Problem A. Easy Jump

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

Waiting for the silk song, Grammy decides to challenge the Path of Pain in White Palace. After 4 to 5 hours of painful efforts, she achieves it. And she suddenly wonders about the expected time for her to pass it because she would feel lucky if the time she used is less than the expected time. The whole process could be modeled as below.

There are n stages in the Path of Pain. For stage i, Grammy can spend 1 unit of time to try it and the probability of passing it is p_i. If she passes it, she will go to stage $i+1$ immediately (or just finish the challenge if $i=n$). Otherwise, she will take 1 unit of damage and back to stage i. For understanding convenience, we use hp and mp to represent mask and soul. If Grammy takes 1 unit of damage, her hp will decrease by 1. When the hp becomes 0, she will die and have to start over. Since Grammy is a lazy girl, she will never let her hp become 0 even if she is at stage 1. At any time, Grammy can do one of the following things.

1. Challenge the stage, costing 1 unit of time, with probability p_i passing it, $1-p_i$ failing and taking 1 unit of damage.
2. Focus, using 1 unit mp to heal 1 unit hp, costing $T1$ unit time.
3. Heal by hiveblood, costing $T2$ unit time to heal 1 unit hp. But hiveblood can work only every time after taking 1 unit of damage.

There are soul totems in some of the stages. For simplification, we assume that Grammy can fill up her soul whenever she is at a stage having a soul totem without costing any time. And she can fill up any number of times in a stage.

Given the hp upper bound H, mp upper bound S, assume that Grammy starts the challenge with full hp and mp, could you tell her the expected time she has to use to achieve the challenge? Note that since Grammy is lazy, she will choose the best strategy when challenging to minimize the expected time.

Input

The input contains only a single case.

The first line contains three positive integers n, H and S ($1 \le n \le 1\,000$, $2 \le H \le 9$, $0 \le S \le 6$), denoting the number of stages, the upper bound of hp and mp.

The second line contains n integers $P_1, P_2, \ldots, P_n$ $(1 \le P_i \le 99)$, denoting the moleculars of probabilities. For each stage, we define $p_i = \frac{P_i}{100}$.

The third line first comes an integer K, denoting there are K stages that have soul totems. Follows K distinct integers $a_1, a_2, \ldots, a_K$ $(1 \le K \le n, 1 \le a_i \le n)$, denoting the index of the stages which have soul totems.

The fourth line contains two integers $T1$ and $T2$ $(1 \le T1, T2 \le 100)$, denoting the cost of focus and healing by hiveblood.

Output

Output the minimum expected time. Your answer will be considered correct if its absolute or relative error does not exceed 10^{-6}.

Examples

standard input	standard output
1 2 0 50 0 1 2	4.000000000000
2 3 1 50 50 1 1 1 3	6.000000000000

Problem B. Terrible Additive Number Theory Problem

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

Define P_i as the i-th prime.

Find the number of solutions x such that $x = \prod_{i=l}^{r} P_i = 2^k P_{r+1} - 1$, where $l, r, k \in \mathbb{N}^+, 1 \leq l \leq r$, and $x \leq n$.

Input

Input contains a single integer n ($1 \leq n \leq 10^{18}$)

Output

Output a single integer, indicating the number of solutions less than or equal to n.

Example

standard input	standard output
100	0

Problem C. Race

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

Pigetown is a city with n crossings and m bidirectional roads. A huge race event is going to be held in Pigetown. There are k types of race tracks, and each road in the city can be viewed as a particular type of race track.

In the race, each participant should choose an integer i such that $1 \le i \le q$, start at crossing S_i, visit each type of race tracks the same number of times, and finally arrive at crossing T_i in order to finish the race.

Grammy wants to know if it is possible to finish the race when choosing each integer i. Write a program to help her solve the problem.

Input

The first line contains 4 integers $n, m, k, q (1 \le n, m, q \le 200\,000,\ 1 \le k \le 30)$, indicating the number of crossings, the number of roads, the number of race track types, the upper limit of chosen integer i, respectively.

In the next m lines, each line contains 3 integers $u, v, t (1 \le u, v \le n, 1 \le t \le k)$, indicating that there is a bidirectional road between crossing u and crossing v with type t.

In the next q lines, each line contains 2 integers $S_i, T_i (1 \le S_i, T_i \le n)$, indicating one possible combination of starting point and ending point.

Output

Output q lines.

In the i-th line, if it is possible to finish the race while choosing integer i, output "Yes", otherwise output "No"(Without quotes).

