NATIONAL OLYMPIAD IN INFORMATICS

Area: Informatics

Style of the Competition:

A. Algorithmic style programming tasks (like International Olympiad in Informatics). Tasks typically used in NOI are focused on designing and programming efficient and correct algorithms.
B. Individual competition
C. Financial conditions: free of charge for contestants
D. The competition has a time limit for solving the tasks (3 to 5 hours depending of the age of the contestants).
E. Style of competition: Presence needed (attendance of the participants at an appointed time and place).
F. Method of evaluation: with postponed evaluation of the submitted source codes.
G. NOI is organized by the Ministry of Education and Science with the scientific support of the Union of Bulgarian Mathematicians. The National Committee in Informatics (NC) is responsible for the Olympiad. The chair and the members of NC are proposed by the Union of Bulgarian Mathematicians and are approved by the Minister of Education and Science. The competition problems are prepared by NC.
H. In the Final round of the NOI there is usually an Organizing committee of 4-5 local persons.
I. Way of announcement of the competition: NOI is included in the annual schedule of the Ministry of Education and Science and is announced by the structures of the Ministry.
J. All the competition materials: problems, tests, results, authors' and contestants' solutions are published on the Internet.
K. For the last 3 years there were the following competition groups: A –12th grade, B – 10th and 11th grade, C – 8th and 9th grade, D – 6th and 7th grade and E – 4th and 5th grade.
L. Types of awards: the best students from the national round (in groups A and D) form the extended national teams. The actual national teams are determined after subsequent control competitions. They participate in the International Olympiad in Informatics, Balkan Olympiad in Informatics and Balkan Olympiad in Informatics for Juniors. The best students from group A of the national round receive the title "Winner of the National Olympiad" and are admitted without entrance exams for the major of Informatics at top Bulgarian universities. All other participants in the National round in group A receive grading marks that are accepted by some universities (including Sofia University) as entry exam grades for the corresponding university.

Target Group:

- School round – open for everyone;
- Regional round – only by invitation, depending on the results of the School round;
- Final round – only by invitation, depending on the results of the Regional round;

Age of Participants: From 11 to 19 years.

School level of Participants: Primary schools and High schools.

Number of Participants and the number of editions of the competition in the Last 3 Years: Editions are yearly, with the final round consisting of 50-60 Group A students and 15-20 Group D students.

History of Competition: In 1985 a team of the Union of Bulgarian Mathematicians organized the first NOI. In the present days NOI is organized by the Ministry of Education and Science with the scientific support of the Union of Bulgarian Mathematicians.

Financial Basis of the competition: The competition is supported financially by the Ministry of Education, the Union of Bulgarian Mathematicians and sponsors.

Competition Problems: Problems given to Final round, Group A, 2007 follows

23-rd NATIONAL OLYMPIAD IN INFORMATICS
Final round, 20-22.04.2007

Problem A1. APPLES

A rectangular square is divided into cells like a rectangular table. In each cell of the table a given quantity of apples is put. The table is oriented to the directions of the world: the rows are in west-east direction, while the columns are in north-south direction. Two men start moving from the most north-west cell. They can move independently but from a current position a man have to go to the neighbor east or to the neighbor south cell. Being on the cell a man takes all the apples in that cell. Write a program **`apple`**, which determines the maximum number of apples that the two men could take in total together.

Input
The program has to read the input data from the standard input. On the first line the values for the number of rows M, and for the numbers of columns N are given (1 <= M, N <=70). On each of the next M lines, there are N nonnegative integers (each of them less than 1000), representing the number of apples in the cells of the corresponding row of the table (from north to south).

Output
The program should output the maximum number of apples that could be taken to the standard output.

EXAMPLE

Input	**Output**

`3 4`
`1 0 1 0`
`1 2 0 0`
`3 0 0 1`
	`8`

Problem A2. COLOR BANDS

Assume that 256 different colors are numbered by the numbers from 0 to 255. White color is numbered by 0. A white ruler of length N cm is given. The numbers from 0 to N are written on the ruler. We have paper bands colored in some color C (a number from 0 to 255).
The following three operations are allowed:
`1 I J C` – cover the part of the ruler from I-th to J-th cm with a band of color C;

`2 I J` – remove the last band placed between the I-th and J-th cm. This command is only possible when the whole band is visible at the current moment;
`3 I` – a question "What is the current color between the I-th and (I+1)-st cm?"

Write a program **`bands`**, which simulates the execution of the described commands.

Input
The first line of the standard input contains two numbers N and M, where N is the ruler length while M is the number of the following commands (1<=N<=20000, 1<=M<=100000). Each of the next M lines contains a single command.

Output
For every command of type 3 (i.e. question), the program should output on a separate line the color number that is the answer of the question.

EXAMPLE

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

Output:
```
0
3
2
```

Note: In 30% of test cases N, M<=5000. In 50% of test cases there in no command of type 2.

