

2017 KAIST RUN Spring Contest
(English)

2017 HYE A Cup

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Naver D²



Problem A. Card Game Contest

Input file: standard input
Output file: standard output
Time limit: 1 second
Memory limit: 256 megabyte

Maisie wants to participate in N kinds of game in card game contest. To participate the game, card deck for that game is needed. For an i -th game, Maisie has A_i distinct card decks. If a participant does not have card deck for certain game, the committee will present basic card deck.

Maisie wanted to know that how many different numbers of plans exists to participate contest. Two plans are different iff participating at least one card game with the different deck.

Calculate the number of plans of Maisie participating the card game contest. Answer can be large, so print remainder when divided by M .

Input

In first line, two space-separated integer N , M is given. ($0 \leq N \leq 100$, $1 \leq M \leq 100$)

In the next i -th line of N line, integer A_i is given ($0 \leq A_i \leq 100$)

Output

Print out the different number of plans for Maisie participating the card game contest. The answer can be large, so print remainder when divided by M .

Example

standard input	standard output
3 99 4 3 0	12
3 10 4 3 0	2
0 10	1

Notice that N can be 0.

Problem B. Mahjong

Input file: standard input
Output file: standard output
Time limit: 1 second
Memory limit: 256 megabyte

Alex loves Mahjong. He wants to make a program for practicing it.

Mahjong is a game played with 136 tiles. We will simplify this game, using 9 kinds of bamboo(sou) tiles(1sou, 2sou, 3sou, 4sou, 5sou, 6sou, 7sou, 8sou, 9sou).

In Mahjong, there is set of tiles called "Eye" and "Meld". "Eye" is set of two identical tiles. "Meld" is set of three identical tiles or three suited tiles in sequence. Followings are examples of Eye, Meld or neither.

- (2sou): This set consist of one tile, thus it is neither Meld or Eye.
- (3sou, 3sou): This set consist of two identical tiles, thus it is Eye.
- (7sou, 8sou, 9sou): 7, 8, 9 is sequence by 1, thus it is Meld.
- (1sou, 3sou, 5sou): 1, 3, 5 is NOT sequence by 1. (Difference of number should be 1.) Therefore, it is not Meld.
- (8sou, 9sou, 1sou): 9 and 1 is not consecutive.
- (9sou, 9sou, 9sou): This set consist of three identical tiles, thus it is Meld.
- (8sou, 8sou, 8sou, 8sou): This set consist of four tiles, thus it is neither Eye or Meld.

Winning hand consists of 14 tiles, and it should be 1 Eye and 4 Melds or 7 Eyes, subset of 36 tiles. But there should not be two identical Eyes if your hand consists of 7 Eyes. If you have 13 tiles and one more tile in remaining 23 tiles makes hand winning hand, the last tile is called **waiting**. For 13 tiles, Alex is practicing finding waiting. Let us help Alex!

Input

In first line, 13 space-separated integer meaning 13 tiles is given as number from 1 to nine.

Output

Print out waiting, in increasing order separated by space. If no waiting exists, print -1.

Example

standard input	standard output
1 1 1 2 2 2 5 5 7 8 8 9 9	7
1 1 1 2 3 4 5 6 7 8 9 9 9	1 2 3 4 5 6 7 8 9
1 1 2 3 3 4 4 6 6 8 8 9 9	2
1 1 1 5 5 6 6 7 7 8 8 9 9	5 6 8 9
1 1 1 1 2 3 4 4 4 4 8 8 8	-1

In the first example, 7sou makes Eye as 55, Meld as 111/222/789/789. In the second example, every tile is waiting. In the third example, waiting is 2, giving 7 Eyes, 11/22/33/44/66/88/99. In the fourth example, 1sou makes 11/11/55/66/77/88/99, but it has two identical Eyes, thus 1 is not waiting. In the fifth example, 1sou makes Eye as 11, Meld as 111/234/444/888 but there does not exist 1sou in remaining 23 tiles (already using 4 tiles of 1 sou), therefore, 1 is not waiting. In same way, 4 is also not waiting.

Problem C. The Way

Input file: standard input
Output file: standard output
Time limit: 1 second
Memory limit: 256 megabyte

Fox and Rabbit WERE good friends. But one day, Rabbit recommended God Game “Heroes of the Storm”. It made Fox angry, chasing Rabbit.

Let’s simplify map of Heroes of the Storm as $3 \times N$ tile grid. Rabbit came from leftmost, uppermost tile. Rabbit should not visit same tile twice since Fox will place trap after Rabbit pass certain grid. Rightmost, undermost tile is safe, so rabbit wants to go there.

