CSES Problem Set

Hamiltonian Flights

Time limit: 1.00 s **Memory limit:** 512 MB

There are n cities and m flight connections between them. You want to travel from Syrjälä to Lehmälä so that you visit each city exactly once. How many possible routes are there?

Input

The first input line has two integers n and m: the number of cities and flights. The cities are numbered $1, 2, \ldots, n$. City 1 is Syrjälä, and city n is Lehmälä.

Then, there are m lines describing the flights. Each line has two integers a and b: there is a flight from city a to city b. All flights are one-way flights.

Output

Print one integer: the number of routes modulo 10^9+7.

Constraints

- $2 \le n \le 20$
- $1 \le m \le n^2$
- $1 \le a, b \le n$

Example

Input:
```
4 6
1 2
1 3
2 3
3 2
2 4
3 4
```

Output:
```
2
```

Cycle Finding

TASK | STATISTICS

Time limit: 1.00 s **Memory limit:** 512 MB

You are given a directed graph, and your task is to find out if it contains a negative cycle, and also give an example of such a cycle.

Input

The first input line has two integers n and m: the number of nodes and edges. The nodes are numbered $1, 2, \dots, n$.

After this, the input has m lines describing the edges. Each line has three integers a, b, and c: there is an edge from node a to node b whose length is c.

Output

If the graph contains a negative cycle, print first "YES", and then the nodes in the cycle in their correct order. If there are several negative cycles, you can print any of them. If there are no negative cycles, print "NO".

Constraints

- $1 \le n \le 2500$
- $1 \le m \le 5000$
- $1 \le a, b \le n$
- $-10^9 \le c \le 10^9$

Example

Input:
```
4 5
1 2 1
2 4 1
3 1 1
4 1 -3
4 3 -2
```

Output:
```
YES
1 2 4 1
```

CSES Problem Set

Road Construction

Time limit: 1.00 s **Memory limit:** 512 MB

There are n cities and initially no roads between them. However, every day a new road will be constructed, and there will be a total of m roads.

A component is a group of cities where there is a route between any two cities using the roads. After each day, your task is to find the number of components and the size of the largest component.

Input

The first input line has two integers n and m: the number of cities and roads. The cities are numbered $1, 2, \dots, n$.

Then, there are m lines describing the new roads. Each line has two integers a and b: a new road is constructed between cities a and b.

You may assume that every road will be constructed between two different cities.

Output

Print m lines: the required information after each day.

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
5 3
1 2
1 3
4 5
```

Output:
```
4 2
```

Graph Algorithms

...
Planets Queries II –
Planets Cycles –
Road Reparation –
Road Construction –
Flight Routes Check –
Planets and Kingdoms –
Giant Pizza –
Coin Collector –
...

3 3
2 3

CSES Problem Set

Counting Rooms

TASK | STATISTICS

Time limit: 1.00 s **Memory limit:** 512 MB

You are given a map of a building, and your task is to count the number of its rooms. The size of the map is $n \times m$ squares, and each square is either floor or wall. You can walk left, right, up, and down through the floor squares.

Input

The first input line has two integers n and m: the height and width of the map.

Then there are n lines of m characters describing the map. Each character is either `.` (floor) or `#` (wall).

Output

Print one integer: the number of rooms.

Constraints

- $1 \le n, m \le 1000$

Example

Input:
```
5 8
########
#..#...#
####.#.#
#..#...#
########
```

Output:
```
3
```

CSES Problem Set

Planets and Kingdoms

Time limit: 1.00 s **Memory limit:** 512 MB

A game has n planets, connected by m teleporters. Two planets a and b belong to the same kingdom exactly when there is a route both from a to b and from b to a. Your task is to determine for each planet its kingdom.

Input

The first input line has two integers n and m: the number of planets and teleporters. The planets are numbered $1, 2, \dots, n$.

After this, there are m lines describing the teleporters. Each line has two integers a and b: you can travel from planet a to planet b through a teleporter.

Output

First print an integer k: the number of kingdoms. After this, print for each planet a kingdom label between 1 and k. You can print any valid solution.

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
5 6
1 2
2 3
3 1
3 4
4 5
5 4
```

Output:
```
2
1 1 1 2 2
```

Graph Algorithms

...
Road Reparation –
Road Construction –
Flight Routes Check –
Planets and Kingdoms –
Giant Pizza –
Coin Collector –
Mail Delivery –
De Bruijn Sequence –
...

