Xuejun Xinyou Cup 1

Provided by Xinyou Team, Hangzhou Xuejun High School, China

Great respect to the warriors fighting against the coronavirus.

Overview

	A	B	C	D	E
Tittle	**Nucleic Acid Testing**	**Fight Against the Epidemic**	**Do Researches on Virus**	**Fight Against Virus**	**The Hammer Went Down in History**
Time Limit (s)	0.1	0.3	1	2	5
Memory Limit (MB)	128	512	512	512	1024
Number of Subtasks	5	4	4	6	3

Languages & Commands

Languages	Commands
C++14	`g++ program.cpp -o target -O2 -std=c++14`
C++11	`g++ program.cpp -o target -O2 -std=c++11`
C++	`g++ program.cpp -o target -O2 -std=c++98`
C	`gcc program.c -o target -O2`
Pascal	`fpc program.pas -o target -O2`

Evaluation environment

Ubuntu 18.04 x64 (`g++ 7.5.0` / `gcc 7.5.0` / `fpc 3.0.4`), i3-2100, ddr3.

Announcement

Since this competition is online, please compete honestly.

The backgrounds of the problems are fictitious.

Good luck and have fun!

A. Nucleic Acid Testing

Time limit: 100 `ms`

Memory limit: 128 `MB`

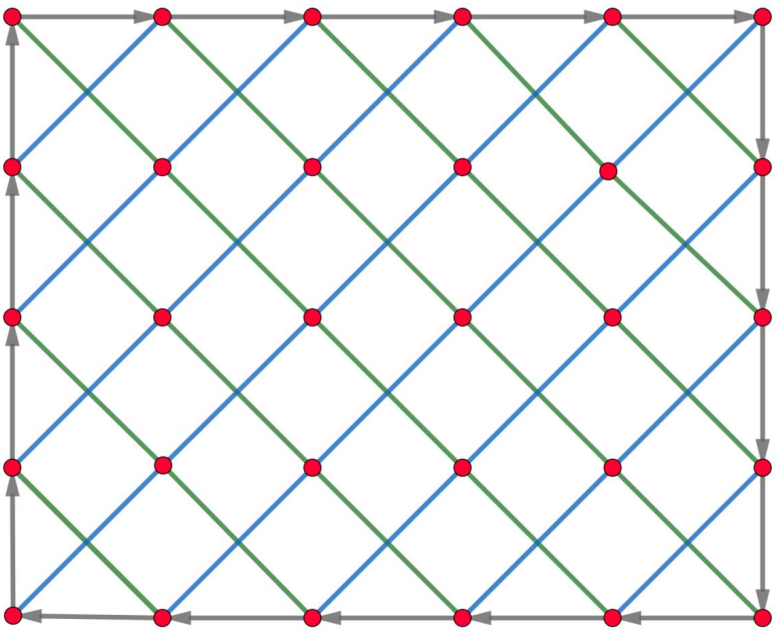
Problem Statement

Novel coronavirus outbreak! A large number of suspected patients in the city are gathered at several isolation points.

The experts are going to these isolation points to perform coronavirus nucleic acid testings for suspected patients.

There are $n(n+1)$ isolation points in the city, which form a matrix of n rows and $(n+1)$ columns. We use (r, c) to denote the isolation point located in the r-th row from the top and the c-th column from the left. For example, the coordinate of the top-left corner is $(1, 1)$, and the coordinate of the bottom-right corner is $(n, n+1)$.

The traffic structure of this city is quite special. There is a **bidirectional road** between any two **diagonally adjacent** isolation points. Besides, along the border of the matrix, there is a **unidirectional** subway loop running **clockwise**. The picture below shows the city of $n = 5$.



The experts can start from any isolation point, then travel through roads or by subway. Traveling through a road and traveling by subway to the adjacent stop both take 1 unit of time. The time required for nucleic acid testings is ignored.

You want to know the **minimum** time required to complete the testings for all isolation points. Print the minimum time required and a route of minimum time.

Input

The only line of input contains a single integer n ($2 \leq n \leq 100$) — the number of rows in the matrix.

Output

In the first line print a single integer T — the minimum time required.

In the next $T + 1$ lines print the coordinates of your route, one each line. The i-th line in this part should contain two integers x_i and y_i, separated by a space, representing the coordinate (x_i, y_i) of the i-th isolation point in your route.

If there are multiple solutions, print any of them.

Sample Input

```
2
```

Sample Output

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

Constraints

Evaluation takes the form of subtasks.

Subtask	Special Constraints	Score
1	$n = 2$	7
2	$n = 3$	15
3	$n \leq 5$	29
4	$n \leq 10$	21
5	$n \leq 100$	28

It's guaranteed that $2 \leq n \leq 100$.