Example

standard input	standard output
7 9 3 4 1 2 1 2 3 1 3 1 2 1 4 3 5 6 2 6 7 1 6 7 3 7 7 2 5 5 1 6 7 1 4 2 4 2 5	Yes No Yes No

Problem D. Candy Machine

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

JB loves candy very much.

One day, he finds a candy machine with N candies in it. After reading the instructions of the machine, he knows that he can choose a subset of the N candies. Each candy has a sweet value. After JB chooses the subset, suppose the average sweet value of the chosen candies is X, all the candies with sweet value strictly larger than X will belong to JB. After JB makes the choice, the machine will disappear, so JB only has one opportunity to make a choice.

JB doesn't care how sweet the candies are, so he just wants to make a choice to maximize the number of candies he will get. JB has been fascinated by candy and can't think, so he needs you to help him.

Input

The first line contains one integer N ($1 \leq N \leq 10^6$), denoting the number of candies in the machine.

The second line contains N integers $a_1, a_2, \ldots, a_N$ ($1 \leq a_i \leq 10^9$), denoting the sweet values of the candies.

Output

One integer, denoting the maximum number of candies JB can get.

Example

standard input	standard output
5 1 2 3 4 5	2

Problem E. Another Last Digit

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	2 seconds
Memory limit:	256 megabytes

Given positive integer N. Find the last digit of the product of first N integers of type $2^{2^{p_i}} + 1$, where p_i is i-th prime number.

Input

The first line of the input contains one integer N ($1 \le N \le 10^{18}$).

Output

Print one decimal digit — the answer to the problem.

Examples

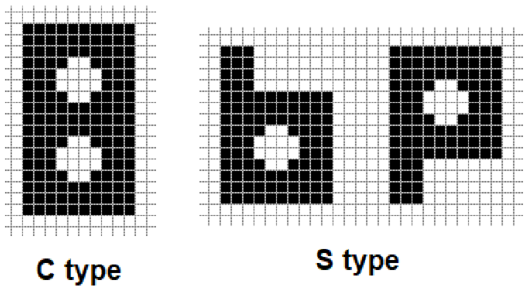
Below you will find examples of input data and answers which should be printed by your program.

input.txt	**output.txt**
1	5

Problem F. BpbBppbpBB

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

Grammy has learned how to engrave stamps recently. She engraved two types of special stamps, type C has a capital letter "`B`" on it, and type S has a small letter "`b`" or a small letter "`p`" on it. The shapes and sizes of the stamps are illustrated in the following picture.



Grammy stamped these letters (with rotations) on a grid paper without overlapping, the letters can only be pressed at the piece of paper if it lies totally inside the piece of paper. However, Grammy forgot how many times she used each type of stamps. Please count the letters and help her to remember them.

The black part of the stamps may be adjacent but may not overlap.

Note that the stamps can be rotated to a multiple of 90 degrees.

Input

The first line consists of two integers n, m ($1 \le n, m \le 1\,000$), representing the size of the paper.

In the following n lines, each line consists of m characters, representing the current state of the paper. "`#`" stands for a black square and "`.`" stands for a white square.

Output

Output two integers, denoting the number of type C stamps and the number of type S stamps, respectively.

Examples

standard input	standard output
10 17 ################# ################# ################# ####..#####..#### ###....###....### ###....###....### ####..#####..#### ################# ################# #################	1 0
14 11 .########## .########## .########## .####..#### .###....### .###....### .####..#### .########## .########## .########## .###....... .###....... .###....... .###.......	0 1
20 14 .##########... .##########... .##########... .####..####... .###....###... .###....###... .####..####... .##########... .##########... .##########... .############# .############# .############# .#######..#### ....###....### ....###....### ....####..#### ############## ############## ##############	0 2

Problem G. Byteland Names

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	2 seconds
Memory limit:	256 megabytes

In ancient Byteland language, the words are composed from lowercase Latin letters. As the names are used the words with following properties: let the word consists of n letters. Then exists $1 \le x < n$, such as all substrings of the length x are equal.

In the list of names found by archeologists, the names are ordered by its length, and names of the same length are ordered lexicographically. Your task is to find the length of the k-th name in the word and print its **last** letter.

Input

The input contains one integer k ($1 \le k \le 10^{18}$) — the number of the name in the list.

Output

Print the integer — the length of the k-th name, then print the space and one character — the last letter of that name.