New chef saw this Rabbit escaping and curious about the number of ways Rabbit escape.

Let’s help New chef!

Input

In the first line, width of grid N is given. ($1 \leq N \leq 1000$)

Output

Print the remainder of the number of ways divided by $1000000009(10^9 + 9)$, for rabbit escape $3 \times N$ grid, from leftmost, uppermost tile to rightmost, undermost tile not visiting the same tile twice.

Example

standard input	standard output
2	4
4	38

Problem D. The Other Way

Input file: standard input
Output file: standard output
Time limit: 2 seconds
Memory limit: 256 megabyte

Kir lives in a country with N cities, labeled from 1 to N . There are M bi-directional roads, connecting two cities.

Kir wants to travel from city S to city E . Kir always walked in same way, so Kir wants to walk to other way. So, Kir wonders how many different shortest path exists from city S to city E . Two paths are different iff there is road such that used in one path but not the other or vice versa.

Let us help Kir!

Input

First line contains 4 space-separated integer; N, M, S, E ($2 \leq N \leq 100000$, $N - 1 \leq M \leq 300000$, $1 \leq S, E \leq N$, $S \neq E$)

Each line of next M lines contains 3 space-separated integer; A, B, C . It means the road connect A and B bi-directional and length of the road is C . ($1 \leq A, B \leq N$, $1 \leq C \leq 1000000000$)

It is guaranteed that the way from any city to any other city exists.

Output

Print the number of shortest path from S to E , remainder divided by $1000000009(10^9 + 9)$

Example

standard input	standard output
3 4 1 3 1 2 1 2 1 1 2 3 1 1 3 2	3

Problem E. Just as Tic Tac Toe

Input file: standard input
Output file: standard output
Time limit: 2 seconds
Memory limit: 256 megabyte

Maisie and Licia are playing game.

At the start of the game, there are some balls in three baskets. Each player takes alternate turns. The first turn starts from Maisie. For each turn, the player has to take 1 through m balls, from any single basket. Needless to say, they can't take more than the current number of balls in the basket. The player who can't take any balls loses.

They thought this game was boring, therefore they decided to add a random factor to the game. Three baskets are picked from n baskets, without duplication.

They think this game is not different from tic-tac-toe. The two players will play the game optimally.

Calculate number of ways of picking three baskets makes Licia win.

Input

First line contains two space-separated integer N , M . ($3 \leq N \leq 500000$, $1 \leq M \leq 500000$) Second line contains N space-separated integer meaning the number of balls in basket. The number of balls in each basket does not exceed 10^{18} .

Output

Print the number of ways of picking three baskets makes Licia win.

Example

standard input	standard output
4 2 2 3 5 6	2

Problem F. Balance

Input file: standard input
Output file: standard output
Time limit: 1 second
Memory limit: 256 megabyte

Reunite is playing with balance scale and masses. There are N masses weighing $2^1, 2^2, \dots, 2^N$. While putting different N masses with some proper order, the total weight of the left pan should not be heavier than the right pan. Calculate the number of ways of putting N masses.

Input

In first line of input, N is given. ($1 \leq N \leq 50000$)

Output

Print out the number of ways of putting N masses in first line. Answer can be large, so print remainder when divided by $1000000009 (= 10^9 + 9)$.

Example

standard input	standard output
2	3
3	15

Problem G. Memory

Input file: standard input
Output file: standard output
Time limit: 1 second
Memory limit: 256 megabyte

Moraeduji always brings his $R \times C$ cards. There are exactly two cards which the same mark is drawn. Rule of the game follows:

1. Shuffle and place the cards in the shape of R by C rectangle.
2. Do the following **action** while all cards are removed from the game.
 - (a) Pick a card and flip to see a mark of the card.
 - (b) Pick another card and flip to see a mark of the card.
 - (c) If two cards have the same mark, remove two cards from the game. Otherwise, flip it back.
3. Win the game!

Moraeduji wants to win the game with minimum possible **action** with the best strategy for reducing the number of **actions**. Calculate the minimum and maximum possible number of **actions** of the game.

Input

First line contains two space-separated integer R, C . ($1 \leq R, C \leq 10$, $R \times C$ can be divided by 2.)

Output

Print the minimum and maximum possible number of **actions** of the game, separated by space.

