Croatian Open Competition in Informatics

Round 6, March 7th 2020

Tasks

Task	Time limit	Memory limit	Score
Datum	1 second	512 MiB	50
Birmingham	1 second	512 MiB	70
Konstrukcija	1 sekunda	512 MiB	110
Skandi	10 sekundi	512 MiB	110
Trener	2 seconds	512 MiB	110
Total			450

Task Datum

The exam season at University of Zagreb is over and students are doing what they love the most – sleeping. In the rare moments of wakefulness, they usually scroll over their Instagram feed. Fabijan is one of those students.

Recently, he read the following caption – the date `02.02.2020.` is the first palindromic date in the last 909 years.

He realized the caption was incorrect and this made him wonder about palindromic dates so he asked himself for each of the N dates what is the first palindromic date that comes after that date. The date is considered *palindromic* if , when disregarding the dots, it is the same when read from left-to-right as if it was read from right-to-left. For example, dates `02.02.2020.` and `12.10.0121.` are palindromic, while `03.02.2020.` and `12.07.1993.` are not.

Note: In this task it is important to take account of leap years which have 29 days in February. For the purposes of this task, we consider a year to be a leap year if it is divisible by 4. Otherwise, months have 31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30 and 31 days in order.

Input

The first line contains an integer N ($1 \leq N \leq 10\,000$) from the task description.

The next N lines contain a valid date in format `DD.MM.YYYY`.

Output

For each date from the input, you should output the first palindromic date that comes strictly after it. That date should be printed in the `DD.MM.YYYY.` and we guarantee that the solution exists in this format.

Scoring

In the test cases worth a total of 10 points, each date in the output will have the same month and year as the corresponding date from the input. Also, N will be equal to 10.

In the test cases worth an additional 10 points, each date in the output will have the same year as the corresponding date from the input. Also, N will be equal to 10.

In the test cases worth an additional 20 points, $N = 10$ will hold.

Examples

input	input	input
1 02.02.2020.	2 01.01.1000. 31.12.2026.	3 01.01.0100. 05.07.0321. 05.05.0505.
output	**output**	**output**
12.02.2021.	10.01.1001. 03.02.2030.	10.10.0101. 10.01.1001. 10.01.1001.

Clarification of the first example: Although the given date is palindromic, Fabijan is interested in the first date that strictly comes after it. That date is `12.02.2021.`

Task Birmingham

It is well known that all horse races in Birmingham are fixed days in advance. It is a little less known that certain people that fix these races (and thereby know the winner) start spreading that information around the city the next day.

The first day after the meeting, all people that know the information about the winner start sharing that information with all people that live at most K steps away from their house.

The second day after the meeting, all people that know the information about the winner start sharing that information with all people that live at most $2 \cdot K$ steps away from their house.

In general, X-th day after the meeting, all people that know the information about the winner start sharing that information with all people that live at most $X \cdot K$ steps away from their house.

We can represent Birmingham as a graph where vertices represent the houses and edges represent bidirectional roads which connect these houses. Houses are indexed with increasing integers from 1 to N and we say that a person can travel each road in a single step. It is possible to reach each house from each other house by traversing a sequence of roads.

Your task is to determine, for each house, on which day will the information about the race winner reach it.

Input

The first line contains four integers N, M, Q and K ($1 \leq N, Q, K \leq 100\,000, Q \leq N, 1 \leq M \leq 200\,000$), the number of houses in Birmingham, the number of roads in Birmingham, the number of people that were present on the secret meeting and the number K from task description.

The next line contains Q integers where the i-th integer represents the index of a house where the i-th person from the secret meeting lives in.

The i-th of the next M lines contains integers A_i and B_i ($1 \leq A_i, B_i \leq N, A_i \neq B_i$), which denote that the i-th road connects houses with indices A_i and B_i.