Examples

Below you will find examples of input data and answers which should be printed by your program.

input.txt	**output.txt**
`1`	`2 a`
`2021`	`79 s`

Problem H. Barbecue

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 seconds
Memory limit:	512 megabytes

Putata and Budada are playing a new game. In the beginning, Putata has a note with a string consists of lowercase letters on it. In each round, the player who has the note must rip off a character from the beginning or the end of the note, then pass it to the other player. If at any moment, the string on the note is a palindrome, then the player who has the note loses. Notice that both before or after the player ripping off a character from the note, the player is considered to have the note. A string $s_1s_2\ldots s_n$ of length n is considered to be a palindrome if for all integers i from 1 to n, $s_i = s_{n-i+1}$.

However, when Putata found the note, he found that someone have played on this note before. Since both Putata and Budada are clever and will always choose the best way to make themselves win, they wonder who will win the game, and they ask you for help. Formally, you are given a string of length n and you have to answer q queries, each query is described by two integers l and r, which means you have to determine who will win if Putata and Budada play the game described above on string $s_l s_{l+1}\ldots s_r$.

Input

The first line contains two integers n, q ($1 \le n, q \le 1\,000\,000$), denoting the length of the string and the number of queries.

The second line contains a string s of length n, consisting of lowercase English letters.

Each of the following q lines contains two integers l and r ($1 \le l \le r \le n$), describing a query.

Output

For each query, print a single line. If Putata wins the game in one query, output "`Putata`" (without quotes). Otherwise output "`Budada`".

Example

standard input	standard output
7 3 potatop 1 3 3 5 1 6	Putata Budada Budada

Problem I. Easy Fix

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	512 megabytes

Since Grammy plays Hollow Knight day and night and forgets the homework Tony gives her, she already has no time to do it. As a talented programmer and good friend of Grammy, you decide to help her. The problem is described as follows.

Given a permutation $p = p_1, p_2, \ldots, p_n$. We define A_i as the number of j satisfying that $j < i \wedge p_j < p_i$, B_i as the number of j satisfying that $j > i \wedge p_j < p_i$, and $C_i = \min(A_i, B_i)$.

There are m queries. For the i-th query, you should output the value of $\sum_{i=1}^{n} C_i$ if we swap p_u and p_v. Note that we will recover the permutation p after each query which means queries are independent of each other.

Input

The input contains only a single case.

The first line contains one positive integer n ($1 \le n \le 100\,000$). It is guaranteed that p is a permutation of $1, 2, \ldots, n$.

The second line contains n **distinct integers** $p_1, p_2, \ldots, p_n$ ($1 \le p_i \le n$).

The third line contains one positive integer m ($1 \le m \le 200\,000$).

The following m lines describe m queries. The i-th line contains two integers u and v ($1 \le u, v \le n$), denoting the parameter of the i-th query. Note that u may be equal to v.

Output

The output contains m lines. Each line contains one integer, denoting the answer to the i-th query.

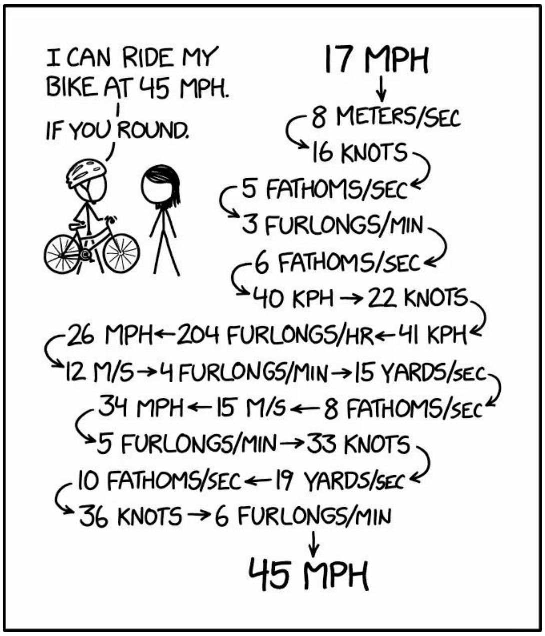
Examples

standard input	standard output
7 1 6 2 7 5 4 3 7 1 7 2 6 3 5 4 4 1 1 2 1 3 7	7 6 6 7 7 6 8
5 5 3 1 2 4 3 3 1 2 5 3 3	3 0 0

Problem J. Rounding Master

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

Grammy has obtained master degree in rounding(she awarded herself). She can use her rounding techniques to obtain a super large number by changing a unit and round.



