

Classroom Game

Ishuri ryisumbuye rizwi cyane ryo muri Tashkent ryizihiza isabukuru yaryo ritegura umukino hagati y'abanyeshuri n'abarimu. Hari abanyeshuri N bicaye mu ishuri, bafite imibare kuva kuri 0 kugeza kuri $N - 1$. Buri munyeshuri afite urupapuro rurimo urutonde rw'imibare. Mu ntangiriro, buri rupapuro ruba rurimo ubusa, bityo rukaba rurimo urutonde rw'imibare.

Abanyeshuri barimo gukina umukino n'abarimu ba M , bafite imibare kuva kuri 0 kugeza kuri $M - 1$, hamwe n'umuyobozi w'ikigo. Umukino ukinwa mu ntambwe za M , kandi urimo inomeru kuva kuri 0 kugeza kuri $M - 1$. Mu ntambwe j , mwarimu j yinjira mu ishuri maze hakurikiraho ibintu bikurikira:

- Bamwe mu banyeshuri (bishoboka ko ari zeru) bazamura ukuboko. Bizewe ko muri buri ntambwe nibura umunyeshuri umwe azamura ukuboko kwe, kandi buri munyeshuri ashobora kuzamura ukuboko kwe inshuro imwe gusa mu mukino wose.
- Umwarimu areba impapuro abanyeshuri bafite ubu, kandi ashobora **kumodifyinga** impapuro abanyeshuri bafite **batazamuye** ukuboko kwabo muri iyi ntambwe. Kuri buri munyeshuri nk'uwo, umwarimu ashobora gusimbuza ibiri mu mpapuro ze urutonde rushya (rushobora kuba rurimo ubusa). Buri mubare wose ugomba kuba uri hagati ya 0 na 63, harimo, kandi urutonde rushobora kugira ibintu bitarenze 63.
- Nyuma y'izi mpinduka, umwarimu j aragenda, abanyeshuri bagahana impapuro zabo hakurikijwe ibanga rya P . Ni ukuvuga ko buri munyeshuri i ($0 \leq i < N$) aha umunyeshuri $P[i]$ impapuro ze, aho $P[0], P[1], \dots, P[N - 1]$ ari N **distinct** integer hagati ya 0 na $N - 1$, harimo. Agaciro ka P **fixed** mu ntambwe zose z'umukino, ariko abarimu n'umuyobozi w'ikigo ntibabizi.

Iyo intambwe zose M zirangiye kandi ihererekanya rya nyuma nk'uko P ibivuga rimaze gukorwa, umuyobozi w'ishuri arinjira. Arebye gusa impapuro abanyeshuri bafite, umuyobozi w'ishuri agomba kugena, kuri buri munyeshuri i ($0 \leq i < N$), inomeru y'intambwe j aho umunyeshuri i azamura ukuboko kwe, cyangwa agafata umwanzuro ko umunyeshuri i atigeze azamura ukuboko kwe.

Abarimu ntibashobora kuvugana n'abandi barimu cyangwa umuyobozi w'ishuri, keretse binyuze mu mibare y'imibare yanditse ku mpapuro. Buri mwarimu azi intambwe yinjiramo mu ishuri.

Inshingano yawe ni ugutegura no gushyira mu bikorwa ingamba z'abarimu n'umuyobozi w'ikigo zigaragaza neza niba buri munyeshuri yazamuye ukuboko kwe n'igihe yazamuye. Amanota yawe azaterwa n'uburebure ntarengwa bw'umurongo uwo ari wo wose wanditse ku rupapuro: uburebure bugufi ntarengwa butanga amanota menshi cyangwa angana.

Implementation Details

Ugomba gushyira mu bikorwa inzira ebyiri, imwe igenewe abarimu n'indi igenewe umuyobozi w'ishuri.