CSES Problem Set

Planets Queries II

Time limit: 1.00 s **Memory limit:** 512 MB

You are playing a game consisting of n planets. Each planet has a teleporter to another planet (or the planet itself).

You have to process q queries of the form: You are now on planet a and want to reach planet b. What is the minimum number of teleportations?

Input

The first input line contains two integers n and q: the number of planets and queries. The planets are numbered $1,2,\dots,n$.

The second line contains n integers $t_1,t_2,\dots,t_n$: for each planet, the destination of the teleporter.

Finally, there are q lines describing the queries. Each line has two integers a and b: you are now on planet a and want to reach planet b.

Output

For each query, print the minimum number of teleportations. If it is not possible to reach the destination, print -1.

Constraints

- $1 \le n,q \le 2 \cdot 10^5$
- $1 \le a,b \le n$

Example

Input:
```
5 3
2 3 2 3 2
1 2
1 3
1 4
```

Output:
```
1
```

Graph Algorithms

...
Game Routes –
Investigation –
Planets Queries I –
Planets Queries II –
Planets Cycles –
Road Reparation –
Road Construction –
Flight Routes Check –
...

2
-1

CSES Problem Set

Building Roads

Time limit: 1.00 s **Memory limit:** 512 MB

Byteland has n cities, and m roads between them. The goal is to construct new roads so that there is a route between any two cities.

Your task is to find out the minimum number of roads required, and also determine which roads should be built.

Input

The first input line has two integers n and m: the number of cities and roads. The cities are numbered $1, 2, \dots, n$.

After that, there are m lines describing the roads. Each line has two integers a and b: there is a road between those cities.

A road always connects two different cities, and there is at most one road between any two cities.

Output

First print an integer k: the number of required roads.

Then, print k lines that describe the new roads. You can print any valid solution.

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
4 2
1 2
3 4
```

Output:

1
2 3

[CSES Problem Set](#)

Knight's Tour

Time limit: 1.00 s **Memory limit:** 512 MB

Given a starting position of a knight on an 8×8 chessboard, your task is to find a sequence of moves such that it visits every square exactly once.

On each move, the knight may either move two steps horizontally and one step vertically, or one step horizontally and two steps vertically.

Input

The only line has two integers x and y: the knight's starting position.

Output

Print a grid that shows how the knight moves (according to the example). You can print any valid solution.

Constraints

- $1 \le x,y \le 8$

Example

Input:
```
2 1
```

Output:
```
8 1 10 13 6 3 20 17
11 14 7 2 19 16 23 4
26 9 12 15 24 5 18 21
49 58 25 28 51 22 33 30
40 27 50 59 32 29 52 35
57 48 41 44 37 34 31 62
42 39 46 55 60 63 36 53
47 56 43 38 45 54 61 64
```

CSES Problem Set

Police Chase

Time limit: 1.00 s **Memory limit:** 512 MB

Kaaleppi has just robbed a bank and is now heading to the harbor. However, the police wants to stop him by closing some streets of the city.

What is the minimum number of streets that should be closed so that there is no route between the bank and the harbor?

Input

The first input line has two integers n and m: the number of crossings and streets. The crossings are numbered $1, 2, \ldots, n$. The bank is located at crossing 1, and the harbor is located at crossing n.

After this, there are m lines that describing the streets. Each line has two integers a and b: there is a street between crossings a and b. All streets are two-way streets, and there is at most one street between two crossings.

Output

First print an integer k: the minimum number of streets that should be closed. After this, print k lines describing the streets. You can print any valid solution.

Constraints

- $2 \le n \le 500$
- $1 \le m \le 1000$
- $1 \le a, b \le n$

Example

Input:
```
4 5
1 2
1 3
2 3
3 4
1 4
```

Output:
2
3 4
1 4

CSES Problem Set

Flight Routes Check

Time limit: 1.00 s **Memory limit:** 512 MB

There are n cities and m flight connections. Your task is to check if you can travel from any city to any other city using the available flights.

Input

The first input line has two integers n and m: the number of cities and flights. The cities are numbered $1, 2, \dots, n$.

After this, there are m lines describing the flights. Each line has two integers a and b: there is a flight from city a to city b. All flights are one-way flights.

Output

Print "YES" if all routes are possible, and "NO" otherwise. In the latter case also print two cities a and b such that you cannot travel from city a to city b.

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
4 5
1 2
2 3
3 1
1 4
3 4
```

