

# Cheating Students

## Problem ID: cheatingstudents



You are a member of the “Cohort of Cheating and Sneaky Students at UCLA” or “CS Students” for short. Your goal? In every exam, you want to cheat in the most efficient way possible. The Leader of your cohort is somehow able to acquire the answers to all the questions five minutes before the exam (it is unclear how the leader manages to do so but the members suspect some insider TA play at hand). Thus, the cohort needs a way to somehow share the answers DURING the exam!

The cohort’s cheating strategy is simple. One of the members of the cohort gets up from their seat and sneakily walks toward another member of the cohort to share all the answers they know. Once a student learns of an answer, they remember it forever and can share it with the next student. There are  $N$  students represented as points in the plane and you may assume the shortest distance between any two students  $(x_i, y_i)$  and  $(x_j, y_j)$  is their manhattan distance  $|x_i - x_j| + |y_i - y_j|$ . Every student takes  $d$  seconds to travel a distance of  $d$ . After sharing answers with another student, the student then returns to their seat (students may inform only one student before returning to their seat). To avoid the professor’s gaze, before a student gets up, anyone from the cohort asks a question which the professor turns around and clarifies on the whiteboard so you needn’t worry about the student getting caught. But you must be careful! Only one student may get up at a time and must return directly to their seat else the professor will find out, and you will sadly be dubbed the “Cohort of Colossally Stupid Students at UCLA”.

The professor has already fixed the seating layout before the exam and shared it with the class. Given this seating layout as a list of  $N$  points  $(x_i, y_i)$  in the plane, can you help everyone in the cohort get all the answers as quickly as possible to ensure everyone finishes on time?

### Input

The first line contains a single integer,  $N$ , the number of students in the cohort taking the exam. The next  $N$  lines contain two space-separated integers each  $x_i$  and  $y_i$  denoting the  $i^{\text{th}}$  student’s position in the examination hall. ( $1 \leq N \leq 2000$ ,  $-1000 \leq x_i, y_i \leq 1000$ )

### Output

Output a single line containing a single integer, the minimum amount of time (in seconds) required to ensure everyone gets all the answers to the exam.

#### Sample Input 1

```
5
0 0
0 1
1 1
-1 0
0 -1
```

#### Sample Output 1

```
8
```

#### Sample Input 2

```
5
0 0
4 2
6 1
7 7
7 0
```

#### Sample Output 2

```
36
```