Output

Output N numbers where the i-th number represents on which day after the meeting will the person living in house with index i find out who will win the race. If the person living in that house was present on the secret meeting, output 0 instead.

Scoring

In the test cases worth a total of 20 points, it will hold $K = 1$, $1 \leq N, Q \leq 100$ and $1 \leq M \leq 200$.
In the test cases worth an additional 15 points, it will hold $1 \leq N, Q \leq 100$ and $1 \leq M \leq 200$.

Examples

input	input	input
6 8 1 1	6 8 2 1	6 8 1 2
6	6 4	6
1 3	1 3	1 3
1 5	1 5	1 5
1 6	1 6	1 6
2 5	2 5	2 5
2 6	2 6	2 6
3 4	3 4	3 4
3 5	3 5	3 5
5 6	5 6	5 6

output	output	output
1 1 2 2 1 0	1 1 1 0 1 0	1 1 1 2 1 0

Clarification of the third example: The figure represents a graph from the third example. Since houses 1, 2, 3 and 5 are at most two steps away from house 6, people living in them will find out about the winner the day after the meeting. Person living in house 4 will find out about the winner two days after the meeting.
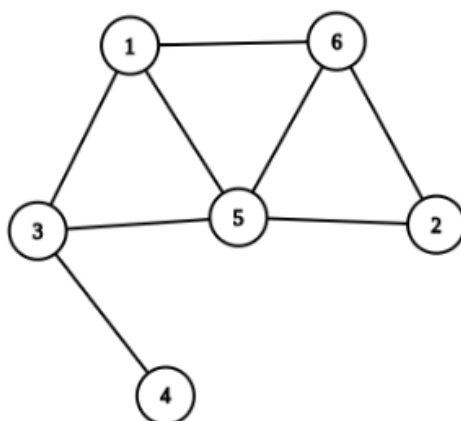
Task Konstrukcija

Neka je G usmjereni graf bez ciklusa. Ako su $c_1, c_2, c_3, \ldots c_n$ različiti čvorovi grafa G takvi da postoji put od c_1 do c_2, postoji put od c_2 do c_3, $\ldots$ i postoji put od c_{n-1} do c_n, kažemo da je niz $C = (c_1, c_2, c_3, \ldots c_n)$ uređeni niz koji počinje u čvoru c_1 i završava u čvoru c_n. Primijetite da između susjednih elemenata c_i i c_{i+1} uređenog niza ne moraju postojati direktni bridovi, nego je dovoljno da postoji put od c_i do c_{i+1}.

Za tako definiran uređeni niz $C = (c_1, c_2, c_3, \ldots c_n)$, definiramo njegovu duljinu $len(C) = n$. Dakle, duljina uređenog niza je jednaka broju čvorova u uređenom nizu. Primijetite da uređeni niz može imati duljinu 1, tj. da se uređeni niz može sastojati od samo jednog čvora koji je ujedno i početak i kraj tog uređenog niza.

Također, za uređeni niz $C = (c_1, c_2, c_3, \ldots c_n)$ definiramo njegov predznak kao $sgn(C) = (-1)^{len(C)+1}$. Za čvorove x i y grafa G, označimo sa $S_{x,y}$ skup svih uređenih nizova koji počinju u x i završavaju u y.

Tada definiramo napetost između čvorova x i y kao $tns(x,y) = \sum_{C \in S_{x,y}} sgn(C)$, tj. napetost između čvorova x i y jednaka je zbroju predznaka svih uređenih nizova koji počinju u x i završavaju u y.

Zadan je cijeli broj K. Vaš je zadatak konstruirati usmjereni graf bez ciklusa čiji broj čvorova **ne prelazi 1000** i čiji broj bridova također **ne prelazi 1000** i za koji vrijedi $tns(1, N) = K$, gdje je N broj čvorova tog konstruiranog grafa i oznake čvorova su prirodni brojevi $1, 2, \ldots, N$.

