

## 681 Convex Hull Finding

Given a single connected contour, which is either convex or non-convex (concave), use any algorithm to find its **Convex Hull**, i.e., the smallest convex contour enclosing the given shape. If the given contour is convex, then its convex hull is the original contour itself. The maximal size of the shape is  $512 \times 512$ , and the maximal number of the vertices of the shape is 512. Write a program to read the input data (the given shapes) from a disk file, implement your convex hull finding algorithm, and then output the shape data of the results to the standard output.

### Input

The order of the vertices is counterclockwise in  $X - Y$  Cartesian Plane (if you consider the origin of the display window is on the upper-left corner, then the orientation of the vertices is clockwise), and none of the neighboring vertices are co-linear. Since all the shapes are closed contours, therefore, the last vertex should be identical to the first vertex. There are several sets of data within a given data file. The negative number -1 is used to separate the data set.

Line Number	Data in the File	Explanation
1	$K$	a positive integer showing how many sets of data in this file
2	$N$	a positive integer showing the number of vertices for the shape
3	$X_1 Y_1$	two positive integers for the first vertex $(X_1, Y_1)$
4	$X_2 Y_2$	two positive integers for the next neighboring vertex $(X_2, Y_2)$
...		
$N + 2$	$X_N Y_N$	two positive integers for the last vertex $(X_N, Y_N)$
$N + 3$	-1	Delimiter
$N + 4$	$M$	a positive integer showing the number of vertices for the next shape
$N + 5$	$XX_1 YY_1$	two positive integers for the first vertex
...		

**Note:** Please note that the **Line Number**, **Data in the File** and **Explanation** are not given in the file. They are shown here only to assist you in reading the data.

### Output

Output the convex hull of all  $K$  input shapes to the standard output. The data format should be the same as the input file. In addition, the vertex with the smallest  $Y$  value should be the first point and if there are points with the same  $Y$  value, then the smallest  $X$  value within those points should be the first point.

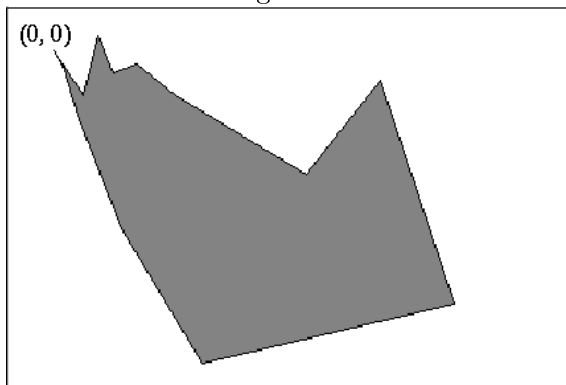
**Sample Input**

```
3
15
30 30
50 60
60 20
70 45
86 39
112 60
200 113
250 50
300 200
130 240
76 150
47 76
36 40
33 35
30 30
-1
12
50 60
60 20
70 45
100 70
125 90
200 113
250 140
180 170
105 140
79 140
60 85
50 60
-1
6
60 20
250 140
180 170
79 140
50 60
60 20
```

**Sample Output**

```
3
8
60 20
250 50
300 200
130 240
76 150
47 76
30 30
60 20
-1
6
60 20
250 140
180 170
79 140
50 60
60 20
-1
6
60 20
250 140
180 170
79 140
50 60
60 20
```

The contour shape of the first data set is shown in figure as follows:



The convex hull of the above shape is shown in the following figure:

