
CODE
WARS
2019

Summary

Mathematics teacher gave Srinath an assignment to determine the difference between the original number and its reverse. Can you write a program to help Srinath complete his assignment?

Problem **1**
Reverse Difference
+4 Points

Input

Any positive number N.

Output

Print the signed difference between the number and its reverse.

Constraints

$0 < N < 10^6$

Sample Input #1

```
321
```

Sample Output #1

```
198
```

Sample Input #2

```
125
```

Sample Output #2

```
-396
```

Summary

Problem **2**

Match nuts with bolts

+4 Points

Tony ordered a self-assembly wooden toy from his favourite online store which has arrived today. The wooden toy contains many nuts and bolts which are of different sizes and shapes. To assemble the toy, he needs to pair the nuts with the matching bolts.

Write a program to help Tony match the nuts with bolts.

Each nut is represented by a unique alphabet within the alphabet range A to Z. Each corresponding bolt is represented by numbers from 1 to 26. For e.g., the nut A matches to bolt 1.

Input

The first line contains the number of nuts and bolts N. The second line contains alphabets A_1, A_2...A_n separated by spaces denoting the nuts. The third line contains numbers B_1, B_2...B_n separated by spaces denoting the bolts.

Output

Print the bolts in one line separated by spaces in the order matching the nuts specified in the input. If any bolt does not match with the nut print `Could not match nuts to bolts`.

Constraints

$0 < N < 27$

Sample Input #1

```
9
A X Y B D E F I U
9 6 21 5 4 2 1 25 24
```

Sample Output #1

```
1 24 25 2 4 5 6 9 21
```

Sample Input #2

```
6
U J M H T F
10 21 5 6 12 14
```

Sample Output #2

```
Could not match nuts to bolts
```

Summary

Problem *3*
Higher Powers
+4 Points

Surya, a 7th standard student is playing simple math game with his twin sister Tanya. The game is about one person telling 2 integers (N & K) and the other having to reply with "Yes" or "No" depending on whether N is a power of K. As the questions are getting harder to calculate mentally, help Surya and Tanya write a program to do this calculation quickly.

Input

The input consists of a single line N and K positive numbers separated by space.

Output

If N is a power of K, print `Yes` otherwise print `No`

Constraints

$0 < N, K < 10^6$

Sample Input #1

```
9 3
```

Sample Output #1

```
Yes
```

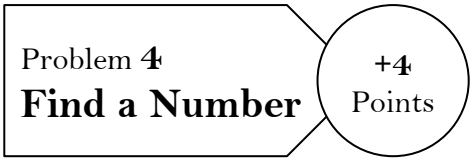
Sample Input #2

```
25 4
```

Sample Output #2

```
No
```

Summary



Drithi and Jivika are playing with numbers during the summer time. Both are very good at number games but they place a bet on finding out the answer in the least amount of time. The game involves knowing basic mathematics like Highest common factor (HCF) and Least Common Multiple (LCM) of two numbers. If HCF and LCM of two numbers are given and one of the numbers is provided, find out the other number.

Highest Common Factor (HCF) of two numbers is the greatest number that divides each of them exactly. Least Common Multiple (LCM) is the lowest number which is exactly divisible by each one of the given numbers.

Can you beat Drithi and Jivika by writing a program to find the second number given HCF, LCM and one of the number?

Input

A single line contains the HCF H, LCM L and number A separated by space.

Output

Print the second number.

Constraints

$0 < A, H, L < 10^6$

Sample Input #1

```
13 1989 117
```

Sample Output #1

```
221
```

Sample Input #2

```
8 6784 128
```

Sample Output #2

```
424
```

Summary

Problem **5**
Prime Lottery
+6 Points

Rishab tries his luck at a lottery event where he needs to pick an odd number of balls from a bag. Each ball in the bag has a unique number printed on it. He then needs to arrange the balls he selected in ascending order. If the number printed on the middle ball turns out to be a prime then he wins a prize.

Can you help Rishab in finding if he won or not?

Input

The first line contains an odd number N specifying the number of balls.

The second line contain $A_1, A_2 ... A_n$ numbers separated by a space.

