Problem A. The Ultimate Duel

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

Sadly, things have come to this cruel end. There are no other ways the three members of the team Dreadnought could agree with each other on the opinion of girls, they have started an ultimate duel of life and death.

TankEngineer, who is a faithful follower of the doctrine of LoliLoli, believes the grand truth of the universe lies within the cuteness of Lolis: Without the Enlightenment of Loli, war shall rage the world, followed by deadly plague and famine, and in the end, the humanity will go extinct with death. There is no but one true hope - Loli.

AngryBacon, in opposite, thinks Lolicon is a distort of human nature. Little girls, well, are not sexy enough. And worst of all, you have to take care of them in most of the time. Only a decent lady with gorgeous curves and a caring character can be of true beauty and thus be admired. [AD: Please contact him at XOX-OOX-XOXX immediately if you have at least 90-60-82.]

Rowdark, however, can't help but laugh at the ignorance of these two. Human girls, no matter older or younger, are just way too boring. And the only choice any noble gentleman who seeks the true nature of human beings won't fail to see is that [CENSORED]. HAHAHAHA!

Now the stage has been set, and the first deathmatch is TankEngineer VS AngryBacon. Not surprisingly, the winner is decided by the fairest game in the world: Rock, Paper and Scissors.

Both TankEngineer and AngryBacon would first write a sequence of operations consists of rock, paper and scissors. And then each sequence will be repeated an infinite number of times to reveal the true operation sequence they will adopt. Then the duel starts, the result of each round is decided by the well-known rule of Rock, Paper and Scissors(that is R¿S, S¿P, P¿R). The winner will be the who wins a larger portion of rounds than his opponent in all the rounds.

Since an infinite amount of time is needed to fight an infinite number of rounds one by one, please calculate the winner given the initial sequences of TankEngineer and AngryBacon.

Input

The first line of input contains a string S consists of only uppercase letters **R**, **P** and **S** which represents the initial sequence of TankEngineer.

The second line contains a string T also consists of **R**, **P** and **S** which represents the initial sequence of AngryBacon.

It is guaranteed that $1 \leq |S|, |T| \leq 10^5$.

Output

Print the name of the final winner "`TankEngineer`" or "`AngryBacon`" (without quotes) in a single line. In case of a tie, print "`Rowdark`" instead (He wins as the other two killed each other, also without quotes).

Examples

standard input	standard output
R S	TankEngineer
RPSSPR RSR	AngryBacon
PPPSSSRRR R	Rowdark

Problem B. The Mighty Spell

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

In a secret camp far far away, the great prophet, ftiasch, is trying to build up a new spell that could solve any ICPC problem with a single submission.

For this great propose, he has carefully crafted a string of n runes, or simply speaking, enchanted symbols. There are m different types of runes which are associated with different elements. For example, fire runes, water runes, light runes, dark runes, C++ runes, loli runes etc. A spell can be forged out of the string by activate some(probably none) of the runes in the string and deactivate the others.

To solve all the ICPC problems in the world is no easy task, even with the help of magic! So ftiasch would like to estimate the might of the spell he is going to get.

Basically, any spell works by rebalancing the flow of elemental energy in the world, so if there exists some element that the spell does not contain an activated rune of that kind, the spell won't work at all and thus have might 0.

Even if a spell contains all types of runes, the might still varies and that's where the crafted string kicks in. Magical bonds will form between consecutive activated runes and a consecutive segment of l runes with generate $g(l)$ units of might and the might of the spell is the sum of the mights of all its consecutive segments. After conducting heavy lots of research involving the forbidden arts of machine learning, ftiasch finally comes up with the explicit formula that $g(x) = 2x^3 + 3x^2 + 3x + 3$.

You might have been wondering why ftiasch doesn't simply activates all the runes in the string? Simply because ftiasch can't do that. And more importantly, that will make this problem too easy. In fact, each rune will be activated independently with probability $\frac{1}{2}$, and you have to calculate the expected might of the spell.

Input

The first line contains two integers n, m ($1 \le n \le 2 \times 10^5, 1 \le m \le 50$). Which are the length of the string and the number of types of runes.

The second line contains n integers $c_1, c_2, \ldots, c_n$ ($1 \le c_i \le m$) which describe the string, c_i is the type of the i-th rune.

Output

A single integer denotes $\mathrm{E} \times 2^n \bmod (10^9 + 7)$ where E is the expected might of the spell.

Examples

standard input	standard output
3 2 1 2 2	152
4 3 1 2 1 2	0
6 3 1 2 3 3 2 1	3627

Problem C. The Defense Fence

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1.5 seconds
Memory limit:	1024 mebibytes

TankEngineer's agent program revealed that the Great General of ALU (the Anti Lolicon United) liuq901 will pillage the peaceful village you and your imaginary girlfriend live in. You feel very worried about this and decided to build a defense fence to protect your village and your imaginary girlfriend.