In particular, she has a number x, which initially equals to 1. She will perform the following operation k times, and finally make her number $x \geq n$. In each operation, she will multiply x by $q(q > 0)$, and round it. Rounding a number w means to find integer a such that $a \leq w < a + 1$, and if $w \geq a + 0.5$, then change w into $a + 1$, otherwise change w into a.

Can you help her to choose the minimum q such that after k operations, x will be greater than or equal to n.

Input

The first line contains two integers $n, k(1 \leq n, k \leq 10^{18})$, representing the final target and the number of operations.

Output

Output a positive real number q, representing the answer. You answer will be considered correct if its absolute or relative error does not exceed 10^{-6}.

Example

standard input	standard output
`18 4`	`2.125000000000`

Problem K. Dense Polynomials

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	2 seconds
Memory limit:	256 megabytes

We will consider the polinomial of n-th degree with integer coefficients

$$x^n + a_1 \cdot x^{n-1} + \ldots + a_{n-1} \cdot x + a_n$$

dense, if this polynomial have exactly n pairwise distinct **integer non-zero** roots, and absolute value $|a_n|$ is minimal possible.

Your task is to find the maxinal and minimal value of a_1 in the dense polynomial.

Input

The input contains one integer n ($1 \le n \le 10^{18}$) — the degree of the polynomial.

Output

Print two pairwise distinct integers — the minimal and the maximal value of a_1 in that polynomial.

Examples

Below you will find examples of input data and answers which should be printed by your program.

input.txt	**output.txt**
1	-1 1

Problem L. Frog

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

Grammy spotted a frog at the border of a circular pillar. The pillar is centered at $(0, 0)$ and has radius 1. The frog can jump to a distance of exactly 1. Grammy wants the frog to move to her desired destination point at the border of the pillar. Please help Grammy to find a route for the frog with minimum number of jumps.

Note that the frog cannot be strictly inside the pillar at any time.

Input

The input contains multiple test cases.

The first line contains a single integer T ($1 \le T \le 10\,000$), indicating the number of test cases.

The only line of each testcase consists of two integers d_s, d_t ($0 \le d_s, d_t \le 359$), indicating that the frog's starting position is $(\cos\frac{\pi d_s}{180}, \sin\frac{\pi d_s}{180})$, and the frog's destination is $(\cos\frac{\pi d_t}{180}, \sin\frac{\pi d_t}{180})$.

Output

For each test case, print one or several lines in the following format.

The first line contains a single integer k, indicating the minimum number of jumps in this test case.

The next $k+1$ lines contain the landing points for the frog, including its starting point and its destination point.

The i-th of the next $k + 1$ lines contains 2 real numbers, indicating the coordinates of the frog's i-th landing point.

Your answer will be considered correct if all the following conditions are satisfied:

- The number of jumps is minimal.
- The distance between the first landing point and the starting point is less than 10^{-6}.
- The distance between the last landing point and the destination point is less than 10^{-6}.
- The distance d between any two consecutive landing points satisfy $1 - 10^{-6} < d < 1 + 10^{-6}$.
- The segment connecting any two consecutive landing points have a distance $d > 1 - 10^{-6}$ to $(0, 0)$.

Example

standard input	standard output
3 0 0 0 90 180 0	0 1.0000000000 0.0000000000 2 1.0000000000 0.0000000000 1.0000000000 1.0000000000 0.0000000000 1.0000000000 4 -1.0000000000 0.0000000000 -1.0000000000 -1.0000000000 -0.0000000000 -1.0000000000 1.0000000000 -1.0000000000 1.0000000000 -0.0000000000

Problem M. Emptycoin

Input file:	`input.txt`
Output file:	`output.txt`
Time limit:	2 seconds
Memory limit:	256 megabytes

To estimate the stability of new cryptocurrencty *Emptycoin*, the analysts are using the data on the houry change of the price d_i of the Emptycoin. There are n observations.

Consider as the *stability distance* the length of the maximum continuous segment, such as sum of d_i on that segment is zero, i.e the maximum integer k such as exists the index j: $\sum_{i=0}^{k-1} d_{j+i} = 0$. If the sum is non-zero for all k and j, then the stability distance is considered to be equal to zero.

Given the data, calculate the stability distance.

Input

First line of the input contains one integer n – the number of the observations ($1 \le n \le 2 \cdot 10^5$).

i-th of the following n lines contains one integer d_i ($-10^9 \le d_i \le 10^9$) — i-th change of the price.

Output

Print one integer — the stability distance.

Examples

Below you will find examples of input data and answers which should be printed by your program.

input.txt	**output.txt**
5 28 -11 11 0 0	4
4 1 2 3 4	0