Output

Print `Won` if the number printed on the middle ball is prime otherwise print `Better luck next time`.

Constraints

$2 < N < 10^3$ where N is odd

$0 < A_1, A_2 ... A_n < 10^6$

Sample Input #1

```
7
12 4 7 5 1 15 8
```

Sample Output #1

```
Won
```

Sample Input #2

```
3
14 6334 654
```

Sample Output #2

```
Better luck next time
```

Summary

Problem **6**

Greatest Common Divisor (GCD)

+6 Points

Ram and Shyam are brothers who recently learnt about Greatest Common Divisors (GCD) at school. Ram brags that he can instantaneously determine the GCD of any set of numbers. Shyam takes him up on his challenge and starts formulating different sets of numbers for Ram to calculate. Can you help Ram to determine the GCD based on the input set of numbers?

Greatest Common Divisor of a set of numbers is the largest positive integer that divides all the numbers in that set.

Input

The first line contains an integer N denoting the number of elements. The second line contains N numbers $A_1, A_2 \ldots A_n$ separated by space for which GCD needs to be calculated.

Output

GCD of the N numbers.

Constraints

$1 < N < 100$

$1 < A_1, A_2 \ldots A_n < 10^6$

Sample Input #1

```
4
484 726 1452 4356
```

Sample Output #1

```
242
```

Sample Input #2

```
2
999 998001
```

Sample Output #2

```
999
```

Summary

Problem **7**
Last Man Standing
+6 Points

After losing in battle, a ruthless Roman General has N men left, but is cornered on all sides. His only way of escape is through a small boat which can carry only two people. He has no option but to select 1 out of his remaining N men to accompany him back to Rome.

He chooses to devise a plan to decide a random winner.

He orders all N soldiers to be numbered and to form a circle in the order of their numbers. Number 1 is given a sword and he must kill the next soldier (i.e. soldier numbered 2) and give the sword to the next surviving soldier (i.e. soldier numbered 3). All soldiers have to do the same until only one of them is left. Which soldier survives at the end?

Input

The number N denotes the number of soldiers remaining.

Output

The assigned number of the last surviving soldier.

Constraints

$0 < N < 10^6$

Sample Input #1

```
100
```

Sample Output #1

```
73
```

Sample Input #2

```
10
```

Sample Output #2

```
5
```

Summary

Problem **8**
Generate Random Password
+8 Points

Arnab has an online account which requires him to change his password every month. He wants to create a program to help him generate the password.

He comes up with an algorithm to generate all combinations of strings of a fixed length using only the starting letter and ending letter of his name (A & B). To randomize the password selection, he then sorts the list in lexicographical (ascending) order and chooses a string at a random position.

Help Arnab implement this algorithm.

For example:

Consider the length of password to be 3 for which Arnab generates all the combinations of strings. He sorts them in ascending order and then picks a password at 2nd position.

The sorted possible strings of length 3 with characters A and B are as follows:

AAA, AAB, ABA, ABB, BAA, BAB, BBA, BBB

The string at index 2 is AAB

Input

The first line contains the length N of the password.

The second line contains the index M of the string to be picked from the sorted list of strings (consider the first item as index 1).

Output

Print the chosen password.

Constraints

$0 < N < 10$

$0 < M < 2^N$

Sample Input #1

```
3
2
```

Sample Output #1

```
AAB
```

Sample Input #2

```
4
7
```

Sample Output #2

```
ABBA
```

Summary

Problem **9**

Cricket World Cup Finals

+8 Points

India and Pakistan are playing the finals of 50 over cricket World Cup 2027 but the match finished in a tie. According to the rules of the tournament, the winner will be decided via a 6-ball super over. In the super over, a maximum of 3 players can bat and only 1 bowler can bowl. If the batting team loses 3 wickets in the super over, their innings is over.

India has won the toss and will bat first in the super over while Pakistan will be chasing. The team that scores the highest number of runs in the super over wins the cup. The result of the super over can be a tie as well in which case, the cup will be shared between the teams (India & Pakistan).

