Indian National Olympiad in Informatics, 2006

Time: 3 hours   *22 April, 2006*

Instructions

(a) You will have to return this question paper at the end of the examination with relevant parts filled out.

(b) There are two questions. You have to write working programs in Pascal, C or C++ to solve each of these questions.

- *Only your source code will be submitted for evaluation. Your program will be recompiled and run on the evaluation computer.*
- *Make sure your C/C++ programs compile with the GNU C compiler (`djgpp`, under Windows). Programs written using Turbo C++ may not compile and run in the evaluation environment and may hence lose marks.*

(c) At the end of each question, there is a space to indicate the location of the source code file for your solution. Please fill up this information without fail. Otherwise, your solution cannot be evaluated.

(d) All input for your programs will come from the keyboard. All output from your programs should be written to the screen.

(e) Please fill out your contact details below as completely as you can. Use your serial number as reported in the ZIO results page as your roll number for INOI. Ask your centre supervisor if you do not know your roll number.

Question 1   Gift Coupons

The world famous online bookstore *SiruSeri.Com* has announced an awards scheme for its customers. As an inaugural offer, every customer who has bought a book during the past year will receive a gift coupon that can be used to order books free from the bookstore.

Each coupon has a fixed value. The catch is that the coupon must be used to buy three *different* books, such that the total value of the books *exactly* adds up to the value of the coupon.

For instance, suppose that the coupon has value 600 and the books available in the catalogue cost 136, 411, 211, 200, 275, 189, 232 and 375. Then, one possible way to use the coupon is to order the books costing 136, 275 and 189, which add up to 600, the value of the coupon. The coupon *cannot* be used to order three copies of the book costing 200 or one copy of the book costing 136 and two copies of the book costing 232, though both these orders add up to 600, because the coupon must be used to buy three *different* books. The books costing 189 and 411 add up to 600, but this is not a valid order because it consists of only two books.

You will be given the value of the gift coupon and the costs of all books available in the catalogue of *SiruSeri.Com*. Your task is to assemble an order consisting of three different books whose total value matches that of the coupon. If there is more than one possible order, it suffices to report any one.

Input format

The first line consists of two integers N and M, where N is the total number of books available in the catalogue of *SiruSeri.Com* and M is the value of the gift coupon. This is followed by N lines of input, lines 2,3,...,$N+1$, each consisting of a single integer giving the value of one book in the catalogue.

Output format

Your output should consist of three lines, each containing one integer, representing the costs of three different books that make up a valid order with total value M. The costs of the three books should be listed in ascending order. If more than one solution is possible, it suffices to report any one. If no solution is possible, your output should consist of the number 0 on each of the three lines.

Test data

You may assume that $3 \leq N \leq 8000$. In 30% of the inputs, $3 \leq N \leq 300$.

The value of the gift coupon M is a positive integer. The cost of each book is a positive integer. No two books have the same cost.

Example

Here is the sample input and output corresponding to the example discussed above.

Sample input

```
8  600
136
411
211
200
275
189
232
375
```

Sample output

```
136
189
275
```

Note: Your program should not print anything other than what is specified in the output format. Please remove all diagnostic print statements before making your final submission. A program with extraneous output will be treated as incorrect!

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Important

Indicate the location of the source code file for your solution to Question 1 in the box below. *If you fail to do this, your solution cannot be evaluated!*

Source file:

Question 2   Train ride

The Siruseri Municipal Corporation has just commissioned its state-of-the art Metro Rail service. The stations are arranged in a single sequence. For simplicity, the stations are numbered 1, 2, ..., N, according to the order in which they appear along this sequence. Each train route operates on a segment of the total network: that is, each train route serves the stations from station i to station j, denoted (i, j), with $1 \leq i < j \leq N$.

Nikhil is keen to travel on these new trains with his father. In a weak moment, his father has agreed to accompany him for a ride starting at station 1.

A single ticket allows a passenger to switch trains to extend the journey. To switch trains, the passenger must get down at a station and catch another train from the same station.

When Nikhil and his father begin their ride, they discover that the tickets sold for the Metro Rail service have a restriction on switching trains: when you switch trains, you must continue in the same direction. Also, you can only get onto a new train whose starting point was later than the starting point of the train from which you just got off.

Nikhil's aim is to maximize the number of trains on which he can travel using a single ticket, rather than the distance. For example, suppose the network has 15 stations numbered 1, 2, ..., 15 and the train routes available are $(1, 5)$, $(4, 8)$, $(12, 14)$, $(5, 9)$, $(8, 15)$, $(7, 11)$ and $(10, 13)$. With this set of routes, Nikhil can travel on seven trains using a single ticket as follows: start on route $(1, 5)$, switch to route $(4, 8)$ at 4, switch to route $(5, 9)$ at 5, switch to route $(7, 11)$ at 7 or 8, switch to route $(8, 15)$ at 8, 9 or 10, switch to route $(10, 13)$ at 10 or 11 and finally switch to route $(12, 14)$ at 12 or 13. Notice that at 14, Nikhil cannot switch back to the route $(8, 15)$ and continue his journey because this route starts at 8, which is earlier than the starting point of the route $(12, 14)$ which he travelled on to reach 14.

You will be given the routes on the Metro Rail network. Your task is to calculate the maximum number of trains that Nikhil can travel on a single ticket, starting at station 1.

Input format

The first line of input consists of two integers N and M. N denotes the number of stations in the network. The stations are numbered 1, 2, ... N. M is the number of train routes in the network. The next M lines, lines 2, 3, ... M+1, describe each route. Each of these lines consists of two integers, denoting the end points of the route.

Output format

A single integer indicating the maximum number of trains that Nikhil can travel on in this network using a single ticket.

Test data

You may assume that N is an arbitrary integer and $1 \leq M \leq 4000$.

There will always be at least one route starting with station 1. For each route, the end points are given in ascending order. Overall, the routes may be in any order.

Example

Here is the sample input and output corresponding to the example discussed above.

Sample input

```
15 7
1 5
4 8
12 14
5 9
8 15
7 11
10 13
```

Sample output

```
7
```

Note: Your program should not print anything other than what is specified in the output format. Please remove all diagnostic print statements before making your final submission. A program with extraneous output will be treated as incorrect!

Important

Indicate the location of the source code file for your solution to Question 2 in the box below. *If you fail to do this, your solution cannot be evaluated!*

Source file: