Alice is providing print service, while the pricing doesn't seem to be reasonable, so people using her print service found some tricks to save money.

For example, the price when printing less than 100 pages is 20 cents per page, but when printing not less than 100 pages, you just need to pay only 10 cents per page. It's easy to figure out that if you want to print 99 pages, the best choice is to print an extra blank page so that the money you need to pay is 100×10 cents instead of 99×20 cents.

Now given the description of pricing strategy and some queries, your task is to figure out the best ways to complete those queries in order to save money.

Input

The first line contains an integer T (≈ 10) which is the number of test cases.

Then T cases follow.

Each case contains 3 lines. The first line contains two integers n, m ($0 < n, m \leq 10^5$). The second line contains $2n$ integers s_1, p_1, s_2, p_2, $\ldots$, s_n, p_n ($0 = s_1 < s_2 < \ldots < s_n \leq 10^9$, $10^9 \geq p_1 \geq p_2 \geq \ldots \geq p_n \geq 0$). The price when printing no less than s_i but less than s_{i+1} pages is p_i cents per page (for $i = 1 \ldots n-1$). The price when printing no less than s_n pages is p_n cents per page. The third line containing m integers $q_1 \ldots q_m$ ($0 \leq q_i \leq 10^9$) are the queries.

Output

For each query q_i, you should output the minimum amount of money (in cents) to pay if you want to print q_i pages, one output in one line.

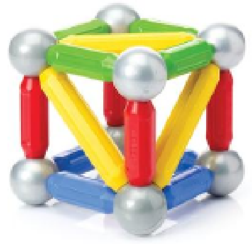
Sample Input

```
1
2 3
0 20 100 10
0 99 100
```

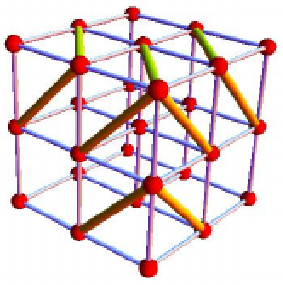
Sample Output

```
0
1000
1000
```

Bob used to have many toy blocks and he loved cube blocks very much and builds many structures only using cube blocks. Now, Bob has new toys to play, a set of magnetic robs with different length and magnetic balls to connect these robs. He decide to use these new toys to reproduce those structure he used to build using cube blocks by replacing every cube block with the cube frame below.



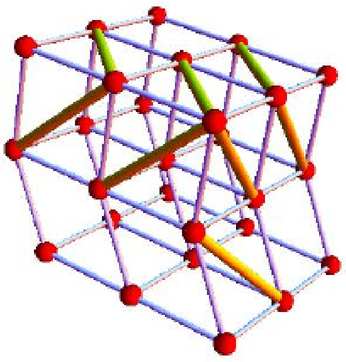
As you can see, each block is composed by 8 magnetic balls, 12 magnetic robs with length 1 (standard rob). And there would be some magnetic robs with length $\sqrt{2}$ (long rob) connecting to diagonal balls to make it rigid. Adjacent cubes can share balls and robs. Before long he realize that there is no need to put 3 long robs to connect the diagonal balls of each cube to make it rigid.

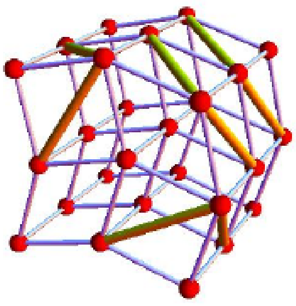


For example, if the structure is a $2 \times 2 \times 2$ cube, only 9 robs is need to prevent the structure from out of its shape.

If there are less than 9 long robs, for example, 8 long rods, the structure may transform into the shape showed in pictures below so it cannot maintain its original shape.

Bob wonder what is the minimum number of long robs need to prevent the structure from out of the shape.





Input

There are multiple cases. The first line of each case contains three integers, H, L and W ($1 \le H, L, W \le 10$), indicating the height, length and width of the structure built by original cube blocks. Then H sections of input following, each section contains L lines and each line contains W characters describing the layout of the structure. The w-th character of l-th line in the h-th section is '`*`' when there is a cube block in position (w, l, h), or '`.`' otherwise.