Output:
```
NO
4 2
```

CSES Problem Set

Flight Routes

TASK | STATISTICS

Time limit: 1.00 s **Memory limit:** 512 MB

Your task is to find the k shortest flight routes from Syrjälä to Metsälä. A route can visit the same city several times.

Note that there can be several routes with the same price and each of them should be considered (see the example).

Input

The first input line has three integers n, m, and k: the number of cities, the number of flights, and the parameter k. The cities are numbered $1, 2, \dots, n$. City 1 is Syrjälä, and city n is Metsälä.

After this, the input has m lines describing the flights. Each line has three integers a, b, and c: a flight begins at city a, ends at city b, and its price is c. All flights are one-way flights.

You may assume that there are at least k distinct routes from Syrjälä to Metsälä.

Output

Print k integers: the prices of the k cheapest routes sorted according to their prices.

Constraints

- $2 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$
- $1 \le c \le 10^9$
- $1 \le k \le 10$

Example

Input:
```
4 6 3
1 2 1
1 3 3
2 3 2
2 4 6
```

Graph Algorithms

...
High Score –
Flight Discount –
Cycle Finding –
Flight Routes –
Round Trip II –
Course Schedule –
Longest Flight Route –
Game Routes –
...

3 2 8
3 4 1

Output:
4 4 7

Explanation: The cheapest routes are $1 \to 3 \to 4$ (price 4), $1 \to 2 \to 3 \to 4$ (price 4) and $1 \to 2 \to 4$ (price 7).

CSES Problem Set

Planets Queries I

Time limit: 1.00 s **Memory limit:** 512 MB

You are playing a game consisting of n planets. Each planet has a teleporter to another planet (or the planet itself).

Your task is to process q queries of the form: when you begin on planet x and travel through k teleporters, which planet will you reach?

Input

The first input line has two integers n and q: the number of planets and queries. The planets are numbered $1, 2, \ldots, n$.

The second line has n integers $t_1, t_2, \ldots, t_n$: for each planet, the destination of the teleporter. It is possible that $t_i = i$.

Finally, there are q lines describing the queries. Each line has two integers x and k: you start on planet x and travel through k teleporters.

Output

Print the answer to each query.

Constraints

- $1 \le n, q \le 2 \cdot 10^5$
- $1 \le t_i \le n$
- $1 \le x \le n$
- $0 \le k \le 10^9$

Example

Input:
```
4 3
2 1 1 4
1 2
3 4
4 1
```

Output:
```
1
```

Message Route

Time limit: 1.00 s **Memory limit:** 512 MB

Syrjälä's network has n computers and m connections. Your task is to find out if Uolevi can send a message to Maija, and if it is possible, what is the minimum number of computers on such a route.

Input

The first input line has two integers n and m: the number of computers and connections. The computers are numbered $1, 2, \dots, n$. Uolevi's computer is 1 and Maija's computer is n.

Then, there are m lines describing the connections. Each line has two integers a and b: there is a connection between those computers.

