Colorful Quadrilateral

Input file:	`standard input`
Output file:	`standard output`
Time limit:	4 seconds
Memory limit:	1024 megabytes

You are given N distinct points on the 2D plane, numbered 1 through N. The coordinates of point i are (x_i, y_i).

Each point has a color. There are N colors in total, numbered 1 through N, and point i has color c_i.

Your task is to select four points with pairwise distinct colors, connect them in any order, and form a quadrilateral. The quadrilateral may have an interior angle of exactly 180°, but no pair of non-adjacent edges may intersect.

Determine whether such a quadrilateral can be formed. If it can, let S be the maximum possible area over all valid quadrilaterals, and output $2S$ as an integer. If it cannot be formed, output 0.

There are T independent test cases.

Input

The input is given in the following format:

T
case_1
case_2
$\vdots$
case_T

Here, each case_i is given in the following form:

N
$x_1\ y_1\ c_1$
$x_2\ y_2\ c_2$
$\vdots$
$x_N\ y_N\ c_N$

- All input values are integers.
- $1 \leq T \leq 10^4$
- $4 \leq N \leq 10^5$
- $|x_i|, |y_i| \leq 10^8$
- $1 \leq c_i \leq N$
- If $i \neq j$, then $(x_i, y_i) \neq (x_j, y_j)$
- The total sum of N over all test cases does not exceed 10^5

Output

For each test case, output the answer on its own line.

Example

standard input	standard output
4 6 2 4 1 5 4 2 6 2 3 5 1 1 2 1 2 1 3 4 4 1 1 1 3 5 2 7 2 3 4 3 4 5 0 0 1 0 1 2 1 0 2 0 2 3 2 0 3 4 0 0 1 0 100000000 2 100000000 0 3 100000000 100000000 4	15 17 0 20000000000000000

Note

In the first example, connecting points $1, 2, 3, 6$ in this order forms a valid quadrilateral with area $15/2$, which is the maximum among all valid choices. The quadrilateral formed by points $1, 2, 4, 5$ has area 9, but points 1 and 4 share the same color, so it is invalid.

In the second example, a valid quadrilateral exists, but no convex quadrilateral satisfies the requirements.

In the third example, no valid quadrilateral can be formed.

As shown in the fourth example, the answer can be very large.