Sections are separated by a blank line. The input structure is guaranteed to be connected by faces and there would be at least one '`*`' in each case. Please note that the final structure is built by replacing each cube block by robs and balls, as mentioned above.

Output

For each case, output one integer, the minimum number of long robs Bob needed to make the structure rigid.

Hint: The last two cases are essentially the same when Bob builds the structure using balls and robs.

Sample Input

```
1 2 3
***
***
1 2 3
*.*
***
2 2 2
**
**

**
**
3 3 3
***
***
***

***
***
***

***
***
***
3 3 3
***
***
***

***
*.*
***

***
***
***
```

Sample Output

```
9
11
9
15
15
```

There's a round medal fixed on an ideal smooth table, Fancy is trying to throw some coins and make them slip towards the medal to collide. There's also a round range which shares exact the same center as the round medal, and radius of the medal is strictly less than radius of the round range. Since that the round medal is fixed and the coin is a piece of solid metal, we can assume that energy of the coin will not lose, the coin will collide and then moving as reflect.

Now assume that the center of the round medal and the round range is origin (Namely $(0, 0)$) and the coin's initial position is strictly outside the round range. Given radius of the medal R_m, radius of coin r, radius of the round range R, initial position (x, y) and initial speed vector (vx, vy) of the coin, please calculate the total time that any part of the coin is inside the round range.

Please note that the coin might not even touch the medal or slip through the round range.

Input

There will be several test cases. Each test case contains 7 integers R_m, R, r, x, y, vx and vy in one line. Here $1 \le R_m < R \le 2000$, $1 \le r \le 1000$, $R + r < |(x, y)| \le 20000$, $1 \le |(vx, vy)| \le 100$.

Output

For each test case, please calculate the total time that any part of the coin is inside the round range. Please output the time in one line, an absolute error not more than 1e-3 is acceptable.

Sample Input

```
5 20 1 0 100 0 -1
5 20 1 30 15 -1 0
```

Sample Output

```
30.000
29.394
```

Do you know Vladimir Arnold? He's a mathematician who demonstrated an image transformation method called arnold transformation, which could shuffle all pixels in an image, and after a serials of this transformation, the image would be transformed to its original form.

The transformation method is quite simple. For a given image with $N \times N$ pixels (Width and height are both equal to N), a pixel at location (x, y) will be shuffled to location $((x+y)\%N, (x+2\times y)\%N)$ $(0 \le x < N, 0 \le y < N)$. In one step of transformation, all $N \times N$ pixels will be shuffled to new corresponding location, making the image a chaotic one. You can do the transformation as many times as you can.

The arnold transformation is very interesting. For every image of size $N \times N$, after finite steps of transformation, the image will become exact the same as the original one. The minimum number of steps which make every possible image become the same as origin will be called as period of arnold transformation. For a given N, can you calculate the period?

Input

There will be about 200 test cases. For each test case, there will be an integer N in one line. Here N $(2 \le N \le 4000000000)$ equals to width and height of images.

Output

For each test case, please calculate the period of arnold transformation and output it in one line.

Sample Input

```
11
29
41
```

Sample Output

```
5
7
20
```

Define matrix $A \in R^{n \times n}$, if for every m $(1 \le m \le n)$,

$$det\ A\begin{pmatrix} i_1, i_2, \dots, i_m \\ i_1, i_2, \dots, i_m \end{pmatrix} = \begin{vmatrix} a_{i_1 i_1} & a_{i_1 i_2} & \dots & a_{i_1 i_m} \\ a_{i_2 i_1} & a_{i_2 i_2} & \dots & a_{i_2 i_m} \\ \dots & \dots & \ddots & \dots \\ a_{i_m i_1} & a_{i_m i_2} & \dots & a_{i_m i_m} \end{vmatrix} < 0, (1 \le i_1, \dots, i_m \le n),$$

then matrix A can be called as partially negative matrix. Here matrix

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \ddots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix}, \text{ and } \{i_1, \dots, i_m\} \text{ is a subset of } \{1, \dots, n\}.$$

If you are not familiar with determinant of a matrix, please read the Note part of this problem.