Given the ball by ball scoring by two teams as input for the super over after the completion of the match, find out which team has won. The standard cricket conventions define that “w” stands for the wicket, “W” stands for wide, “N” stands for no ball, “L” stands for leg before wicket and “H” stands for hit wicket. Please note that the conventions are case sensitive. A number and alphabet can appear together. For example, N6 means a six has been hit off a no-ball and accounts for 7 runs and an extra delivery. Similarly 2w stands for 2 runs was scored but also a wicket fell and 5W means 6 runs and an extra delivery.

Input

The first line denotes the ball by ball scoring for team India separated by spaces.

The second line denotes the ball by ball scoring for team Pakistan separated by spaces.

Output

Print the name of the winning team. In case of a tie, print `India & Pakistan`

Constraints

For any ball, the input can have a maximum of two characters. For example, `N6` or `4w` (the order of the characters does not matter)

Consider the maximum allowed deliveries in an over is 100 (keeping in mind the wides and no-balls).

Sample Input #1

```
2 2 w 1 4 6

W 6 4 0 6
```

Sample Output #1

```
Pakistan
```

Sample Input #2

```
5W w 6N 2 L 2 4 6

6 6 6 6N w w 0
```

Sample Output #2

```
India
```

Summary

Problem **10**
Circular Prime Numbers
+10 Points

Roger is doing his major in mathematics and his next assignment is to come up with an algorithm to find circular primes.

A circular prime is a very special kind of prime number because all rotations of the digits are prime numbers themselves.

For example, 197 is called a circular prime because all rotations of the digits: 197, 971, and 719, are themselves prime.

Roger wants to find the number of circular primes from 2 to a given number N. Can you help him write a program for this?

Input

A number N.

Output

Number of circular primes from 2 to N.

Constraints

$1 < N < 10^6$

Sample Input #1

```
100
```

Sample Output #1

```
13
```

Sample Input #2

```
84
```

Sample Output #2

```
12
```

Summary

Problem **11**
Palindrome Permutations
+10 Points

Anna likes palindromes ever since she got to know that her name was one.

Her favourite author is James Joyce who coined “tattarrattat” (to mean “a knock on the door”) which is the largest English palindromic word.

She wants to write a book using words which have as many palindromes within them as possible. For example, from the word “racecar”, 6 palindromic permutations can be generated which are racecar, carerac, acrerca, rcaeacr, craearc and arcecra. While from the word “abracad” no palindromic permutations can be generated.

Can you help her create a program to determine how many palindromic permutations can be generated for any input string using all the characters?

Input

A line containing string S.

Output

Number of possible palindromic permutations using all characters present in input string S.

Constraints

$1 < \text{length}(S) < 100$

Sample Input #1

```
fglklgk
```

Sample Output #1

```
6
```

Sample Input #2

```
abracad
```

Sample Output #2

```
0
```

Summary

Guru, an engineering student is reading about various classes that IPs (IPv4) are classified into. Being a programmer, he wants to develop a program to validate the IP address and classify it. Please help Guru.

Problem **12**
Validate IPv4 Address
+10 Points

IPv4 Address and Classful Networks

An IP address is binary numbers but can be stored as text for human readers. For example, a 32-bit numeric address (IPv4) is written in decimal as four numbers separated by periods. Each number can be zero to 255.

Originally IP addresses were divided into five classes as shown below.

Class	Start Address	End Address
Class A	1.0.0.0	127.255.255.255
Class B	128.0.0.0	191.255.255.255
Class C	192.0.0.0	223.255.255.255
Class D	224.0.0.0	239.255.255.255
Class E	240.0.0.0	255.255.255.255

In Class A there could be a set of loopback addresses as mentioned below:

Loopback	127.0.0.0	127.255.255.255

Input

The IP address in the format `a.b.c.d` to be validated.