Ulazni podaci

U prvom se retku nalazi cijeli broj K ($|K| \leq 10^{18}$), iz teksta zadatka.

Izlazni podaci

U prvom retku redom treba ispisati broj čvorova i broj bridova konstruiranog grafa iz teksta zadatka. Označimo broj čvorova tog grafa s N ($1 \leq N \leq 1000$), a broj bridova s M ($0 \leq M \leq 1000$).

U i-tom od sljedećih M redaka redom treba ispisati dva različita prirodna broja X_i i Y_i ($1 \leq X_i, Y_i \leq N$), koji nam predstavljaju i-ti brid koji je usmjeren s čvora X_i u čvor Y_i. Svaki brid smije biti ispisan najviše jednom.

Također, apsolutna vrijednost napetosti između svaka dva čvora u grafu mora biti manja ili jednaka 2^{80}.

Ako postoji više mogućih rješenja, ispišite bilo koje.

Bodovanje

Podzadatak	Broj bodova	Ograničenja
1	15	$1 \leq K < 500$
2	15	$-300 < K \leq 1$
3	20	$|K| < 10000$
4	60	Nema dodatnih ograničenja.

Probni primjeri

input	input	input
0	1	2

output	output	output
6 6	1 0	6 8
1 4		1 2
1 5		1 3
4 3		1 4
5 3		1 5
3 2		5 4
2 6		2 6
		3 6
		4 6

Pojašnjenje prvog probnog primjera: Konstruirani graf ima 6 čvorova. Uređeni nizovi koji počinju u 1 i završavaju u 6 su: $(1,6)$, $(1,4,6)$, $(1,5,6)$, $(1,3,6)$, $(1,2,6)$, $(1,4,3,6)$, $(1,4,2,6)$, $(1,5,3,6)$, $(1,5,2,6)$, $(1,3,2,6)$, $(1,4,3,2,6)$, $(1,5,3,2,6)$. Njihove duljine su redom $1, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4$, pa su njihovi predznaci redom $-1, 1, 1, 1, 1, -1, -1, -1, -1, -1, 1, 1$, pa je napetost između čvorova 1 i 6 jednaka $-1 + 1 + 1 + 1 + 1 - 1 - 1 - 1 - 1 - 1 + 1 + 1 = 0$.
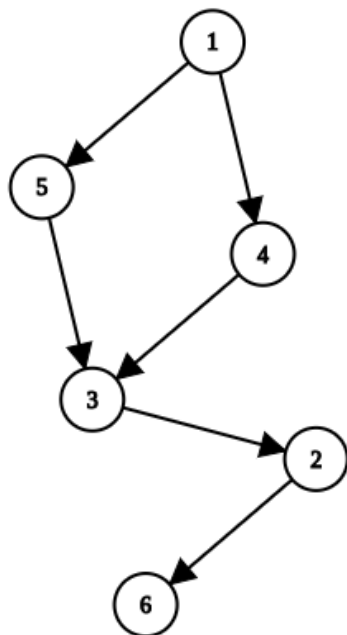
Task Skandi

Dragica je predsjednica treće podružnice Udruge umirovljenika grada Samobora, strastvena kuharica te vjerojatno jedna od najboljih rješavateljica skandinavki u Hrvatskoj. Skandinavka je pravokutna križaljka dimenzija $N \times M$ u kojoj su polja ili prazna (te se trebaju popuniti) ili ispunjena. Ispunjena polja sadrže najviše dva pitanja, jedno na koje se odgovara prema desno i drugo na koje se odgovara prema dolje. Odgovori na pitanja upisuju se na prazna polja prema dolje ili prema desno od polja na kojem se nalazi pitanje do idućeg ispunjenog polja ili do ruba križaljke. Pitanje prema desno će uvijek postojati osim ako je blokirano rubom skandinavke ili ispunjenim poljem zdesna. Analogno, pitanje prema dolje će uvijek postojati osim ako je blokirano rubom skandinavke ili ispunjenim poljem odozdo

Dragica zna odgovoriti na sva pitanja u skandinavki, ali je svjesna da joj nije preostalo još puno vremena pa želi odgovoriti **na što manje pitanja, a da ispuni cijelu skandinavku**. Nažalost, ona ne zna na koliko pitanja minimalno mora odgovoriti te koja će to pitanja biti pa zato traži svoje najdraže unuke da joj pomognu.