B. Fight Against the Epidemic

Time Limit: 300 `ms`

Memory Limit: 512 `MB`

Problem Statement

There are n counties in a city. The counties are connected by $n-1$ two-way highways.

Affected by the epidemic, there are a_i infected patients in the i-th county. The government decided to select 2 counties x, y in which the number of patients in county y is not less than that in county $x (a_x \leq a_y)$. The government required the county x to help county y. The county x will send a medical bag to each patient of the county y, which will be transported in the shortest path from x to y. It will cost ￥1 to transport a medical bag through each highway. The government will pay money for it.

If the 2 counties are selected arbitrarily, how much money will the government pay in the most expensive case?

Input

The first line contains an integer n.

The second line contains n integers, where the i-th is a_i.

Each of the following $n-1$ lines contains 2 integers u, v, which means there is a highway between u and v.

Output

There is only an integer — the answer.

Sample Input

```
8
3 1 4 1 5 9 2 6
1 2
2 3
2 4
1 5
5 6
4 8
3 7
```

Sample Output

```
45
```

Constraints

Evaluation takes the form of subtasks.

Subtask	$n \leq$	Score
1	2	18
2	100	30
3	2000	19
4	50000	33

It's guaranteed that $2 \leq n \leq 50000$, $1 \leq a_i \leq 1000$.

C. Do Researches on Virus

Time Limit: 1000 `ms`

Memory Limit: 512 `MB`

Problem Statement

A scientist is leading his team studying the virus, and he wants to know how to reduce the activity of the virus. The activity of the virus can be expressed as an integer, but he does not know what the specific integer is.

He can perform $m+1$ operations. For the first m operations, the i-th operation costs v_i to reduce the activity of the virus by w_i. The $(m+1)$-th operation is to check the current state of the virus, at no cost.

The virus has n states. There are $n+1$ increasing numbers $a_0, a_1, a_2, \ldots, a_n$, and it's guaranteed that $a_0 = 0$; if the activity of the virus x satisfies $a_{i-1} < x \leq a_i$, then the virus is in the state i. It is ensured that the activity of the virus is no greater than a_n.

He can use each operation as many times as desired, but he does not want the virus to be completely inactive. So if after using an operation, the activity of the virus ≤ 0, then the research fails. And if the activity of the virus is too high, it is also not suitable for research. Only when the virus is in the state 1, it's most suitable for research.

Now, he only knows that the activity of the virus is a random integer, which has equal probability in $[1, a_n]$. He wants to know the minimum expected cost to make the virus into the state 1, while ensuring that the virus wouldn't be inactive.

It can be found that the answer multiplied by a_n is an integer, so you should output the answer multiplied by a_n.

If there is no guarantee that the virus will not be completely inactive, output -1 instead.

Input

At first line there's an integer T, indicating that there are T sets of data. The following is a description of each set of data.

The first line has two integers n, m.

The next line has n integers $a_1, a_2, \ldots, a_n$.

In the next m lines, there are two integers v_i and w_i in the i-th line.

Output

For each set of data, output an integer representing the answer.

Sample Input

```
1
2 2
1 3
1 1
1 2
```

Sample Output

```
3
```

Sample Explanation

If the activity of the virus is 1 in the beginning, the goal can be achieved directly without any cost.

Otherwise the activity of the virus might be 2 or 3. At first, we would use the 1-th operation. If the virus is in the state 1 at this time, it means that the initial activity of the virus is 2, and the goal has been reached; otherwise, the initial activity of the virus is 3, and you can use the 1-th operation again to achieve the goal.

The expected cost is $\frac{0+1+2}{3}=1$, and the answer multiplied by a_n is 3.

Constraints

Evaluation takes the form of subtasks.

Subtask	$a_n \leq$	Score
1	10	17
2	50	33
3	200	12
4	2000	38

It is guaranteed that $1 \leq T \leq 10$, $1 \leq a_1 < a_2 < \cdots < a_n \leq 2000$, $1 \leq m \leq a_n$, $1 \leq v_i \leq 10^6$, $1 \leq w_i \leq a_n$.

D. Fight Against Virus

Time Limit: 2000 ms

Memory Limit: 512 MB

Problem Statement

Since the outbreak of the COVID-19 epidemic, the virus has continued to spread and humans have taken various measures to curb the spread of the virus. We can build a mathematical model for this fight against the epidemic, and abstract the continuous transmission of the virus and the continuous action of humans into a game where the two players take turns to act. We believe that for each round of actions taken by humans and the virus, a positive integer should be chosen as the value of it to evaluate the action. However, due to various restrictions, the total value of all actions of both players must be equal to a constant m, and the value of each action cannot exceed the value of the opponent's action in the previous round. For humans, to contain the epidemic, he should be the last player to act. That is, after a certain action on his side, the sum of the action value m happens to be used up.