Output

If IP address is invalid, print `Invalid`

If valid, print the class of IP address as `Class A` or `Class B` or `Class C` or `Class D` or `Class E`

Additionally, if the IP address is class A, indicate it as loopback in parenthesis, if it is a loopback IP address

`Class A (loopback)`

Constraints

$0 \leq a, b, c, d \leq 10^3$

Sample Input #1

```
10.1.1.1
```

Sample Output #1

```
Class A
```

Sample Input #2

```
127.0.0.1
```

Sample Output #2

```
Class A (loopback)
```

Summary

Problem **13**
Improve Wait Time
+12 Points

Acme bank is conducting a study to improve the wait times for customers in their branches. Each branch has different number of bank representatives serving their customers. Each bank representative is assigned an ID starting with `1`. Each customer takes varied amount of time to finish their required task. The priority is given to customers as first come first serve basis. The customer is always assigned a bank representative with the least ID when multiple representatives are free. Given the number of people in queue and the time taken by each individual, can you come up with a program to find the waiting time of a customer who just walked in and the ID of the bank representative who will be servicing the customer?

For example consider a branch that has `3` bank representatives and there are `5` customers already in the queue. If the five customers take `3, 2, 4, 1, 2` minutes respectively for their transactions, the wait time for a customer who just walks in would be `3` min and the bank representative serving the customer would be ID `2`.

<table>
<tr><th>Time Elapsed</th><th>Bank Representative 1</th><th>Bank Representative 2</th><th>Bank Representative 3</th></tr>
<tr><td>1</td><td rowspan="3">Customer 1 takes 3 mins</td><td>Customer 2 takes 2 mins</td><td rowspan="3">Customer 3 takes 4 mins</td></tr>
<tr><td>2</td><td rowspan="2">Customer 4 takes 1 min</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td><td rowspan="2">Customer 5 takes 2 mins</td><td>New Customer</td><td rowspan="2"></td></tr>
<tr><td>5</td><td></td></tr>
</table>

Input

The first line contains the number of bank representatives M and the number of customers N separated by spaces.

The second line contains N numbers $T_1, T_2 ... T_n$ representing each customer's time taken for their transaction separated by spaces.

Output

Print the wait time for a customer who just walked-in, and the bank representative ID servicing the customer separated by space.

Constraints

$0 < M, N < 10^3$

$0 < T_1, T_2 ... T_n < 10^3$

Sample Input #1

```
3 5
3 2 4 1 2
```

Sample Output #1

```
3 2
```

Sample Input #2

```
4 6
3 2 4 3 2 7
```

Sample Output #2

```
3 4
```

Summary

Problem **14**
Minimum Number of Platforms
+12 Points

Harish's father is in construction business. He recently got a government contract to construct railway station and platforms in their village. Due to budget constraints, his father needs to construct the station with minimum number of platforms based on the arrival and departure times of all the trains.

So, he asks Harish to come up with a program that gives minimum number of platforms given the list of various train's arrival and departure times, such that no train needs to be kept waiting for an available platform. Note that a train remains at a platform till it's departure time.

For e.g., considering that no trains are in the station and if 5 trains arrive at 12:00 noon, then there needs to be 5 platforms built.

Input

The first line contains the number of trains N passing through the station in a single day.

The second line contains the arrival times $A_1, A_2 \ldots A_n$ in the chronological order in 24 hour format time ($HH{:}MM$) separated by a space.

The third line contains the departure times $D_1, D_2 \ldots D_n$ corresponding to the order of arrival times of the train in 24 hour format time ($HH{:}MM$) separated by a space.

Output

Print the minimum number of platforms required to be built.

Constraints

$0 < N < 100$

$0 \leq HH < 24$

$0 \leq MM < 60$

Departure time cannot be earlier than arrival time.

Sample Input #1

```
6
9:00 9:40 9:50 11:00 15:00 18:00
9:10 12:00 11:20 11:30 19:00 20:00
```

Sample Output #1

```
3
```

Sample Input #2

```
4
7:00 8:00 9:00 23:58
7:10 8:15 9:20 23:59
```

Sample Output #2

```
1
```

Summary

Problem **15**
Cost Optimization
+12 Points

As a stock boy in a warehouse, Rishi is given a task of joining ropes of different lengths. He can join only two ropes at a time. The cost of joining two ropes is equal to sum of their lengths. For e.g., consider Rishi needs to join 4 ropes of lengths 4, 3, 2 and 6. He picks the ropes in the below order:

a) First he joins ropes with length 4 and 3. The cost incurred is 7
b) The remaining ropes are 7, 2 and 6. Then he joins 7 and 2 for which the cost incurred is 9.
c) The remaining ropes are 9 and 6. He then joins the last two ropes to incur a cost of 15.