Ulazni podaci

U prvom su retku prirodni brojevi N i M ($2 \leq N, M \leq 500$), iz teksta zadatka.

U sljedećih se N redaka nalazi po M znakova '0' ili '1', gdje '0' predstavlja prazno polje koje treba popuniti, a '1' predstavlja ispunjeno polje . Kao i u pravim skandinavkama, vrijedi da će prvi red i stupac biti popunjeni znakovima '1'.

Garantiramo da će postojati barem jedno polje s oznakom '0'.

Izlazni podaci

U prvom retku treba ispisati najmanji mogući broj pitanja na koja se mora odgovoriti da bi se popunila cijela skandinavka. Označimo taj broj s X.

U sljedećih X redaka treba ispisati na koja pitanja Dragica mora odgovoriti. Ispis je oblika: R S smjer, gdje je R oznaka reda u kojem se nalazi pitanje, S oznaka stupca i smjer jedna od riječi "DESNO" ili "DOLJE".

Ako postoji više mogućih rješenja, ispišite bilo koje.

Bodovanje

Podzadatak	Broj bodova	Ograničenja
1	18	Bit će najviše 9 polja s oznakom '1'
2	32	$N \leq 500$ i $M \leq 10$
3	60	Nema dodatnih ograničenja.

Ako vaše rješenje ispiše točan prvi redak na svim testnim primjerima nekog podzadatka, ali na barem jednom testnom primjeru neispravno ispiše preostale retke, osvojit ćete 50% bodova predviđenih za taj podzadatak.

Probni primjeri

input	input	input
4 5	6 4	9 8
11111	1111	11111111
10000	1011	10000000
10000	1000	10001000
10000	1011	10010001
	1010	11100001
output	1000	10100110
		10001000
3	**output**	10100001
2 1 DESNO		10010001
3 1 DESNO	4	
4 1 DESNO	1 2 DOLJE	**output**
	4 4 DOLJE	
	5 3 DOLJE	14
	3 1 DESNO	5 2 DOLJE
		5 8 DOLJE
		8 3 DOLJE
		2 1 DESNO
		3 1 DESNO
		3 5 DESNO
		4 1 DESNO
		4 4 DESNO
		5 3 DESNO
		6 3 DESNO
		7 1 DESNO
		7 5 DESNO
		8 3 DESNO
		9 4 DESNO

Pojašnjenje trećeg probnog primjera: Primjer prave skandinavke koja je ekvivalentna ovom probnom primjeru prikazan je na idućoj stranici. Ispunjena polja označena su crnom bojom, a polja koja sadrže barem jedno pitanje su dodatno numerirana. Ispod slike prikazana su pitanja koja se rješavaju prema desno (stupac "vodoravno") i pitanja koja se rješavaju prema dolje (stupac "okomito"). Primijetite da neka ispunjena polja sadrže samo jedno pitanje (primjerice polja 8 i 13), dok neka ispunjena polja sadrže po dva pitanja (primjerica poja 10 i 12). Ovu konkretnu skandinavku moguće je u potpunosti riješiti ako znamo odgovore na 14 pitanja koja su navedena u izlazu probnog primjera. Okušajte se sami!
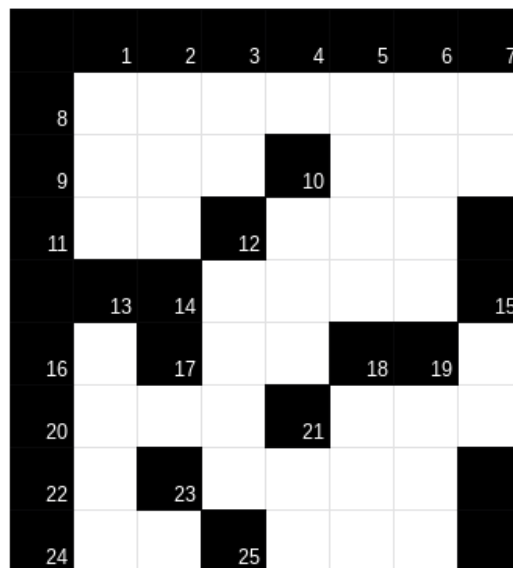
Vodoravno:

8. Otac dinamičkog programiranja, Richard
9. Prvi zadatak, četvrto kolo
10. Uzvik u koridi
11. chr(115) * 2 u Pythonu
12. Internet of things
14. Najbolje informatičko natjecanje
16. Leksikografski najmanja riječ
17. Međunarodni sustav mjernih jedinica
19. Fiktivni lik iz serijala o Jamesu Bondu
20. Balkanska informatička olimpijada
21. Natjecanje na platformi TopCoder
22. Bor
23. Poseban pokazivač u jeziku C
24. Umjetna inteligencija
25. Popularan kriptografski algoritam

Okomito:

1. Pretraga u širinu
2. Konstanta strojnog epsilona
3. Unix naredba (ispis sadržaja direktorija)
4. Šesnaesto slovo abecede
5. Mjesec (engl.)
6. Duboki ženski glasovi
7. Negacija
10. Međunarodna informatička olimpijada
12. Hrvatski savez informatičara
13. Palindromična pop-grupa iz Švedske
15. "Korijenast" algoritam
17. Kisik
18. Nepopularna poruka na evaluatoru
19. Naredba za brisanje ekrana u QBasic-u
21. Zadnji i prvi samoglasnik
23. Jod

Task Trener

At this point we already know that students love to sleep. Patrik is a record holder in this category. He wakes up only when he needs to eat or if he wishes to play *FIFA 20*. Therefore, his dreams usually revolve around football. In his last dream, he found himself in the role of a football manager of his favourite team – GNK Dinamo Zagreb.
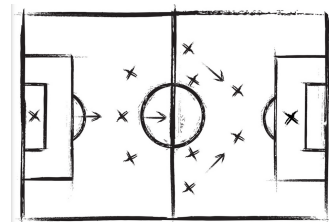
His job is to select N players that will defend the blue colors in the next season, but the board has some peculiar requests. They are:

- All players must have surnames of distinct lengths.

- Surname of a player must appear as a continuous subsequence of surnames of all players whose surnames are longer.

To make his job easier, Patrik divided the potential players in N buckets such that players in i-th bucket have exactly i letters in their surname. In each of these buckets there are exactly K players. Patrik wants to know in how many distinct ways (modulo $10^9 + 7$) can he choose the players for his squad while also conforming to the given requests.

Input

The first line contains two integers N ($1 \le N \le 50$) and K ($1 \le K \le 1\,500$).

Each of the next N lines contains K not necessarily distinct surnames of players. The surnames of players in i-th of those lines consist of exactly i lowercase letters from the English alphabet.

Output

In the only line you should output the answer from the task description.

Bodovanje

Subtask	Score	Constraints
1	22	$N = 5$ and $K = 10$
2	33	$N = 50$ and $K = 100$
3	55	No additional constraints.

Examples

input	input	input
3 2 a b ab bd abc abd	3 3 a b c aa ab ac aaa aab aca	3 1 a bc def
output	**output**	**output**
5	6	0

Clarification of the first example: Patrik can choose the following teams: (a, ab, abc), (a, ab, abd), (b, ab, abc), (b, ab, abd) and (b, bd, abd).