Every connection is between two different computers, and there is at most one connection between any two computers.

Output

If it is possible to send a message, first print k: the minimum number of computers on a valid route. After this, print an example of such a route. You can print any valid solution.

If there are no routes, print "IMPOSSIBLE".

Constraints

- $2 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
5 5
1 2
1 3
1 4
2 3
```

5 4

Output:
3
1 4 5

CSES Problem Set

Shortest Routes II

Time limit: 1.00 s **Memory limit:** 512 MB

There are n cities and m roads between them. Your task is to process q queries where you have to determine the length of the shortest route between two given cities.

Input

The first input line has three integers n, m and q: the number of cities, roads, and queries.

Then, there are m lines describing the roads. Each line has three integers a, b and c: there is a road between cities a and b whose length is c. All roads are two-way roads.

Finally, there are q lines describing the queries. Each line has two integers a and b: determine the length of the shortest route between cities a and b.

Output

Print the length of the shortest route for each query. If there is no route, print -1 instead.

Constraints

- $1 \le n \le 500$
- $1 \le m \le n^2$
- $1 \le q \le 10^5$
- $1 \le a, b \le n$
- $1 \le c \le 10^9$

Example

Input:
```
4 3 5
1 2 5
1 3 9
2 3 3
1 2
2 1
1 3
1 4
```

3 2

Output:
5
5
8
-1
3

CSES Problem Set

Mail Delivery

Time limit: 1.00 s **Memory limit:** 512 MB

Your task is to deliver mail to the inhabitants of a city. For this reason, you want to find a route whose starting and ending point are the post office, and that goes through every street exactly once.

Input

The first input line has two integers n and m: the number of crossings and streets. The crossings are numbered $1, 2, \dots, n$, and the post office is located at crossing 1.

After that, there are m lines describing the streets. Each line has two integers a and b: there is a street between crossings a and b. All streets are two-way streets.

Every street is between two different crossings, and there is at most one street between two crossings.

Output

Print all the crossings on the route in the order you will visit them. You can print any valid solution.

If there are no solutions, print "IMPOSSIBLE".

Constraints

$2 \le n \le 10^5$
$1 \le m \le 2.10^5$
$1 \le a, b \le n$

Example

Input:
```
6 8
1 2
1 3
2 3
2 4
2 6
3 5
```

3 6
4 5

Output:
1 2 6 3 2 4 5 3 1

CSES Problem Set

Coin Collector

Time limit: 1.00 s **Memory limit:** 512 MB

A game has n rooms and m tunnels between them. Each room has a certain number of coins. What is the maximum number of coins you can collect while moving through the tunnels when you can freely choose your starting and ending room?

Input

The first input line has two integers n and m: the number of rooms and tunnels. The rooms are numbered $1, 2, \dots, n$.

Then, there are n integers $k_1, k_2, \dots, k_n$: the number of coins in each room.

Finally, there are m lines describing the tunnels. Each line has two integers a and b: there is a tunnel from room a to room b. Each tunnel is a one-way tunnel.

Output

Print one integer: the maximum number of coins you can collect.

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le k_i \le 10^9$
- $1 \le a, b \le n$

Example

Input:
```
4 4
4 5 2 7
1 2
2 1
1 3
2 4
```

Output:
16

CSES Problem Set

Distinct Routes

Time limit: 1.00 s **Memory limit:** 512 MB

A game consists of n rooms and m teleporters. At the beginning of each day, you start in room 1 and you have to reach room n.

You can use each teleporter at most once during the game. How many days can you play if you choose your routes optimally?

Input

The first input line has two integers n and m: the number of rooms and teleporters. The rooms are numbered $1,2,\dots,n$.

After this, there are m lines describing the teleporters. Each line has two integers a and b: there is a teleporter from room a to room b.

There are no two teleporters whose starting and ending room are the same.

Output

First print an integer k: the maximum number of days you can play the game. Then, print k route descriptions according to the example. You can print any valid solution.

Constraints

- $2 \le n \le 500$
- $1 \le m \le 1000$
- $1 \le a,b \le n$

Example

Input:
```
6 7
1 2
1 3
2 6
3 4
3 5
```

4 6
5 6

Output:
2
3
1 2 6
4
1 3 4 6

CSES Problem Set

Download Speed

Time limit: 1.00 s **Memory limit:** 512 MB

Consider a network consisting of n computers and m connections. Each connection specifies how fast a computer can send data to another computer.