To simplify the problem, the village is regarded as a plane and a fence can be seen as a closed curve without self-crossing or self-touching on the plane. To make it defensive, you decide to make it electric, thus the fence you built must contain a positive pole and a negative pole which are connected to the power grid.

Because of limited time, you have to use the only existing poles - a positive pole located at $(0, 0)$ and a negative pole at $(d, 0)$. Furthermore, the power supply is also limited, so you can only build your fence by connecting some pairs of points from the set consists of the poles and n other hubs in your village. It is guaranteed that no two points coincide with each other.

There is another restriction, the euclidean distance of any pair of points on the fence can be no larger than d or the fence wouldn't have enough power to stop the army of liuq901.

You want to protect as much area in your village as possible. Calculate the maximum area your fence can cover.

Input

The first line contains two integers n, d ($1 \le n \le 300, 1 \le d \le 10^9$), the number of hubs and the maximum distance allowed.

Each of the next n lines contains two integers x_i, y_i ($-10^9 \le x_i, y_i \le 10^9$), the position of the i-th hub.

Output

Print an integer in a single line — the maximum area multiplied by 2.

Examples

standard input	standard output
2 10 5 6 5 -4	100
2 10 5 6 5 -5	60
2 10 1 5 5 0	0

Problem D. The Road Network

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

AngryBacon, the King of ALU(the Anti Lolicon United), rules a kingdom of n cities with military force. Each city has a parameter w_i that describes the city scale. Two cities i, j are connected by a road if and only if $w_i + w_j \geq d$ for some known constant d.

One night, AngryBacon had a terrible nightmare that some of his cities turned against him because he does not like Loli while some people perceive them as angels, and the kingdom is teared into two halves: the king and the rebel. All the roads between the cities that belong to different sides are destroyed. The rebels are equipped with advanced data structures and his army couldn't even stand a chance. ALU soon falls and become a land of republic and loli.

Now awake and realised it's just a dream that can't be true, AngryBacon starts to calculate the maximum number of roads could be destroyed under such a scenario. And furthermore, how many different situations are there this number can be achieved if any set of city(even the whole kingdom or the empty set) could turn against him at the same time, modulo $10^9 + 7$.

Input

The first line contains two integers n, d ($1 \leq n \leq 2000, 0 \leq d \leq 10^9$). n is the number of cities and d is the constant determines the connections between cities.

The second line contains n integers $w_1, w_2, \ldots, w_n$ ($0 \leq w_i \leq 10^9$). w_i is the parameter of the i-th city.

Output

Print a single line contains two integers m and w, where m denotes the maximum number of roads could be destroyed, and m denotes the number of situations are there this number can be achieved. Because m may be too large, print it modulo $10^9 + 7$.

Examples

standard input	standard output
4 7 1 4 6 3	3 6
4 11 1 4 6 3	0 16
4 5 1 4 6 3	4 2

Problem E. The Great Hunt

Input file:	*standard input*
Output file:	*standard output*
Time limit:	6 seconds
Memory limit:	1024 mebibytes

The Special Agents of ALU (the Anti Lolicon United) lead by the Prime Minister Rowdark himself has spotted an extremely dangerous Lolicon as he often participates in ICPC contests called TankEngineer. His false beliefs in Loli will corrupt the citizens of ALU and must be eliminated!

To prevent such a potential criminal from escaping, the Special Agents has closed most of the roads in ALU, so there are only $n-1$ bidirectional roads connects the n cities now but one can still travel to any other city by those roads. Furthermore, only the capital city(numbered 1) can have more than two open roads connected to it.

Though there has been a large amount of bounty on TankEngineer, the elite Special Agents failed to catch him in months. It is rumored that TankEngineer disguised himself as one of the Special Agents so no one could recognize him! The Prime Minister Rowdark got very angry and decided to clear this treat for the last time.

He gathered n of his most trusted agents and built up a plan. Rowdark knows the i-th agent can only be sent to a city on the unique simple path between city u_i and v_i because these are the cities he knows well of. And the key to success is that: there should be exactly one agent sent to each city, thus if another agent is spotted, it must be the disguised TankEngineer and will be eliminated at once.

Given the constrains where all the n agents could be sent, is it possible to come up with such a successful plan? Please give out the correct answer within 5 hours or you will be identified as an extremely dangerous Lolicon who participates ICPC contests and have your ID printed on the next problemset.

Input

The first line of input line contains a single integer n ($2 \le n \le 10^4$), which is both the number of the cities and the number of the agents.

The $(n-1)$ following lines describe the open roads in ALU. Each line contains two integers a_i, b_i which denote a road between cities a_i and b_i ($1 \le a_i, b_i \le n$). The capital city is numbered with number 1.

The later n lines describe the constrains for the agents. The i-th line of them contains two integers u_i, v_i ($1 \le u_i, v_i \le n$) which means the i-th agent could only be sent to a city lies on the path between city u_i and v_i, both ends included.

Output

Print a single line of "`No`" (without quotes) if such a plan is impossible.

Otherwise print "`Yes`" (without quotes) in the first line and print n integers in the second line. The i-th integer is the number of the city the i-th agent should be sent to.

If there are more than one possible plans, output anyone of them.

Examples

standard input	standard output
10 2 1 3 1 6 1 8 2 4 3 9 6 5 4 7 8 10 7 8 7 10 2 7 2 10 1 3 1 5 2 5 1 6 1 9 2 3 4	Yes 7 10 8 2 3 1 5 6 9 4
5 1 2 1 3 1 4 3 5 5 4 5 3 3 1 1 4 1 1	No

Problem F. The Jump Address

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

TankEngineer has been found in one of cities in ALU according to the Prime Minister Rowdark's plan. But his quicksort algorithm outran the agent who tried to catch him, so he barely escaped. However the cruel Prime Minister Rowdark gathered all the lolis in that city and claimed to kill them all if TankEngineer doesn't submit himself to ALU in one day.

TankEngineer had no choice, how could he place his life heavier than the lives of a thousand of lolis? After all, as long as there are kawaii lolis and the love for them in this world, there shall be light and there shall be hope, someday everyone shall understand this. So he submitted himself to ALU over the night.

The execution is held at the city square. All the people gathered to watch the horrible death of an ¡¡extremely dangerous¿¿ Lolicon who likes to participate in ICPC contests. TankEngineer is going to be brunt alive. He closed his eyes as the fire was lit.

Suddenly, he hears a little loli crying, ¡¡He saved us! Why would they burn him?¿¿ A tear runs down his face. ¡¡I wish he could jump to another address during the execution!¿¿

With that powerful wish and a bright flash of holy light, TankEngineer felt his body was lifted by a great wind, higher and higher until he doubts whether he is still alive. Another voice bursted out, ¡¡Oh man, why on earth did I put a jump in this place?!¿¿

It's the great prophet ftiasch! TankEngineer realized he has jumped out of the world of ALU and went to some other dimension by the power of the loli's wish (or ftiasch's misfired mighty spell?). But he must act fast or he'll jump to some really weird place full of bugs!

Hurry up! Let the function $D(P) = \{x | P_x > P_{x+1}\}$ defined on all the n-permutations P. Tell TankEngineer the address he needs by counting how many permutations would satisfy $(\sum_{x \in D(P)} x) = k$ before the next instruction kicks in!

Input

The first line contains two integers n and k ($1 \le n \le 400, 0 \le k \le \frac{n(n-1)}{2}$) which are the size of the permutation and the constant described above.

Output

Print the remainder of the answer divided by $10^9 + 7$ in a single line.

Examples

standard input	standard output
5 5	22
10 10	21670

Problem G. The Imaginary Girlfriend

Input file:	*standard input*
Output file:	*standard output*
Time limit:	5 seconds
Memory limit:	512 mebibytes

It's a cold, rainy night. You are wandering aimlessly in the dark streets. The grievous news came a few days ago that your good friend TankEngineer has been burnt alive in ALU as he is a lolicon. "He just thinks little girls are lovely and likes to participate in ICPC contests.¿¿ - you said to yourself, "Why things have come to this?"

Walking alone, you have never found the streets of your village so strange and alien. They are either strictly South-North or strictly East-West. "Another dead end." , you sighed, "This world is so cruel." The joy and happiness it offers, compared nothing to the grief and the sorrows it brings.

You don't know how long you have been in the streets. "Come on darling, what's the sad look on your face?" As you remembered the angelic voice, it's your imaginary girlfriend, a very cute loli. "He did not die, he just jumped to another dimension. Come to my place, I will show you."

You can't believe what you have heard. How could this be true? Maybe you just go insane as you never had a girlfriend in your life so you came up with an imaginary one with your imagination in your mind. Whatsoever, you begin to rush down the streets as fast as you can towards your girlfriend's place.

"As long as there are kawaii lolis and the love for them in this world, there shall be light and there shall be hope." What TankEngineer had always been saying echoes in your mind. The streets can be seen as n horizontal or vertical segments on the plane. What is the shortest route to your imaginary girlfriend's place?

Input

The first line contains a single integer n, ($1 \le n \le 2 \times 10^4$), the number of streets.

Each of the following n lines contains four integers $x_{i1}, y_{i1}, x_{i2}, y_{i2}$ which means the i-th street is from (x_{i1}, y_{i1}) to (x_{i2}, y_{i2}).