Uburyo ugomba gushyira mu bikorwa **teachers** ni:

```
std::vector<std::vector<int>> process_step(  
    int N, int M, int R,  
    std::vector<int> T,  
    std::vector<std::vector<int>> A)
```

- N : umubare w'abanyeshuri.
- M : umubare w'intambwe, ndetse n'umubare w'abarimu.
- R : inomeru y'intambwe iriho ubu (kuva kuri 0 kugeza kuri $M - 1$).
- T : array (ishobora kuba irimo ubusa) igizwe n'ibipimo by'abanyeshuri bazamura ukuboko kwabo muri iyi step, bitondetse mu buryo bwiyongera.
- A : array of length N rusobanura impapuro, aho $A[i]$ ($0 \leq i < N$) ari array y'imibare yose iri ku rupapuro rufitwe n'umunyeshuri i mu ntangiriro y'intambwe.
- Ubu buryo bwitwa neza neza inshuro M kuri buri mukino, mu buryo $R = 0, 1, \dots, M - 1$.

Uburyo bugomba gusubiza urutonde rw'uburebure \$BN
, *rugaragaza impapuro nyumay'impindukazamwarimu, mu buryo bumwena* A\$.

- Kuri buri munyeshuri i wazamuye ukuboko (ni ukuvuga i igaragara muri T), urupapuro ntirugomba guhindurwa, bityo $B[i] = A[i]$.
- Kuri buri i ku buryo $0 \leq i < N$, uburebure bwa $B[i]$ ntibugomba kurenza 63, kandi buri mubare w'intege nke muri $B[i]$ ugomba kuba uri hagati ya 0 na 63, harimo.

Uburyo ugomba gushyira mu bikorwa kuri **headmaster** ni:

```
std::vector<int> determine_steps(  
    int N, int M, std::vector<std::vector<int>> A)
```

- N, M : kimwe n'ibyo twavuze haruguru.
- A : urutonde rw'uburebure N , aho $A[i]$ ari urutonde rw'imibare yose iri ku rupapuro rufitwe n'umunyeshuri i nyuma y'intambwe zose M .
- Ubu buryo bwitwa rimwe gusa kuri buri mukino, nyuma yo guhamagara bwa nyuma kuri `process_step`.

Uburyo bugomba gusubiza urutonde D rw'uburebure N . Kuri buri i nk'uko $0 \leq i < N$, bigomba kuba bifite

- $D[i] = j$ niba umunyeshuri i yazamuye ukuboko kwe mu ntambwe j , cyangwa

- $D[i] = -1$ niba umunyeshuri i atigeze azamura ukuboko kwe mu mukino wose.

Gahunda yawe ntiyemerewe kubika cyangwa kohereza amakuru ayo ari yo yose kuva kuri 'process_step' imwe ujya kuri process_step indi, keretse binyuze mu gaciro ko gusubiza process_step . Niba gahunda yawe igerageje kubikora, amanota yawe muri CMS ashobora kuba atari yo kandi ashobora kugabanuka nyuma y'uko irushanwa rirangiye. Menya ko umutoza ashobora gukora ingero nyinshi za gahunda yawe icyarimwe. Ibi bivuze ko guhamagara process_step na determine_steps kuva ku mukino umwe bishobora gukorwa mu bihe bitandukanye, kandi guhamagara process_step na determine_steps kuva ku mikino itandukanye bishobora gukorwa mu bihe bimwe. Buri kizamini kirimo imikino igera kuri 5 .

Constraints

- $2 \leq N \leq 63$
- $1 \leq M \leq 63$
- Each student raises their hand **at most once** during the entire game. In other words, for every student i , there is at most one step j in which i raises their hand.
- At each step, at least one student does **not** raise their hand.

Subtasks and Scoring

Subtask	Score	Additional Constraints
1	4	$M = 1$
2	6	$N = 2$
3	9	$P[i] = i$ for all $0 \leq i \leq N - 1$.
4	25	At most one student raises their hand at each step.
5	56	No additional constraints.

For each test case, your score is 0 (reported as `Output isn't correct` in CMS) if the return value of any call to procedure `process_step` is invalid or if the return value of any call to procedure `determine_steps` is incorrect.