Kotivalo wants to download some data from a server. What is the maximum speed he can do this, using the connections in the network?

Input

The first input line has two integers n and m: the number of computers and connections. The computers are numbered $1, 2, \dots, n$. Computer 1 is the server and computer n is Kotivalo's computer.

After this, there are m lines describing the connections. Each line has three integers a, b and c: computer a can send data to computer b at speed c.

Output

Print one integer: the maximum speed Kotivalo can download data.

Constraints

- $1 \le n \le 500$
- $1 \le m \le 1000$
- $1 \le a, b \le n$
- $1 \le c \le 10^9$

Example

Input:

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

Graph Algorithms

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De Bruijn Sequence –
Teleporters Path –
Hamiltonian Flights –
Knight's Tour –
Download Speed –
Police Chase –
School Dance –
Distinct Routes –

Output:
6

CSES Problem Set

Flight Discount

Time limit: 1.00 s **Memory limit:** 512 MB

Your task is to find a minimum-price flight route from Syrjälä to Metsälä. You have one discount coupon, using which you can halve the price of any single flight during the route. However, you can only use the coupon once.

Input

The first input line has two integers n and m: the number of cities and flight connections. The cities are numbered $1, 2, \dots, n$. City 1 is Syrjälä, and city n is Metsälä.

After this there are m lines describing the flights. Each line has three integers a, b, and c: a flight begins at city a, ends at city b, and its price is c. Each flight is unidirectional.

You can assume that it is always possible to get from Syrjälä to Metsälä.

Output

Print one integer: the price of the cheapest route from Syrjälä to Metsälä.

When you use the discount coupon for a flight whose price is x, its price becomes $\lfloor x/2 \rfloor$ (it is rounded down to an integer).

Constraints

- $2 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$
- $1 \le c \le 10^9$

Example

Input:
```
3 4
1 2 3
2 3 1
```

1 3 7
2 1 5

Output:
2

CSES Problem Set

Giant Pizza

Time limit: 1.00 s **Memory limit:** 512 MB

Uolevi's family is going to order a large pizza and eat it together. A total of n family members will join the order, and there are m possible toppings. The pizza may have any number of toppings.

Each family member gives two wishes concerning the toppings of the pizza. The wishes are of the form "topping x is good/bad". Your task is to choose the toppings so that at least one wish from everybody becomes true (a good topping is included in the pizza or a bad topping is not included).

Input

The first input line has two integers n and m: the number of family members and toppings. The toppings are numbered $1, 2, \dots, m$.

After this, there are n lines describing the wishes. Each line has two wishes of the form "+ x" (topping x is good) or "- x" (topping x is bad).

Output

Print a line with m symbols: for each topping "+" if it is included and "-" if it is not included. You can print any valid solution.

If there are no valid solutions, print "IMPOSSIBLE".

Constraints

- $1 \le n, m \le 10^5$
- $1 \le x \le m$

Example

Input:
```
3 5
+ 1 + 2
```


Graph Algorithms

...
Road Construction –
Flight Routes Check –
Planets and Kingdoms –
Giant Pizza –
Coin Collector –
Mail Delivery –
De Bruijn Sequence –
Teleporters Path –
...

- 1 + 3
+ 4 - 2

Output:
- + + + -

Road Reparation

Time limit: 1.00 s **Memory limit:** 128 MB

There are n cities and m roads between them. Unfortunately, the condition of the roads is so poor that they cannot be used. Your task is to repair some of the roads so that there will be a decent route between any two cities.

For each road, you know its reparation cost, and you should find a solution where the total cost is as small as possible.

Input

The first input line has two integers n and m: the number of cities and roads. The cities are numbered $1, 2, \ldots, n$.

Then, there are m lines describing the roads. Each line has three integers a, b and c: there is a road between cities a and b, and its reparation cost is c. All roads are two-way roads.

Every road is between two different cities, and there is at most one road between two cities.

Output

Print one integer: the minimum total reparation cost. However, if there are no solutions, print "IMPOSSIBLE".

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$
- $1 \le c \le 10^9$

Example

Input:
```
5 6
1 2 3
2 3 5
2 4 2
3 4 8
5 1 7
```

5 4 4

Output:
14

CSES Problem Set

De Bruijn Sequence

Time limit: 1.00 s **Memory limit:** 512 MB