Problem A3. SKI LIFT

To & Fro Ltd. has just finished the construction of its newest ski lift, connecting the world famous ski runs Upper Downhill and Lower Uphill. Due to financial difficulties the lift has, for the time being, only one cable car but the company management have decided to put it into operation. *To & Fro* rely extensively on group travels, that is why they have an attractive offer for their clients:

- The price of one journey between the two ski runs per person is determined by their height – you pay according to your height in centimeters, i.e. a person 175 cm tall will pay 175 eurocents.
- If a group of tourists travel together, they pay only the price that the tallest one has to pay.

The company set only a few minor requirements:

- The total weight of passengers on one journey should not exceed ***T*** kg.
- The lift should not travel without passengers in neither of the two directions.

A group of ***N*** tourists is at present the only one which wants to use the lift to go from Upper Downhill to Lower Uphill but they do not know how much they will have to pay. Write a program **`lift`** to find out the minimum price that the group will have to pay.

Input

Your program should read the standard input. The first line of the input contains two integers – ***N*,** representing the number of tourists and ***T***, representing the maximum total weight of passengers on one journey ($0 < N < 15$, $100 < T < 500$). Each of the next ***N*** lines of the standard input contains two natural numbers – the height in centimeters and weight in kilograms of each of the passengers. Each of the passengers is at most 200 cm tall and weighs 150 kg.

Output
The only line of the standard output should write the minimum price in eurocents that the group will have to pay, or 0, if the group cannot be transported.

EXAMPLE

Input	**Output**

`3 200`
`170 90`
`160 80`
`150 100`
	`480`

Problem A4. AREA.

A rectangle *Q* with sides parallel to the axes of orthogonal planar coordinate system and a point *T*, which is internal for the rectangle, are given. *N* lines are also given ($0 < N < 50$), not passing trough *T*. For each line let us consider the half of the plane defined by the line, that contain the point *T* and to form the area of the plane that is an intersection of all such half planes. Write a program **`area`** to find the face of obtained area.
Input. The first line of the standard input contains the coordinates (x_B, y_B) of the bottom left and (x_E, y_E) of the upper right corner of the rectangle *Q*. The second line contains the coordinates of the point *T*. Third line contains the number *N*. Each of the following *N* lines contains the coordinates (x_1, y_1) and (x_2, y_2) of couple of points that define one of the given lines. All coordinates are non negative integers, less than 10000. All lines, including the lines defined by the corners of the rectangle *Q* are such that no three lines that pass through a common point.
Output. The program has to print on the standard output one integer – the found face truncated after the decimal point.

EXAMPLE

Input	**Output**

`0 0 5000 5000`
`4000 2500`
`2`
`2800 4100 400 4300`
`800 2200 4600 80`
	`14348737`

Problems A5. NUMBERS, NUMBERS, ...

Let N be a natural number and D is the product of its digits in decimal system. Let us define an operation over N giving as a result the numbers $N_1 = N - D$ and $N_2 = N + D$. Let us apply the operation to N_1 and N_2, to the numbers obtained from them, and so on. A question: is it possible, starting with given number N and applying the operation, to obtain the number N again? For some numbers it is easy to answer, positive or negative, of the question, for other numbers it will be difficult to find the answer and there are numbers for which finding the answer seems impossible.

Input. Ten files are given, named **`numb.01.in`**, **`numb.02.in`**,…, **`numb.10.in`**. In the single line of each file 10 different integers between 0 and 1000 will be given.

Output. For each file **`numb.xx.in`** you have to produce a file named **`numb.xx.out`** containing string of length 10, composed of characters `0`, `1` and `2`. Each character correspond to one number from the input. The character has to be `1`, if you established that the corresponding number in the input could be obtained by itself with applying the operation. The character has to be `0`, if you established that the corresponding number in the input could not be obtained by itself with applying the operation. If you where not able to establish the true then the character has to be `2`.

EXAMPLE

`numb.xx.in`

```
10 11 12 13 14 15 16 17 18 19
```

`numb.xx.out`

```
1000100010
```

Evaluation. If your output file is the same as the file of the author then 10 points will be assigned for the test. For each `2` in your output, placed where `0` or `1` is expected, the result will be decreased by 1 point. If in your input there is `1` in place, where `0` is expected or the opposite – 0 points will be assigned for the test.

Problem A6. STRINGS

The string S of length L is composed of the characters of given set T. Write a program **`string`** to find the number of different strings X of length P, composed of the characters of T, such that S is not a substring of X.

Input. On the first line of the standard input the string S of length Lwill be given ($1 \le L \le 2000$). Second line of the input contains also a string such that each character of T appears once in it. The characters of T are small and/or capital letters of Latin alphabet (so the size of T is no more than 52). On the third line of the standard input the number P will be given ($1 \le P \le 2000$). In 30% of tests the set T contains 2 letters and $P \le 20$.

Output. On the single line of the standard output the program has to print asked number of strings reduced by modulo 10^6.

EXAMPLE

Input	**Output**
`aa` `ab`	`5`

Remark. In 30% of tests T is composed of 2 letters and $P \leq 20$.

Contact Address of the Organizers, E-mail, Web page(s):

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