Otherwise, let C be the maximum length of **any** array in **any** B returned by `process_step`. Then, the score for a test case in a subtask with score S is calculated as $S \cdot X$, where X depends on C according to the following table:

Condition	X
$C \leq 2$	1.00
$C = 3$	0.75
$C = 4$	0.55
$5 \leq C \leq 13$	$0.50 - 0.03 \cdot (C - 5)$
$14 \leq C \leq 63$	$0.19 \cdot \frac{64-C}{64-14} + 0.04$

Example

Tekereza ku rugero rwa $N = 4$, $M = 2$, na permutation $P = [0, 3, 1, 2]$. Mu ntangiriro, impapuro zose ziba zambaye ubusa.

The grader first calls:

```
process_step(4, 2, 0, [1], [[], [], [], []])
```

Umunyeshuri 1 yazamuye ukuboko, bityo inyandiko ye ntishobora guhindurwa. Umwarimu 0 ashobora gufata icyemezo cyo kwandika $[10]$ ku mpapuro z'umunyeshuri 0, akandika $[1, 63, 4]$ ku mpapuro z'umunyeshuri 3, hanyuma agasiga impapuro z'umunyeshuri 2 zirimo ubusa. Kugira ngo ibi bigerweho, inzira igomba gusubiza $B = [[10], [], [], [1, 63, 4]]$.

Nyuma yuko mwarimu 0 avuye, abanyeshuri bahinduranya impapuro zabo hakurikijwe P . Nyuma yo guhinduranya impapuro, impapuro ni $A = [[10], [], [1, 63, 4], []]$.

The grader now calls:

```
process_step(4, 2, 1, [0, 3], [[10], [], [1, 63, 4], []])
```

Abanyeshuri 0 na 3 bazamuye ukuboko, bityo impapuro zabo ntizishobora guhindurwa. Umwarimu 1 ashobora gufata icyemezo cyo kwandika $[0, 40]$ ku rupapuro rw'umunyeshuri 1 hanyuma akandika $[1, 50]$ ku rupapuro rw'umunyeshuri 2. Kugira ngo ibi bigerweho, inzira igomba gusubiza $B = [[10], [0, 40], [1, 50], []]$.

Nyuma yuko mwarimu 1 avuye, impapuro zongera guhindurwa hakurikijwe P . Nyuma yo guhindurwa, impapuro ni $A = [[10], [1, 50], [], [0, 40]]$.

Finally, the grader calls:

```
determine_steps(4, 2, [[10], [1, 50], [], [0, 40]])
```

Ubu buryo bugomba gusubiza urutonde $D = [1, 0, -1, 1]$ kubera ko abanyeshuri 0 na 3 bazamuye ukuboko kwabo mu ntambwe 1 , abanyeshuri 1 bazamuye ukuboko kwabo mu ntambwe 0 , kandi abanyeshuri 2 ntibigeze bazamura ukuboko kwabo. Muri uru rugero, $C = 3$.

Sample Grader

Input format:

```
N M
Q[0] Q[1] ... Q[N-1]
P[0] P[1] ... P[N-1]
```

Aha, Q ni array y'uburebure N , aho $Q[i] = j$ niba umunyeshuri i azamura ukuboko kwe muri step j , cyangwa $Q[i] = -1$ niba umunyeshuri i atazamura ukuboko kwe mu mukino wose.

Output format:

Nyuma ya buri guhamagara `process_step` , icyitegererezo cy'icyitegererezo gisohora ibikubiye mu mpapuro. Reka K ibe uburebure bwa B na $L[i]$ ibe uburebure bwa $B[i]$ (kuri buri $0 \leq i < K$). Icyitegererezo cy'ingero cyandika B muri ubu buryo bukurikira, **hagakurikiraho umurongo uri ubusa**:

```
K
L[0] B[0][0] B[0][1] ... B[0][L[0]-1]
L[1] B[1][0] B[1][1] ... B[1][L[1]-1]
:
L[K-1] B[K-1][0] B[K-1][1] ... B[K-1][L[K-1]-1]
```

The sample grader then exchanges the papers according to permutation P . If $K \neq N$, the sample grader prints an error message and terminates instead.

After calling `determine_steps`, the sample grader outputs:

```
C H
D[0] D[1] ... D[H-1]
```

Here, H is the length of the array D returned by `determine_steps`.