South African Computer Olympiad
Camp 1, 2008
Day 2

Overview

Author	**Timothy Stranex**	**Nick Pilkington**	**Harry Wiggins**
Problem	**quotes**	**housing**	**tda**
Source	quotes.java quotes.py quotes.c quotes.cpp quotes.pas quotes.hs	housing.java housing.py housing.c housing.cpp housing.pas housing.hs	tda.java tda.py tda.c tda.cpp tda.pas tda.hs
Input file	quotes.in	housing.in	tda.in
Output file	quotes.out	housing.out	tda.out
Time limit	2 seconds	2 seconds	1 second
Number of tests	10	10	10
Points per test	10	10	10
Total points	**100**	**100**	**100**

The maximum total score is 300 points.

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Quotes

Author

Timothy Stranex

Introduction

Bruce enjoys watching Monty Python skits. In fact, he's seen them all so many times that he can recall most of the scenes perfectly. Now Bruce has decided to just go ahead and memorizes everything by filling in the (few) holes he doesn't already know. You must write a program to help Bruce keep track of these holes.

Task

There are W Monty Python skits with each skit lasting for H minutes. This can be represented by a grid with H rows and W columns. The grid cells are coloured either black or white. A white cell means Bruce has already memorized that minute and a black cell means Bruce still has to memorize that minute.

As input your program will be given the list of N black cells (x, y) where x is the Monty Python skit number and y is the minute. Your program will also be given a list of M rectangles (x_1, y_1, x_2, y_2) where (x_1, y_1) is the upper-left corner and (x_2, y_2) is the lower-right corner. For each rectangle you must output the number of black cells it contains inclusive of the boundary. A cell can be listed more than once in the list of black cells if the part is particularly hard to remember. (The pronunciation of "Ekke Ekke Ekke Ptang Zoo Boing", for example.) In this case, the cell should be counted more than once as being inside the rectangle.

Example

Suppose there are $W = 6$ Monty Python skits of $H = 4$ minutes each. Also suppose that the list of black cells is $(1, 1)$, $(4, 3)$, $(6, 4)$ and $(1, 1)$. Then, there is one black cell in the rectangle $(1, 1, 1, 1)$, two black cells in the rectangle $(1, 1, 2, 2)$ and two black cells in the rectangle $(3, 2, 6, 4)$.

Input (quotes.in)

The first line of the input contains four space-separated integers W, H, N and M. The next N lines each contain two space-separated integers describing the black cells. The next M lines will each contain four space-separated integers describing the rectangles.

Sample input

```
6 4 4 3
1 1
1 2
4 3
6 4
1 1 1 1
1 1 2 2
3 2 6 4
```

Output (quotes.out)

The output consists of M lines. The ith line contains a single integer, the number of black cells contained in the ith rectangle inclusive of the boundary.

Sample output

```
1
2
2
```

Constraints

- $1 \leq W, H \leq 1000$
- $1 \leq N, M \leq 100000$

50% constraints

- $1 \leq N, M \leq 1000$

Time limit

2 seconds.

Scoring

For each test case, if your output is correct, you score 100% for that test case. Otherwise, you score 0% for the test case.

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Housing

Author

Nick Pilkington

Introduction

Carl is shopping for property. Like any shrewd buyer, Carl is concerned with two criteria: cost and distance to the pub. Carl has asked you to assist him in selecting the best house to buy that meets his criteria.

Task

Carl's estate agent has drawn up a list of N houses. The list contains exactly one house for every integral amount of money from 0 (some property is free) to $N-1$. For each house on this list Carl has painstakingly taken the time to measure the distance in meters to the nearest pub. Carl will present you with this list, sorted in order of ascending order of cost. He will also present you with a list of K budgets each of the form a_i and b_i, Where a_i and b_i represent a minimum and maximum amount of money Carl is willing to spend, respectively. For each of these budgets you must determine what is the minimum distance from the pub that Carl can live.

Example

Input (housing.in)

The first line of the input contains a single integer N. The next N each represent a property with cost from 0 to $N-1$. Each of these lines will contain a single integer d_i representing the distance that the property is from the pub. Line $N+1$ with contain a single integer K. The next K lines each contain two space separated integer a_j and b_j indicating the minimum and maximum amount of money Carl is willing to spend in that budget.

Sample input

```
5
2
4
6
1
8
2
0 1
0 4
```

Output (housing.out)

The output should contain K lines with a single integer on each. This integer represents the minimum distance that Carl can afford to live from the pub.

Sample output

```
2
1
```

Constraints

- $1 \leq N \leq 300000$
- $1 \leq K \leq 10000$
- $0 \leq a_j, b_j < N$
- $1 \leq d_i \leq 2000000$

50% constraints

- $1 \leq N \leq 5000$

Time limit

2 seconds.

Scoring

If your output is correct for all K budgets you will score 100% otherwise you will score 0%.

Tour de Afrique

Author

Harry Wiggins

Introduction

Carl is taking part in the annual Tour de Afrique cycling race. He somehow discovered the secret stopping locations for each day of the tournament and would like your help to plan the most efficient route for the contest.

Task

Tour de Afrique is a cycling race around N cities on the African continent over M days on specified one-way roads. All the contests start at the same city (number 1). For each day of the contest the organizers reveal a list of possible pit stops they have to reach before the end of the day. It is up to the contestants to choose which one they want to reach that could be more advantageous. Your task is to work out the least number of kilometers Carl needs to cycle to finish the race.

Example

For the sample input if Carl travels from city 1 to 5 via city 2 on day 1, city 5 to city 1 on day 2 and city 1 to city 1 on day 3 he would have traveled 5 kilometers which is the least possible to complete the race.

Input (tda.in)

The first line of the input contains two integer N and M. The next N lines contains N integers. The j^{th} number on the i^{th} line represents the number d_{ij} of kilometers to travel from city i to city j. The next M lines contains the locations of the pit stops for each day in order. The first integer K on each line is the number of possible stopping locations. The next K integers on the line is the actual cities they could stop that day.

Sample input

```
5 3
0 3 6 7 6
3 0 5 6 2
9 1 0 2 7
0 9 3 0 6
0 6 2 6 0
3 4 3 5
3 1 3 4
2 1 5
```

Output (tda.out)

The output should contain a single line with a single integer. This integer represents the minimum distance that Carl needs to cycle to finish the tournament.

Sample output

```
5
```

Constraints

- $1 \leq N \leq 100$
- $1 \leq M \leq 100$
- $0 \leq d_{ij} < 1000$
- $1 \leq K \leq 100$

50% constraints

- $1 \leq N \leq 20$

Time limit

1 second.

Scoring

If your output is correct you will score 100% otherwise you will score 0%.