Your task is to construct a minimum-length bit string that contains all possible substrings of length n. For example, when $n = 2$, the string 00110 is a valid solution, because its substrings of length 2 are 00, 01, 10 and 11.

Input

The only input line has an integer n.

Output

Print a minimum-length bit string that contains all substrings of length n. You can print any valid solution.

Constraints

- $1 \le n \le 15$

Example

Input:
2

Output:
00110

Planets Cycles

Time limit: 1.00 s **Memory limit:** 512 MB

You are playing a game consisting of n planets. Each planet has a teleporter to another planet (or the planet itself).

You start on a planet and then travel through teleporters until you reach a planet that you have already visited before.

Your task is to calculate for each planet the number of teleportations there would be if you started on that planet.

Input

The first input line has an integer n: the number of planets. The planets are numbered $1, 2, \dots, n$.

The second line has n integers $t_1, t_2, \dots, t_n$: for each planet, the destination of the teleporter. It is possible that $t_i = i$.

Output

Print n integers according to the problem statement.

Constraints

- $1 \le n \le 2 \cdot 10^5$
- $1 \le t_i \le n$

Example

Input:
```
5
2 4 3 1 4
```

Output:
```
3 3 1 3 4
```

CSES Problem Set

School Dance

TASK | STATISTICS

Time limit: 1.00 s **Memory limit:** 512 MB

There are n boys and m girls in a school. Next week a school dance will be organized. A dance pair consists of a boy and a girl, and there are k potential pairs.

Your task is to find out the maximum number of dance pairs and show how this number can be achieved.

Input

The first input line has three integers n, m and k: the number of boys, girls, and potential pairs. The boys are numbered $1,2,\dots,n$, and the girls are numbered $1,2,\dots,m$.

After this, there are k lines describing the potential pairs. Each line has two integers a and b: boy a and girl b are willing to dance together.

Output

First print one integer r: the maximum number of dance pairs. After this, print r lines describing the pairs. You can print any valid solution.

Constraints

- $1 \le n,m \le 500$
- $1 \le k \le 1000$
- $1 \le a \le n$
- $1 \le b \le m$

Example

Input:
```
3 2 4
1 1
1 2
2 1
3 1
```

Output:
```
2
```

Graph Algorithms

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De Bruijn Sequence –
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Download Speed –
Police Chase –
School Dance –
Distinct Routes –

1	2
3	1

CSES Problem Set

Investigation

Time limit: 1.00 s **Memory limit:** 512 MB

You are going to travel from Syrjälä to Lehmälä by plane. You would like to find answers to the following questions:

- what is the minimum price of such a route?
- how many minimum-price routes are there? (modulo 10^9+7)
- what is the minimum number of flights in a minimum-price route?
- what is the maximum number of flights in a minimum-price route?

Input

The first input line contains two integers n and m: the number of cities and the number of flights. The cities are numbered $1,2,\ldots,n$. City 1 is Syrjälä, and city n is Lehmälä.

After this, there are m lines describing the flights. Each line has three integers a, b, and c: there is a flight from city a to city b with price c. All flights are one-way flights.

You may assume that there is a route from Syrjälä to Lehmälä.

Output

Print four integers according to the problem statement.

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a,b \le n$
- $1 \le c \le 10^9$

Example

Input:
```
4 5
1 4 5
```

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

Output:
5 2 1 2

CSES Problem Set

Building Teams

Time limit: 1.00 s **Memory limit:** 512 MB

There are n pupils in Uolevi's class, and m friendships between them. Your task is to divide the pupils into two teams in such a way that no two pupils in a team are friends. You can freely choose the sizes of the teams.

Input

The first input line has two integers n and m: the number of pupils and friendships. The pupils are numbered $1, 2, \dots, n$.

Then, there are m lines describing the friendships. Each line has two integers a and b: pupils a and b are friends.

Every friendship is between two different pupils. You can assume that there is at most one friendship between any two pupils.

Output

Print an example of how to build the teams. For each pupil, print "1" or "2" depending on to which team the pupil will be assigned. You can print any valid team.

If there are no solutions, print "IMPOSSIBLE".

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
5 3
1 2
1 3
4 5
```

Output:
```
1 2 2 1 2
```

Round Trip

Time limit: 1.00 s **Memory limit:** 512 MB

Byteland has n cities and m roads between them. Your task is to design a round trip that begins in a city, goes through two or more other cities, and finally returns to the starting city. Every intermediate city on the route has to be distinct.

Input

The first input line has two integers n and m: the number of cities and roads. The cities are numbered $1, 2, \dots, n$.

Then, there are m lines describing the roads. Each line has two integers a and b: there is a road between those cities.

Every road is between two different cities, and there is at most one road between any two cities.

Output

First print an integer k: the number of cities on the route. Then print k cities in the order they will be visited. You can print any valid solution.

If there are no solutions, print "IMPOSSIBLE".

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
5 6
1 3
1 2
5 3
1 5
2 4
4 5
```

Output:
4
3 5 1 3

CSES Problem Set

Teleporters Path

Time limit: 1.00 s **Memory limit:** 512 MB

A game has n levels and m teleportes between them. You win the game if you move from level 1 to level n using every teleporter exactly once.

Can you win the game, and what is a possible way to do it?

Input

The first input line has two integers n and m: the number of levels and teleporters. The levels are numbered $1, 2, \dots, n$.

Then, there are m lines describing the teleporters. Each line has two integers a and b: there is a teleporter from level a to level b.

You can assume that each pair (a, b) in the input is distinct.

Output

Print $m+1$ integers: the sequence in which you visit the levels during the game. You can print any valid solution.

If there are no solutions, print "IMPOSSIBLE".

Constraints

- $2 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
5 6
1 2
1 3
2 4
2 5
3 1
4 2
```

Output:
1 3 1 2 4 2 5

CSES Problem Set

Game Routes

TASK | STATISTICS

Time limit: 1.00 s **Memory limit:** 512 MB

A game has n levels, connected by m teleporters, and your task is to get from level 1 to level n. The game has been designed so that there are no directed cycles in the underlying graph. In how many ways can you complete the game?

Input

The first input line has two integers n and m: the number of levels and teleporters. The levels are numbered $1, 2, \dots, n$.

After this, there are m lines describing the teleporters. Each line has two integers a and b: there is a teleporter from level a to level b.

Output

Print one integer: the number of ways you can complete the game. Since the result may be large, print it modulo $10^9 + 7$.

