanner(System.in);`
1. To read in one line of input into a string, use the scanner’s `nextLine` method: `String line = in.nextLine();`
2. To read in a single word into a `String`, stopping at a space, use the `next` method: `String word = in.next();`
3. To read a numerical value use the `nextInt` method for integers, or the `nextDouble` method for real numbers:

```
int number1 = in.nextInt();
double number2 = in.nextDouble();
```

Java Output

1. To output a `String` constant or variable, use the `System.out.println` function which takes one argument, prints it to the screen, then prints a new line:

```
System.out.println("This will be printed") // print a message
int x;
System.out.println(x); // print a value
```

2. To output something without a new line at the end, use the `System.out.print` function which outputs its argument with no newline:

```
// print a message with no new line
System.out.print("The value of X is ")
// print a value with no newline
int x;
System.out.print(x);
```

Python Input

1. The `input` function in Python reads in one line of input and returns it as a string.

```
line = input() # read in a string
```

2. In order to convert from a string to a number, you can use the int function for integers, or the float function for real numbers:

```
number = int(input()) # read in string and convert to int
```

3. In order to break a line of input into multiple strings, separated by spaces, you can use the `.split()` function which returns a list of strings:

```
line = input() # read in whole line
words = line.split() # split line into strings based on spaces
```

Python Output

1. Output in Python is done with the print function which outputs all of its arguments, separated by spaces, and puts a newline at the end:

```
print("X is equal to", x) # print msg, number, and new line
```

2. In order to prevent print from putting spaces between each item, pass sep=' ' as an arg:

```
print("X is equal to", x, sep= ) # no space between msg and value
```

3. In order to prevent print from putting a new line at the end, pass end=' ' as an argument:

```
print("X is equal to", x, end= ) # no new line added
```

C++ Input

1. To skip over whitespace (spaces or new lines), and read in a single value (such as an integer or string), use `cin >> value;`

```
int number;
cin >> number; // read one integer
char str1[100];
cin >> str1; // read one character string
string str2;
cin >> str2; read one string object
```

2. To read in one entire line of input, which may contain spaces, use `cin.getline`.

```
char str1[100];
cin.getline(str1, 100) // read character string upto 100 chars
string str2;
getline(cin, str2); // read in a string object
```

C++ Output

Output is done with `cout <<` in C++ which can take any built-in data type. For example:

```
int x;
cout << "X is equal to " << x << endl; // print msg, int, new line
```