The total cost of joining the ropes is 7 + 9 + 15 which comes up to 31.

However his boss wanted an optimized cost for joining the ropes. His boss believes the cost could have come down if Rishi had picked the ropes in a different order.

Write a program to help Rishi in calculating the minimum cost of joining the given set of ropes.

Input

The first line contains the number of ropes N.

The second line contains the lengths $L_1, L_2 \ldots L_n$ of the ropes separated by a space.

Output

Print the minimum cost incurred for joining these ropes.

Constraints

$0 < N < 100$

$0 < L_1, L_2 \ldots L_n < 10^3$

Sample Input #1

```
4
4 3 2 6
```

Sample Output #1

```
29
```

Sample Input #2

```
5
4 5 6 8 1
```

Sample Output #2

```
53
```

Summary

After being reincarnated recently, Julius Caesar dug up his hidden treasure and now wants to live a lavish life in the Roman countryside. He wants to rebuild the Colosseum and does not wish to spare any expense on the venture.

Problem **16**
Rebuild the Colosseum
+12 Points

While checking the prices of raw materials, he found strange markings instead of the Roman Numerals that he was used to. He is looking for a translator who can help him convert the Roman numerals to modern numbers so that he can budget out the rebuilding of the Colosseum.

Can you help Julius Caesar by writing a program to perform this conversion from the older Roman numeral system to the modern Decimal numeral system?

Standard Number	Roman Number
1	I
5	V
10	X
50	L
100	C
500	D
1000	M

Standard Number	Roman Number
5000	v
10000	x
50000	l
100000	c
500000	d
1000000	m

Input

Single line consisting of Roman numerals without spaces that represent a number N

Output

Print the equivalent number of N in decimal system.

Constraints

$0 < \text{DecimalValue}(N) < 10^6$

Assume N is a valid Roman numeral representation.

Sample Input #1

```
CMXCV
```

Sample Output #1

```
995
```

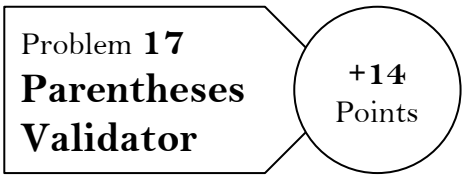
Sample Input #2

```
cxxMxDLXXVIII
```

Sample Output #2

```
129578
```

Summary



Siddarth is doing his final year project for B. Tech. in Computer Science and he decides to implement his own compiler that will behave exactly as any other programming language compiler. So, as a starting step, he needs to implement a parser that validates whether the various types of parentheses used in the program being compiled are in correct order or else, he needs to generate a compilation error.

For every type of opening parenthesis there should be a corresponding closing parenthesis in the order of opening parenthesis. Additionally each closing parenthesis needs to be preceded by its corresponding opening parenthesis.

The supported parenthesis pairs are "{", "}", "[", "]", "<", ">", "(", and ")"

Help Siddarth develop this parser.

Input

A string S containing only various types of parenthesis.

Output

Print `Valid` if the string S can be validated by the parser else print `Invalid`.

Constraints

$0 < \text{length}(S) < 10^3$

Sample Input #1

```
[]{(<>)}
```

Sample Output #1

```
Valid
```

Sample Input #2

```
{[}]
```

Sample Output #2

```
Invalid
```

Summary

Problem **18**
Measuring Jars
+16 Points

Amit runs a grocery store where he sells various grains. The store contains only a few measuring jars that can weigh the grains exactly. Amit uses a combination of these jars to get the required weight of grains requested by customers.

For e.g., if he has jars of 2 Kg and 5 Kg, for measuring 7 Kg he would require to use both the jars. For measuring 3 Kg, he would need to use 5 Kg jar and the 2 Kg jar. For measuring 4 Kg he would use 2 Kg jar twice.