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
4 5
1 2
2 4
1 3
3 4
1 4
```

Output:
```
3
```

Graph Algorithms

...
Round Trip II –
Course Schedule –
Longest Flight Route –
Game Routes –
Investigation –
Planets Queries I –
Planets Queries II –
Planets Cycles –
...

CSES Problem Set

Round Trip II

Time limit: 1.00 s **Memory limit:** 512 MB

Byteland has n cities and m flight connections. Your task is to design a round trip that begins in a city, goes through one or more other cities, and finally returns to the starting city. Every intermediate city on the route has to be distinct.

Input

The first input line has two integers n and m: the number of cities and flights. The cities are numbered $1, 2, \ldots, n$.

Then, there are m lines describing the flights. Each line has two integers a and b: there is a flight connection from city a to city b. All connections are one-way flights from a city to another city.

Output

First print an integer k: the number of cities on the route. Then print k cities in the order they will be visited. You can print any valid solution.

If there are no solutions, print "IMPOSSIBLE".

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
4 5
1 3
2 1
2 4
3 2
3 4
```

Output:

4
2 1 3 2

CSES Problem Set

Labyrinth

Time limit: 1.00 s **Memory limit:** 512 MB

You are given a map of a labyrinth, and your task is to find a path from start to end. You can walk left, right, up and down.

Input

The first input line has two integers n and m: the height and width of the map.

Then there are n lines of m characters describing the labyrinth. Each character is `.` (floor), `#` (wall), `A` (start), or `B` (end). There is exactly one `A` and one `B` in the input.

Output

First print "YES", if there is a path, and "NO" otherwise.

If there is a path, print the length of the shortest such path and its description as a string consisting of characters `L` (left), `R` (right), `U` (up), and `D` (down). You can print any valid solution.

Constraints

- $1 \leq n, m \leq 1000$

Example

Input:
```
5 8
########
#.A#...#
#.##.#B#
#......#
########
```

Output:
```
YES
9
LDDRRRRRU
```

Graph Algorithms

Counting Rooms
Labyrinth
Building Roads
Message Route
Building Teams
Round Trip
Monsters
Shortest Routes I
...

CSES Problem Set

Monsters

Time limit: 1.00 s **Memory limit:** 512 MB

You and some monsters are in a labyrinth. When taking a step to some direction in the labyrinth, each monster may simultaneously take one as well. Your goal is to reach one of the boundary squares without ever sharing a square with a monster.

Your task is to find out if your goal is possible, and if it is, print a path that you can follow. Your plan has to work in any situation; even if the monsters know your path beforehand.

Input

The first input line has two integers n and m: the height and width of the map.

After this there are n lines of m characters describing the map. Each character is `.` (floor), `#` (wall), `A` (start), or `M` (monster). There is exactly one `A` in the input.

Output

First print "YES" if your goal is possible, and "NO" otherwise.

If your goal is possible, also print an example of a valid path (the length of the path and its description using characters `D`, `U`, `L`, and `R`). You can print any path, as long as its length is at most $n \cdot m$ steps.

Constraints

- $1 \le n, m \le 1000$

Example

Input:
```
5 8
########
#M..A..#
#.#.M#.#
#M#..#..
#.######
```

Output:

```
YES
5
RRDDR
```

CSES Problem Set

Longest Flight Route

Time limit: 1.00 s **Memory limit:** 512 MB

Uolevi has won a contest, and the prize is a free flight trip that can consist of one or more flights through cities. Of course, Uolevi wants to choose a trip that has as many cities as possible.

Uolevi wants to fly from Syrjälä to Lehmälä so that he visits the maximum number of cities. You are given the list of possible flights, and you know that there are no directed cycles in the flight network.

Input

The first input line has two integers n and m: the number of cities and flights. The cities are numbered $1, 2, \dots, n$. City 1 is Syrjälä, and city n is Lehmälä.

After this, there are m lines describing the flights. Each line has two integers a and b: there is a flight from city a to city b. Each flight is a one-way flight.

Output

First print the maximum number of cities on the route. After this, print the cities in the order they will be visited. You can print any valid solution.

If there are no solutions, print "IMPOSSIBLE".

Constraints

- $2 \le n \le 10^5$
- $1 \le m \le 2 \cdot 10^5$
- $1 \le a, b \le n$

Example

Input:
```
5 5
1 2
2 5
```

1 3
3 4
4 5

Output:
4
1 3 4 5