For example, matrix $\begin{pmatrix} -2 & 4 \\ 4 & -6 \end{pmatrix}$ is a partially negative matrix because $|-2|$, $|-6|$ and $\begin{vmatrix} \text{-2} & 4 \\ 4 & \text{-6} \end{vmatrix}$ are negative.

A symmetric matrix is a square matrix that equals to its transpose. Formally, matrix A is symmetric if $A = A^T$. For example, $\begin{pmatrix} 1 & 3 \\ 3 & 1 \end{pmatrix}$ is a symmetric matrix.

Given two N-dimensional vector x and b, and we guarantee that there will be at least one 0 value in vector b. You task is to judge if there exists a symmetric partially negative matrix A, which fulfills $Ax = b$.

Input

There are several test cases. Proceed to the end of file.

Each test case is described in three lines.

The first line contains one integer N $(2 \le N \le 100000)$.

The second line contains N integers x_i $(-1000000 < x_i < 1000000,\ 1 \le i \le N)$, which is vector x.

The third line contains N integers b_i $(-1000000 < b_i < 1000000,\ 1 \le i \le N)$, which is vector b. There will be at least one b_i which equals to zero.

Output

For each test case, output '`Yes`' if there exists such a matrix A, or '`No`' if there is no such matrix.

Hint:

There exists a symmetric partially negative matrix $\begin{pmatrix} -2 & 4 \\ 4 & -6 \end{pmatrix}$

$$Ax = \begin{pmatrix} -2 & 4 \\ 4 & -6 \end{pmatrix} \begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 6 \end{pmatrix} = b.$$

Note: Determinant of an $n \times n$ matrix A is defined as below:

$$det(A) = \sum_{\sigma \in S_n} sgn(\sigma) \prod_{i=1}^{n} A_{i,\sigma_i}$$

Here the sum is computed over all permutations σ of the set $\{1, 2, \dots, n\}$. A permutation is a function that reorders this set of integers. The value in the i-th position after the reordering σ is denoted σ_i. For example, for $n = 3$, the original sequence 1, 2, 3 might be reordered to $\sigma = [2, 3, 1]$, with $\sigma_1 = 2$, $\sigma_2 = 3$, and $\sigma_3 = 1$. The set of all such permutations (also known as the symmetric group on n elements) is denoted S_n. For each permutation σ, $sgn(\sigma)$ denotes the signature of σ, a value that is +1 whenever the reordering given by σ can be achieved by successively interchanging two entries an even number of times, and -1 whenever it can be achieved by an odd number of such interchanges.

Sample Input

```
2
2 1
0 6
```

Sample Output

```
Yes
```

"You are too young to be burdened with all my cares," the father told her, "but you are also a Stark of Winterfell. You know our words."

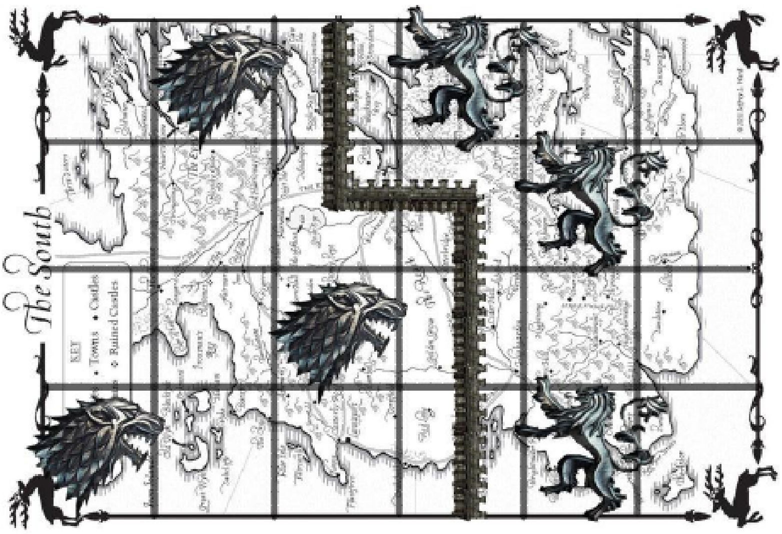
"Winter is coming," Arya whispered, thinking of Nymeria. She hugged her knees against her chest, suddenly afraid.