Suppose there are many customers waiting in a queue with different quantities, help Amit to quickly serve his customers by using the minimum number of jars.

Input

The first line specifies the number of jars N in the store and the number of customers C waiting.

The second line specifies the various jars having weight $W_1, W_2 \ldots W_n$ available in the store separated by space.

The third line specifies the various quantities $Q_1, Q_2 \ldots Q_c$ required by the customers separated by space.

Output

For each customer print the minimum number of jars required to measure the grains, separated by space in the same order that is specified in the input. If for any customer there is no way to measure the weight of the grains using the jars then print "NA".

Constraints

$0 < N < 10$

$0 < C < 100$

$0 < W_1, W_2 \ldots W_n < 10^3$

$0 < Q_1, Q_2 \ldots Q_c < 10^3$

N, C, W and Q are whole numbers

Sample Input #1

```
3 4
1 2 5
8 4 16 12
```

Sample Output #1

```
3 2 4 3
```

Sample Input #2

```
3 5
8 10 12
15 20 26 28 2
```

Sample Output #2

```
NA 2 3 3 2
```

Summary

DNA molecules are composed of sequence of nucleotides (A Adenine, T Thymine, C Cytosine, G Guanine). The order of these nucleotides determine the DNA's genetic code.

Problem **19**
Gene Editing
+18 Points

In the year 2050, scientists have determined that palindromic sequences of these nucleotides correspond to viruses that cause diseases and they plan to use CRISPR gene editing tool to remove these viruses. However, it was discovered that if the virus was not completely removed, the virus survived.

In order to remove the virus completely, the largest palindromic subsequence needs to be removed first and remaining parts are concatenated. This process is continued till all viruses are removed.

If there are two palindromes of the same size at any step, we must remove the palindrome in lexicographical order.

Given a string containing part of the DNA sequence of an infected person, write a program to print all the palindromic sub-sequences that are removed in every step.

For e.g., given a sequence ATCGGCGATTCGCGCGCA following the below steps would result in a virus-free sequence.

- Step 1: The largest palindromic sub-sequence is CGCGCGC. Removing it results in ATCGGCGATTA.
- Step 2: There are two palindromic sub-sequences of same length (CGGC and ATTA) therefore, the sub-sequence ATTA (as ATTA comes ahead of CGGC lexicographically) needs to be removed. The resulting sequence is ATCGGCG.
- Step 3: The palindromic sub-sequence CGGC is removed resulting in the final virus-free sequence ATG.

Input

A string S containing the sequence of nucleotides `A`, `T`, `C` and `G`

Output

Print all the virus sub-sequences removed at each step separated by new line. Print "`No Virus Found`" in case there was no virus sub-sequence found in the given input.

Constraints

$0 < \text{length}(S) < 10^6$

Sample Input #1

```
ATCGGCGATTCGCGCGCA
```

Sample Output #1

```
CGCGCGC
ATTA
CGGC
```

Sample Input #2

```
ATAACACGGCAATTAAATATA
```

Sample Output #2

```
AATTAA
ACGGCA
ATA
ATA
```

Summary

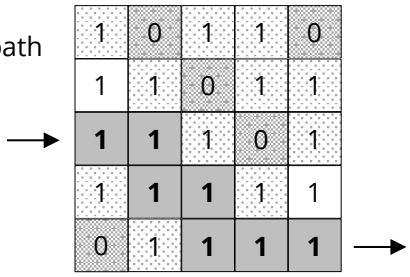
Problem **20**
Crossing a Minefield
+20 Points

During the allied invasion of Normandy, the brave allied forces have to navigate the landmines placed by the German Forces on the beach. This is critical to the allied forces winning the war. Thanks to their expert cryptographic readers, they have an idea about where the landmines are placed on the beach. Due to the sensitive nature of the landmine, they cannot step on the ground adjacent to the landmine either.

Given the minefield in a rectangular matrix of M x N size with landmine cells marked as `0` and other cells marked as `1`, the allied forces approach the field from the left and must reach the right end by crossing the field without stepping onto a landmine cell or a cell adjacent (left, right, up and down) to a landmine cell. The soldiers cannot move in diagonal directions.

