



KRITI'25

Optimization

Organizer :
Coding Club



Mid Prep
| 400 Pts

Optimization

400 Points

Start : 20/01

End : 05/02

Your space empire is expanding in the **Orion Expanse**, a vast and unexplored region of space rich with **Stellar Crystals** and **Void Mines**. The Stellar Crystals are highly valuable resources, providing the core energy for your empire's technologies, while Void Mines are dangerous remnants of an ancient war that pose significant risks to any nearby assets.

In this context, you are tasked with constructing a Containment Field to capture the maximum value of Stellar Crystals while avoiding Void Mines as much as possible. Your space empire has developed advanced devices to generate an energy field that can enclose these resources in a 2D space. However, these devices are limited, so you can only create a polygon with a certain number of vertices.

The goal is to **maximize the net value** enclosed by the energy field, which is determined by the total value of Stellar Crystals inside the polygon minus the total penalties from Void Mines inside it.

OBJECTIVE

Maximize the net value V , defined as:

$$V = \sum_{i \in \text{Stellar Crystals}} c_i - \sum_{j \in \text{Void Mines}} m_j$$

Here c_i is the value of the i th Stellar Crystal and m_j is the penalty of the j th Void Mine.

Note : The cost is only counted for the points that lie **inside the polygon** (including boundary points). Points outside the polygon do not contribute to the total value.

CONSTRAINTS

- The total number of **Stellar Crystals** and **Void Mines** combined is 10000:
$$N + M = 10,000$$
- The polygon must be constructed with no more than **1000 vertices**.
- The polygon must not **self-intersect**: non-adjacent edges must not share any points, and adjacent edges must only meet at their endpoints.
- Each edge of the polygon must be aligned **parallel** to the **x-axis** or **y-axis** in 2D space.
- The vertices of the polygon are in 2D space with integer coordinates satisfying $0 \leq x, y \leq 10,000$.

INPUT FORMAT

The input consists of:

1. N Stellar Crystals : Each represented as a point in 2D space with value (c_i)
 (x_i, y_i, c_i) for each Stellar Crystal
2. M Void Mines : Each represented as a point in 2D space with value (m_j)
 (x_j, y_j, m_j) for each Void Mine

N

$x_1 \ y_1 \ c_1$

$x_2 \ y_2 \ c_2$

...

$x_N \ y_N \ c_N$

M

$x_1 \ y_1 \ m_1$

$x_2 \ y_2 \ m_2$

...

$x_M \ y_M \ m_M$

OUTPUT FORMAT

The output must contain:

- The cost on the first line. The cost is calculated as the net value inside the polygon.
- The number of vertices (V) and edges (E) of the polygon.
- The following E lines should contain each edge of the polygon, represented by a pair of vertices. Each edge should be formatted as:

$$(x_1, y_1), (x_2, y_2)$$

Cost

V, E

$(x_1, y_1), (x_2, y_2)$

$(x_3, y_3), (x_4, y_4)$

...

$(x_{2E-1}, y_{2E-1}), (x_{2E}, y_{2E})$

Example Input

4 # Number of Stellar Crystals

10 20 100

40 50 150

25 35 200

50 50 300

3 # Number of Void Mines

15 25 50

70 60 75

30 200 60

Example Output

400

4,4

(0, 0), (0, 60)

(0, 60), (60, 60)

(60, 60), (60, 0)

(60, 0), (0, 0)

Explanation

The polygon encloses 3 Stellar Crystals with values 100, 150, and 200, totalling 450. It also encloses 1 Void Mine with a penalty of 50. The net value of this containment field is:

$$V = (100 + 150 + 200) - 50 = 400$$

JUDGING CRITERIA

You will be marked on the following criteria:

1. Optimality of the solution : This refers to the **sum of the net values** of each test case. The higher the value, the better. In case the solution is invalid, the value of that test case will be taken as 0. This will have a weightage of 50%.
2. Code Quality : This refers to the quality of the solution: how **well organized** your code is, how **scalable** and **generalizable** your solution is, how unique the algorithms employed are, etc. This will have a weightage of 30%.
3. Presentation : This refers to how well you can explain your solution and any additional features. This will have a weightage of 20%.

RULES

1. The team must consist of 6 members with atleast 2 second yearites.
2. The runtime of the code should be 10 minutes maximum. A penalty of 20% will be applied for every consequent minute after the 10 minute limit.

TEST CASES

There will be 20 test cases. The first 10 will be released on January 22, while the rest will be revealed only after the submission period ends.