"Remember the sigil of our House, Arya. Let me tell you something about it. When the snows fall and the white winds blow, the lone Wolf dies, but the pack survives. Summer is the time for squabbles. In winter, we must protect one another, keep each other warm, share our strengths. So if you must hate, Arya, hate those who would truly do us harm. Sansa... Sansa is your sister. You may be as different as the sun and the moon, but the same blood flows through both your hearts. You need her, as she needs you... and I need both of you, gods help me. Gods commanded us to build a long wall, which is regardless of the thickness, to defend the attack from the Lannister. Now we should carry out the wall." Ned Stark sounded so tired that it made Arya sad.

"I do not mean to frighten you, but neither will I lie to you. We have come to a dark dangerous place, child. We have enemies who mean us ill in the King's Landing. We'll point the swords to the Lannister, rather than fight a war among ourselves. Our construction crew will build a wall which connect the north border and south border, separate the mainland into exact two parts. All our Wolf's cities should lie on the left part, while All Lannister's cities lie on the right part. Precisely, the wall can't pass through a grid more than once, and should run parallel or vertically to the four borders. With winter soon upon us, that is a different matter that we should minimize the time cost."

"How much time do we have, roughly?" Arya take out the draft and has been ready to calculate.

"Winter is coming." Her father frowned.



Input

There are multiple cases. The first line of each case contains two integers, N, M ($1 \le N \le 20$, $1 \le M \le 10$), indicating the width and length of the mainland's layout. In the map, the character is '`W`' indicated the Wolf's city, '`L`' indicated the Lannister's city, '`#`' means a grid where forbade any construction, and a number in '`0`'-'`9`' indicated the time cost to build a wall on this grid.

Output

For each case, output one integer, the minimum time cost to build a valid wall, or '`-1`' if we can't work out an approach.

Sample Input

```
6 8
88W888L8
888#W888
888888L8
8W88L#88
8888888L
88888W88
```

Sample Output

```
88
```

Let there be a simple graph with N vertices but we just know the degree of each vertex. Is it possible to reconstruct the graph only by these information?

A simple graph is an undirected graph that has no loops (edges connected at both ends to the same vertex) and no more than one edge between any two different vertices. The degree of a vertex is the number of edges that connect to it.

Input

There are multiple cases. Each case contains two lines. The first line contains one integer N ($2 \leq N \leq 100$), the number of vertices in the graph. The second line contains N integers in which the ith item is the degree of i-th vertex and each degree is between 0 and $N-1$ (inclusive).

Output

If the graph can be uniquely determined by the vertex degree information, output '`UNIQUE`' in the first line. Then output the graph.

If there are two or more different graphs can induce the same degree for all vertices, output '`MULTIPLE`' in the first line. Then output two different graphs in the following lines to proof.

If the vertex degree sequence cannot deduce any graph, just output '`IMPOSSIBLE`'.

The output format of graph is as follows:

N E
u_1 u_2 ... u_E
v_1 v_2 ... v_E

Where N is the number of vertices and E is the number of edges, and $\{u_i, v_i\}$ is the i-th edge of the graph. The order of edges and the order of vertices in the edge representation is not important since we would use special judge to verify your answer. The number of each vertex is labeled from 1 to N. See sample output for more detail.

Sample Input

```
1
0
6
5 5 5 4 4 3
6
5 4 4 4 4 3
6
3 4 3 1 2 0
```

Sample Output

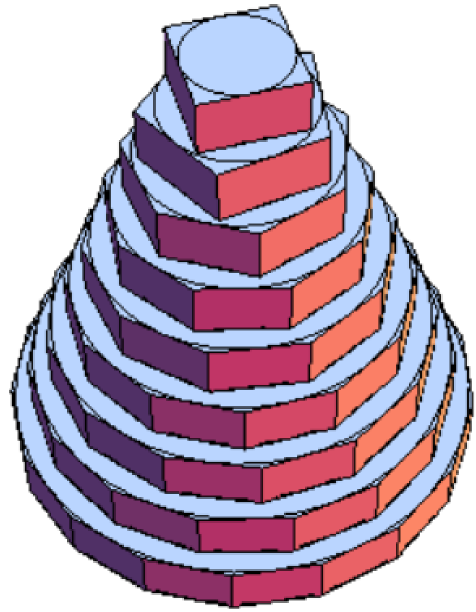
```
UNIQUE
1 0


UNIQUE
6 13
3 3 3 3 3 2 2 2 2 1 1 1 5
2 1 5 4 6 1 5 4 6 5 4 6 4
MULTIPLE
6 12
1 1 1 1 1 5 5 5 6 6 2 2
5 4 3 2 6 4 3 2 4 3 4 3
6 12
1 1 1 1 1 5 5 5 6 6 3 3
5 4 3 2 6 4 3 2 4 3 4 2
IMPOSSIBLE
```

The world's new tallest building is going to be built in Changsha, which will be called as "Skycity". The Skycity is going to be built as a circular truncated cone, radius of its bottom is marked as R, and radius of its top is marked as r, height of the building is marked as H, and there will be F floors with exact the same height in the whole building.

After construction of the building's skeleton, the construction team is going to construct the curtain wall using thousands of glass panes. The curtain wall is installed in each floor. When installing the curtain wall in a floor, first the construction team will measure the radius r' of the ceiling, then they will install the glass curtain wall as a regular prism which can exactly contain the ceiling circle. When constructing the glass curtain wall, all the glass pane has a minimum area requirement S, and amount of glass usage should be as little as possible.

As all the glass has exact the same thickness, so we can calculate the consumption of each glass pane as its area. Could you calculate the minimum total glass consumption?



Input

There will be multiple test cases. In each test case, there will be 5 integers R, r ($10 \leq r < R \leq 10000$), H ($100 \leq H \leq 10000$), F ($10 \leq F \leq 1000$) and S ($1 \leq S < \sqrt{3} \times r \times H \div F$) in one line.

Output

For each test case, please output the minimum total glass consumption, an absolute error not more than 1e-3 is acceptable.

Sample Input

```
50 10 800 120 5
300 50 2000 500 10
```

Sample Output

```
149968.308
2196020.459
```

A microblog caused a war recently — There's the war between LIKE and CANDLE.

As you see, there are N accounts are trying to show their support of LIKE or CANDLE. The way they show the support is forwarding a microblog, which means you choose someone's microblog and repost it with some comment. A valid support microblog is forwarding the original account's microblog or a other valid support microblog. We can assume that all accounts will forward the microblog only once. Also, it is impossible for a microblog forwarding a microblog that posts after it. When the activity ends, someone will use a software to check these accounts and calculate a *Power Point* for LIKE and CANDLE. Specifically, each account will have a value based on some algorithm (you need not to care). The value will be added to LIKE if the account is voting LIKE, vice versa. So easy, isn't it?

Edward is a programmer and he supports LIKE. He found a bug in the software that used in the activity — He can spend X *Power Point* of LIKE to *flip* an account. When an account is flipped, it will be seen as it votes the other side. For example, if Alice votes LIKE and then it is flipped, the software will add the value to CANDLE. Of course, an account can be flipped for several times — If Alice is flipped again, it votes for LIKE again. And if we called the account *the flipped account* (Notice it's only a concept indicates the account has been flipped and not an attribute of an account), all accounts which forwarding *the flipped account*'s microblog will also be flipped.

Soon, Edward found that someone uses this bug before! Some accounts have been flipped already. He can't spend X *Power Point* to flip them anymore; instead, he need spend Y *Power Point* to *flip* an account which has been flipped directly by someone. For the glory of the LIKE, please help Edward to flip accounts so that the *PowerPoint* of LIKE can be larger than CANDLE as much as possible.

You can spend *Power Point* as much as you like, no matter the total *Power Point* of LIKE is negative or not.

Input

The input contains no more than 20 test cases. Notice there's no empty line between each test case.

For each test case, first line has three integers N $(1 \le N \le 50000)$ — the number of the accounts, X $(0 \le X \le 1000)$ and Y $(0 \le Y \le 1000)$ — as the problem description. The account is numbered from 1 to N and '`0`' represent the original account.

Following N lines, the i-th line means the i-th account. Each line has four integers: V $(0 \le V \le 1000)$ — the value of the ith account, F $(0 \le F \le N)$ — which account did the i-th account's forwarding account come from (0-th microblog is original account's microblog), S $(0 \le S \le 1)$ — the status of flipped ('`0`' means no changed, '`1`' means changed) and P $(0 \le P \le 1)$ — the side the account supports without flipped ('`0`' means LIKE, '`1`' means CANDLE).

The original microblog's account can't be flipped, and it hasn't the value and the support side.

Output

For each test case print an integer, represents the maximum result of the value of LIKE minus the value of CANDLE. If the value of CANDLE is larger than the LIKE, then just output '`HAHAHAOMG`' (without quote).

Sample Input

```
4 3 2
5 0 0 0
3 1 0 1
4 2 1 0
1 2 0 0
```

Sample Output

```
8
```

A role-playing game (RPG and sometimes roleplaying game) is a game in which players assume the roles of characters in a fictional setting. Players take responsibility for acting out these roles within a narrative, either through literal acting or through a process of structured decision-making or character development.

Recently, Josephina is busy playing a RPG named TX3. In this game, M characters are available to by selected by players. In the whole game, Josephina is most interested in the "Challenge Game" part.

The Challenge Game is a team play game. A challenger team is made up of three players, and the three characters used by players in the team are required to be different. At the beginning of the Challenge Game, the players can choose any characters combination as the start team. Then, they will fight with N AI teams one after another. There is a special rule in the Challenge Game: once the challenger team beat an AI team, they have a chance to change the current characters combination with the AI team. Anyway, the challenger team can insist on using the current team and ignore the exchange opportunity. Note that the players can only change the characters combination to the latest defeated AI team. The challenger team gets victory only if they beat all the AI teams.

Josephina is good at statistics, and she writes a table to record the winning rate between all different character combinations. She wants to know the maximum winning probability if she always chooses best strategy in the game. Can you help her?

Input

There are multiple test cases. The first line of each test case is an integer M ($3 \leq M \leq 10$), which indicates the number of characters. The following is a matrix T whose size is $R \times R$. R equals to $C(M, 3)$. $T(i, j)$ indicates the winning rate of team i when it is faced with team j. We guarantee that $T(i, j) + T(j, i) = 1.0$. All winning rates will retain two decimal places. An integer N ($1 \leq N \leq 10000$) is given next, which indicates the number of AI teams. The following line contains N integers which are the IDs (0-based) of the AI teams. The IDs can be duplicated.

Output

For each test case, please output the maximum winning probability if Josephina uses the best strategy in the game. For each answer, an absolute error not more than 1e-6 is acceptable.

Sample Input

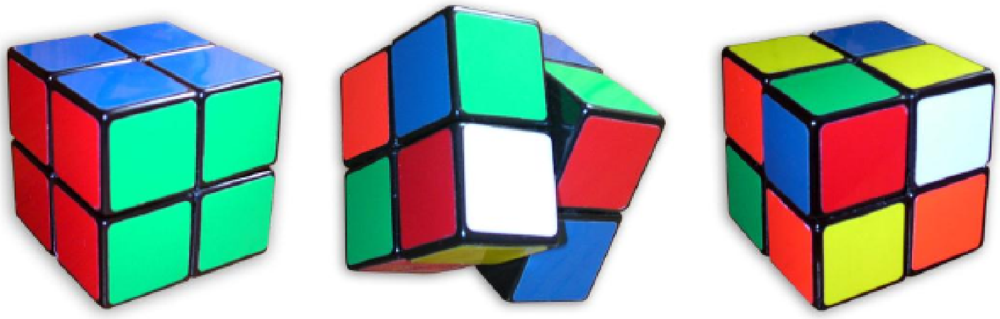
```
4
0.50 0.50 0.20 0.30
0.50 0.50 0.90 0.40
0.80 0.10 0.50 0.60
0.70 0.60 0.40 0.50
3
0 1 2
```