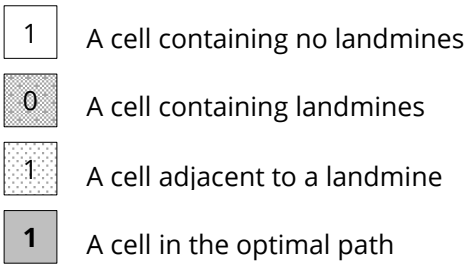
Can you help the allied forces by writing a program to chart the shortest path to cross the minefield and conquer the Normandy beach?

For example, given a 5 x 5 minefield as shown:



The allied forces must start at the third row and take the path as indicated.

The quickest path takes them through 7 cells.



Input

The first line specifies M and N separated by a space.

The next M lines specifies N numbers separated by space.

Output

Print the least number of cells visited to cross the minefield. Print "`Unable to cross the minefield`" if a safe path doesn't exist.

Constraints

$0 < M, N < 100$

Sample Input #1

```
5 5
1 0 1 1 0
1 1 0 1 1
1 1 1 0 1
1 1 1 1 1
0 1 1 1 1
```

Sample Output #1

```
7
```

Sample Input #2

```
7 5
1 1 1 1 1
1 1 1 1 0
1 1 1 1 1
1 1 1 0 1
1 1 1 1 1
1 0 1 1 1
0 1 1 1 1
```

Sample Output #2

```
Unable to cross the minefield
```

Summary

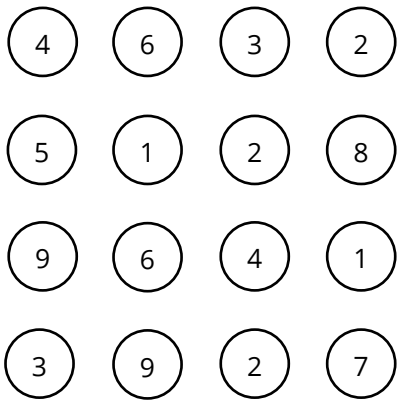
Problem **21**
Travelling Salesman
+20 Points

Justin is a salesman who sells insurance to customers in multiple cities. His company provides him with a fuel reimbursement for his daily sales travels. He prefers to completely utilize the fuel reimbursement otherwise he has to pay additional tax on the remaining amount.

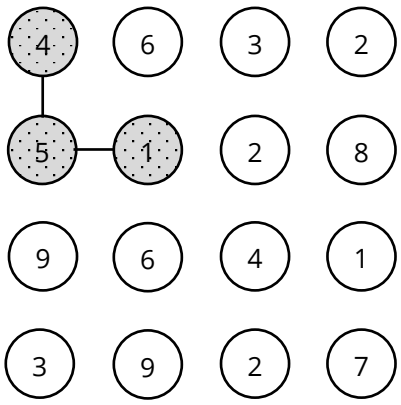
He wants to visit maximum number of cities in any given day without revisiting a city. Travelling from one city to another city incurs fuel expenses. He wants to keep the cumulative fuel expenses for the day not to exceed the daily fuel reimbursement amount.

He is given a map of the cities which shows the geographical location as well as the fuel expense for each city. He starts from one of the cities and then travels to any of its adjoining cities in any direction. He can continue further to another adjoining city provided the fuel expense doesn't exceed the daily reimbursement.

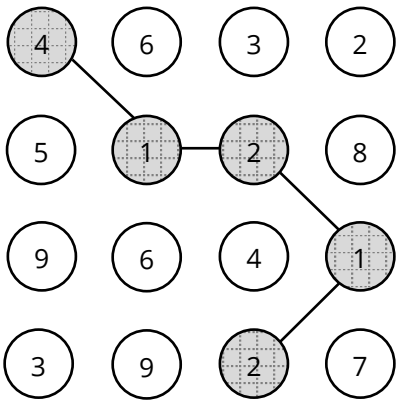
For example, consider the matrix given below. Each entry in the matrix represents the fuel expenses (in $) for the city. Considering that his daily fuel reimbursement is $10, and that he chooses to start from the city at index (0, 0) the maximum number of cities that he can visit in a day is 5.