The last line contains four integers sx, sy, tx, ty which are the start point(where you are now) and the terminal point(your imaginary girlfriend's place).

It is guaranteed that any segment is either horizontal ($y_{i1} = y_{i2}$) or vertial ($x_{i1} = x_{i2}$). Any two parallel segments don't intersect (they can touch). The absolute value of any coordinate is no larger than 10^9.

Output

Print a single integer l in one line, the length of the shortest path from (sx, sy) to (tx, ty). In case you can't reach (tx, ty) from (sx, sy), print -1 instead.

Examples

standard input	standard output
8 0 0 0 2 0 2 2 2 2 2 2 0 2 0 0 0 -1 1 1 1 1 1 1 3 1 3 -1 3 -1 1 -1 3 2 0 -1 3	6

Problem H. The Kirakira Cycle

Input file:	*standard input*
Output file:	*standard output*
Time limit:	7 seconds
Memory limit:	256 mebibytes

Your imaginary girlfriend who is a genius at math (that is why she is studying at your university though she is much younger) tells you that she is recently working on the following function:

$$f_n(x) = \sum_{i=1}^{n} (x \mod i)$$

in which n is a fixed positive integer.

You quickly realize that this function actually defines a graph in the sense that all the integers are vertices and there is an directed edge for every x from x to $f_n(x)$.

Your imaginary girlfriend seems to be interested in the cycles in such a graph, as she called them the **kira cycles**.

In order to please your imaginary girlfriend, you decided to find out the length of the **kirakira cycle**, that is, the largest cycle in this graph.

Input

The first line contains a single integer n ($1 \le n \le 10^4$), the constant described above.

Output

Print a single integer l, the length of the **kirakira cycle**.

Examples

standard input	standard output
2	1
10	4
43	7

Problem I. The Impressive Path

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	256 mebibytes

Your imaginary girlfriend has been kidnapped by the evil ALU when you were solving ICPC problems, and you must save her before it's too late! The ALU has put her in a maze of size $n \times m$. You begin your journey at $(1, 1)$ and your imaginary girlfriend is kept at (n, m).

However, the evil ALU knew you are coming and had set up numerous deadly traps in the maze. But you do not come unprepared as you have mastered the art of problem solving. Deduced from some simple observations, you noticed that the traps will do no harm to you if you move in the way a knight moves on a chessboard and never visit the same place twice.

But there is another important problem: the timing. Your imaginary girlfriend, who is a kawaii loli with twintails, has recently got some tsundere characteristics for her affection to you. And you can only successfully impress her if you come to save her at the exact moment of t seconds. You must take that into consideration. Making a single knight-move costs exactly 1 second and you are at $(1, 1)$ at time 0.

Now it's time for you to come up with the plan and save her from the evil!

Input

The first line contains three positive integers n, m, t, ($8 \le n, m \le 500$, $n + m \le t \le \frac{3}{4}nm$). It is guaranteed that the parity of t is the same as the parity of $n + m$.

Output

Print t lines with two positive integers each line. The pair in the i-th(1-based) line represents the coordinates you are at at the time i. The output should be a valid path from $(1, 1)$ to (n, m) thus the t-th line should be n m. Each move should be a valid knight move and no coordinate can be outside the maze or appear more than once.

Examples

standard input	standard output
8 8 16	3 2 4 4 2 3 3 5 5 6 7 7 8 5 6 6 8 7 6 8 7 6 8 4 6 5 8 6 6 7 8 8

Problem J. The Magic Square

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

In order to save the world from the evil Anti Lolicon United and make your imaginary girl friend(who is a very kawaii loli) happy, a magic amulet of pure LoliLoli magic power must be crafted.

According to an ancient scroll, such a magic amulet should be in the shape of a square and be composed of exactly n gems not necessarily of different sizes. Each of the gems should be a square itself and its edges should parallel to the edges of the amulet. The figure part of the scroll has been worn out and you have to overcome this difficulty with your love for Loli.

Input

The first line contains a single positive integer n ($n \leq 100$), which is the number of the gems you should use.

Output

If there is no solution, print a single line of "`Impossible`" (without quotes).

Otherwise, print "`Possible`" (without quotes) in the first line and a positive integer $m \leq 1000$, which is the size of the amulet you come up with in the second line. Followed by m lines of m positive integers separated by a single space. c_{ij}, the j-th integer in the i-th following line represents the id of the gem this square belongs to. $c_{ij} \leq n$ must hold and for each $1 \leq k \leq n$, those with $c_{ij} = k$ should form a connected square of some integer size.

Examples

standard input	standard output
2	Impossible
4	Possible 2 1 2 3 4

Note

Here is a possible solution for $n = 21$.