Assuming that humans act first, we can defeat the virus by taking an action of value m in the first round. However, at the very beginning, the lack of awareness of the severity of the epidemic often made it difficult to carry out large-scale operations. For this reason, we let h_m represent the minimum action value of the first act of humans (i.e. the first mover) which guarantees victory in the case where the sum of action values is m.

For statistical needs, a scientist let $f_i = \sum_{m|i} h_m$ and wants to know $\sum_{i=1}^{n} f_i$. For convenience, print the answer module 998244353.

Input

The first line contains one integer n .

Output

Print an integer which represents the answer.

Sample Input

```
3
```

Sample Output

```
6
```

Constraints

Evaluation takes the form of subtasks.

Subtask	$n \leq$	Score
1	3	1
2	1000	9
3	10^5	31
4	10^{11}	28
5	5×10^{13}	26
6	10^{15}	5

It is guaranteed that $1 \leq n \leq 10^{15}$.

E. The Hammer Went Down in History

Time Limit: 5000 `ms`

Memory Limit: 1024 `MB`

Problem Statement

In another two-dimensional (only Horizontal and Vertical) parallel world, an epidemic broke out.

Medical supplies were running out, and gradually the hospital could not accommodate all the patients, and it was urgent to build a new hospital.

The construction team called Reed, was commissioned in distress and decided to build a new hospital in a mountainous area, turning the high mountains into valleys.

The length of the mountain is n, and the height of the i-th unit is now h_i, which is reduced by d_i per day due to the hit of the construction team's stone hammer.

Just as the new hospital was being built in full swing, the epidemic was already under the control of the promising officials and the united people.

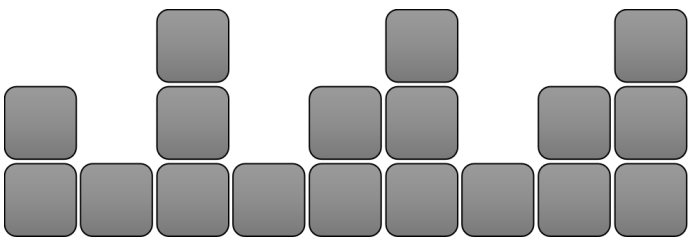
The construction team was unwilling to waste their efforts and decided to transform a certain area of the mountain into a reservoir to continue to benefit the society. Now the foreman wants to know how many units of water can be stored if only the mountains of $[l, r]$ are kept on the t-th day. Please answer such inquiries a total of m times.

So far, the reservoir has benefited everyone within the 800-mile radius. Every day, tourists in front of the reservoir are like jam, and many literati and writers come to enjoy the scenery, lost in thought of the uncommon days.

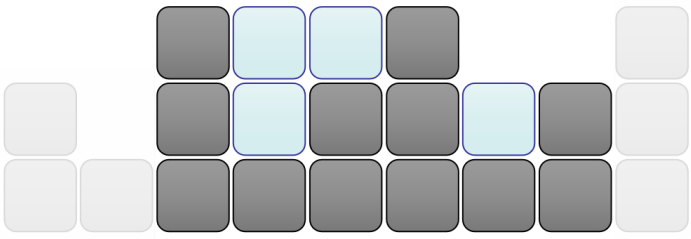
A weather-beaten stone hammer of that year was perfectly preserved in the memorial, and the rusty surface seemed to be telling the incomparable old times. We don't know how many disasters will come to human in the future, but we are convinced that human will be united and united.

Regarding water storage, there is no need to consider the surface tension of water. Each unit of water can be stored if and only if there are higher (or equal) mountains on both sides.

For example, the montain of $\{2, 1, 3, 1, 2, 3, 1, 2, 3\}$ looks like:



For the segment $[3, 8]$, 4 units of water can be stored.



Input

The first line contains two integers n, m.

The second line contains n integers describing h.

The third line contains n integers describing d.

Then following m lines, each of them contains three integers t_i, l_i, r_i.

Output

m lines, one answer per line.

Sample Input

```
9 1
2 1 3 1 2 3 1 2 3
1 1 1 2 1 1 1 1 1
23333 3 8
```

Sample Output

```
23337
```

Constraints

Evaluation takes the form of subtasks.

Subtask	$n \leq$	$m \leq$	Special Constraints	Score
1	5×10^4	5×10^4		33
2	2.3×10^5	2.3×10^5	There are at most 50 different i satisfied $d_i \neq 5 \times 10^5$	28
3	2.3×10^5	2.3×10^5		39

It's guaranteed that $1 \leq h_i \leq 10^{12}$, $1 \leq d_i \leq 10^6$, $1 \leq t_i \leq 10^6$.