Matrix representation of cities map



Route where the number of cities visited is 3



Route where the number of cities visited is 5

Input

The first line contains the daily fuel reimbursement amount F.

The next line contains M and N separated by a space.

The next M rows contains N columns of fuel expenses E_i for each city separated by a space.

The next line consists of the index X and Y of the starting city separated by a space where X is the row and Y is the column. Consider the index of the top left element as (0, 0).

Output

Print the maximum number of cities that can be visited in a day starting from the given index.

Constraints

$0 < M, N, X, Y < 100$

$0 < E_i, F < 10^6$ where $F > E_i$

Sample Input #1

```
10
4 4
4 6 3 2
5 1 2 8
9 6 4 1
3 9 2 7
0 0
```

Sample Output #1

```
5
```

Sample Input #2

```
6
3 4
1 5 5 1
5 1 1 5
1 5 5 1
0 3
```

Sample Output #2

```
4
```

Summary

Problem **22**
Vector Processor
+22 Points

ACME is one of the biggest companies to produce weapons to hunt Road Runners. Coyote buys weapons from ACME to hunt his arch rival Road Runner. ACME and Coyote use special devices to communicate with each other so that Road Runner doesn't eavesdrop on their conversation. This special device uses a vector processor to encrypt the messages. Road Runner is now trying to break the encryption so that he can take necessary precautions against the hunt being planned by Coyote.

A vector processor performs operations on a vector of numbers simultaneously. A vector processor holds N integers and performs various operations on these N integers at the same time. The operations supported by the vector processor are

Vector Processor Operations	
$A(x)$	add x to all N integers
$M(y)$	multiply y to all N integers
$S(z)$	Subtract z from all N integers
$R(p)$	Rotate elements in the vector right p times
$L(q)$	Rotate elements in the vector left q times

For e.g., given an input vector of `8, 6, 4` and `9` the operation $A(5)$ on it gives an output vector of `13, 11, 9` and `14`

Before sending any message using the special device, Coyote and ACME come up with a sequence of operations to be performed on the message. This sequence of operations is a secret key between Coyote and ACME. For e.g., Coyote and ACME decided on having their secret key as $A5\ A5\ S3\ R2\ M2\ L1$. For ease of reading, the parenthesis is dropped in the secret key.

Then any message such as `8 6 4 9` when sent through the vector processor will get transformed into `32 30 26 22`

Input	Operations	Output
`8 6 4 9`	A5	`13 11 9 14`
`13 11 9 14`	A5	`18 16 14 19`
`18 16 14 19`	S3	`15 13 11 16`
`15 13 11 16`	R2	`11 16 15 13`
`11 16 15 13`	M2	`22 32 30 26`
`22 32 30 26`	L1	`32 30 26 22`

From a well-placed spy inside ACME Corporation, Road Runner has got previous messages, encrypted output and a part of the secret key. Road runner got the values used for the operations in the vector processor but could not get the actual sequence of operations.

Can you help Road Runner, write a program to find the sequence of operations used for encrypting the messages between ACME and Coyote?

Input

The first line specifies the number of elements N in the message.

The second line specifies N integers $X_1, X_2 ... X_n$ of the message separated by space.

The third line specifies N integers $Y_1, Y_2 ... Y_n$ of the encrypted message separated by space.

The fourth line specifies the values for the operations in the order A, M, S, R and L separated by space.

Output

Print the sequence of operations used to get the encrypted message without any spaces. If there are multiple sequence of operations possible, print the one that has the least number of operations and comes first lexicographically.

Constraints

$0 < N < 100$

$0 < x, y, z, p, q < 10^3$

$-10^6 < X_1, X_2 ... X_n, Y1, Y_2 ... Y_n < 10^6$

Sample Input #1

```
4
8 6 4 9
32 30 26 22
5 2 3 2 1
```

Sample Output #1

```
AALRSM
```

Sample Input #2

```
5
16 12 8 4 2
20 12 8 36 28
5 2 3 2 1
```

Sample Output #2

```
ALLSM
```