Example

standard input	standard output
1 2	1 1
2 2	2 3

In the second game, there are 4 cards. In the first action, if two cards are same, remove them and remove another two cards in additional action. if two cards were different, flip one of the cards, check the mark and flip the same marked card of two cards flipped in the first action and removed them and remove another two cards in additional action. Therefore, the minimum number of actions is 2 and the maximum number of actions is 3.

Problem H. Too Many Traps

Input file: standard input
Output file: standard output
Time limit: 1 second
Memory limit: 256 megabyte

Hyea has N shoes. Let the power of i -th shoes as A_i . Hyea wants to go to the place where treasures are hidden, $A_1 + A_2 + \dots + A_N$ km far from here. Due to the laziness, Hyea will **rocket-jump(!)** using shoes to get the treasure.

Using i -th shoes will make Hyea jump A_i km far from here and shoes will wear out. Hyea will use every shoe to treasure once, take the treasure and become building owner.

Kahr heard Hyea will be building owner, worried Hyea will not come out from the building and placed M blankets. The blanket is on the straight line to the treasure. If Hyea lands exactly on the blanket, they will not come out from the blanket and never will be able to reach the treasure. If the blanket is placed where the treasure is, Hyea will prefer blanket and will not be able to get the treasure.

Let us help Hyea to reach where the treasure is, while not landing on a blanket.

Input

First line contains two space-separated integer N , M . ($1 \leq M < N \leq 100000$)

Second line contains N space-separated integer. The i -th number is A_i meaning power of shoes i . Power is from 1 to 10^9 , inclusive, different from each other.

Third line contains M space-separated integer, which means where blanket is. If the number is x , there is blanket x km from here. x is from 1 to 10^{14} , inclusive, different from each other.

Output

If Hyea cannot reach to the treasure, print -1 in first line.

If Hyea can reach to the treasure, print N space-separated integer. The i -th number as j means that i -th jump uses shoes j . If there are multiple answers, you can print any of them.

Example

standard input	standard output
2 1 4 5 4	2 1
2 1 4 5 9	-1
3 2 4 5 9 4 14	2 1 3

Problem I. Protocol

Input file: standard input
Output file: standard output
Time limit: 2 seconds
Memory limit: 256 megabyte

Licia who lives in the Maisie country made protocol using wire. Due to protocol of Licia, every wire have capacity. The wire having capacity i can send i characters.

The number of characters used in Maisie country is 112345. This means that if a wire has capacity i , it can send 112345^i kinds of data, and price of it is 112345^i too.

There are many engineers other than Licia in Maisie country. For every year, every wire in Licia country, if the wire has capacity X , they are changed into two wires, having capacity $f(X) = aX^2 + bX + c$ and $g(X) = dX^2 + eX + f$ using Banach-Tarski paradox(!). Starting with one wire with capacity N , after 1 year, there will be 2 wires with capacity $f(N), g(N)$; after 2 years, there will be 4 wires with capacity $f(f(N)), f(g(N)), g(f(N)), g(g(N))$; after M year, there will be 2^M wires in similar sense.

Calculate the sum of price of wires after M years.

Input

First line contains two space-separated integer N, M .

Second line contains six space-separated integer a, b, c, d, e, f .

Input meets $0 \leq N, M, a, b, c, d, e, f \leq 1000000000 = 10^9$

Output

Print the sum of price of wires after M years, remainder divided by $1000000009(=10^9 + 9)$

Example

standard input	standard output
0 1 1 2 3 4 5 6	844207762
0 2 1 0 0 0 0 1	337036

In first example, sum of price of wires is $112345^3 + 112345^6$.

Problem J. Communism

Input file: standard input
Output file: standard output
Time limit: 1 seconds
Memory limit: 512 megabyte

Peaceful Rinkaru city has N works to do. This works will be done by Rinkaru, Adnim, and LemonBerry. Adnim and LemonBerry think serious about fairness, so pay for works of two should not differ by more than D .

Every work will be done by exactly one of Rinkaru, Adnim, and Lemonberry. Calculate the number of ways of dividing works.

Two ways of dividing works are considered different iff at least one work is done by different people in two ways.

Input

First line contains one integer N meaning number of works.

Second line contains N space-separated integer A_1, \dots, A_N meaning pay for works.

Third line contains one integer, D meaning maximum difference of pay for works. ($1 \leq N \leq 30$, $1 \leq A_i \leq 10^{16}$, $1 \leq D \leq 10^{18}$)

Output

Print the number of ways dividing works.

Example

standard input	standard output
3 1 2 3 1	9
3 1 2 3 0	3