Sample Output

```
0.378000
```

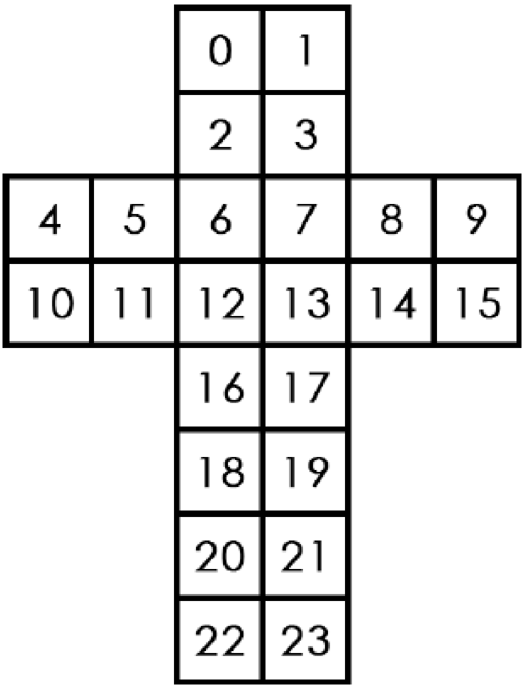
Pocket Cube is a 3-D combination puzzle. It is a $2 \times 2 \times 2$ cube, which means it is constructed by 8 mini-cubes. For a combination of 2×2 mini-cubes which sharing a whole cube face, you can twist it 90 degrees in clockwise or counterclockwise direction, this twist operation is called one twist step.

Considering all faces of mini-cubes, there will be totally 24 faces painted in 6 different colors (Indexed from 0), and there will be exactly 4 faces painted in each kind of color. If 4 mini-cubes' faces of same color rely on same large cube face, we can call the large cube face as a completed face.



Now giving you an color arrangement of all 24 faces from a scrambled Pocket Cube, please tell us the maximum possible number of completed faces in no more than N twist steps.

Index of each face is shown as below:



Input

There will be several test cases. In each test case, there will be 2 lines. One integer N ($1 \leq N \leq 7$) in the first line, then 24 integers C_i separated by a single space in the second line. For index $0 \leq i < 24$, C_i is color of the corresponding face. We guarantee that the color arrangement is a valid state which can be achieved by doing a finite number of twist steps from an initial cube whose all 6 large cube faces are completed faces.

Output

For each test case, please output the maximum number of completed faces during no more than N twist step(s).

Sample Input

```
1
0 0 0 0 1 1 2 2 3 3 1 1 2 2 3 3 4 4 4 4 5 5 5 5
1
0 4 0 4 1 1 2 5 3 3 1 1 2 5 3 3 4 0 4 0 5 2 5 2
```

Sample Output

```
6
2
```

Alice is providing print service, while the pricing doesn't seem to be reasonable, so people using her print service found some tricks to save money.

For example, the price when printing less than 100 pages is 20 cents per page, but when printing not less than 100 pages, you just need to pay only 10 cents per page. It's easy to figure out that if you want to print 99 pages, the best choice is to print an extra blank page so that the money you need to pay is 100×10 cents instead of 99×20 cents.

Now given the description of pricing strategy and some queries, your task is to figure out the best ways to complete those queries in order to save money.

Input

The first line contains an integer T (≈ 10) which is the number of test cases.

Then T cases follow.

Each case contains 3 lines. The first line contains two integers n, m ($0 < n, m \leq 10^5$). The second line contains $2n$ integers s_1, p_1, s_2, p_2, ..., s_n, p_n ($0 = s_1 < s_2 < \ldots < s_n \leq 10^9$, $10^9 \geq p_1 \geq p_2 \geq \ldots \geq p_n \geq 0$). The price when printing no less than s_i but less than s_{i+1} pages is p_i cents per page (for $i = 1 \ldots n-1$). The price when printing no less than s_n pages is p_n cents per page. The third line containing m integers $q_1 \ldots q_m$ ($0 \leq q_i \leq 10^9$) are the queries.

Output

For each query q_i, you should output the minimum amount of money (in cents) to pay if you want to print q_i pages, one output in one line.

Sample Input

```
1
2 3
0 20 100 10
0 99 100
```

Sample Output

```
0
1000
1000
```