Lab4 Questions

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Lab4.A:Postman

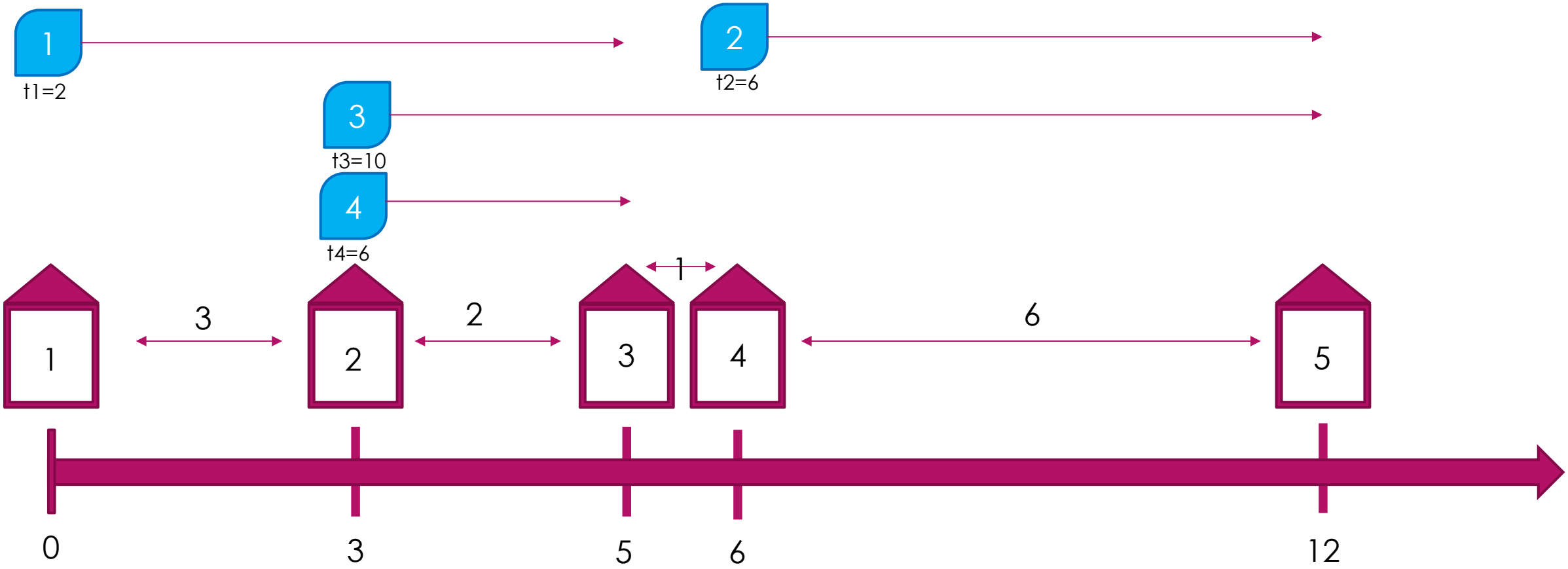
- Lida Pu is a postman from Twilight Company. There are N houses along a long straight street, and it takes d_i seconds for Lida Pu to walk from the i^{th} to the $(i+1)^{th}$ house. Lida Pu begins his work at the first house at time 0 everyday, singing songs while walking down the street, and finishes his work at the last house.
- Lida Pu is in charge of M letters: the i^{th} letter which should be sent to house b_i would appear at house a_i at time t_i punctually ($a_i < b_i$). As a responsible postman, Lida Pu would not miss any letters, so he would not leave certain house until all letters from it appears. Also, as an experienced postman, Lida Pu collects and sends letters within no time.
- However, one day Lida Pu is accused of noise making. Thus he is required to run instead of walking and singing. Yet he could run K times at most. When Lida Pu runs from the i^{th} house, he could reduce the original d_i by 1. Note that Lida Pu could run from the same house multiple times, but $0 \leq d_i$ should be satisfied at all times.
- Suppose Lida Pu arrives at the i^{th} house at time x_i, then the waiting time of the j^{th} letter is $w_j = x_{b_i} - t_j$. Now Lida Pu wants to minimize $f = \sum_{j=1}^{M} w_j$. Please calculate it for him.

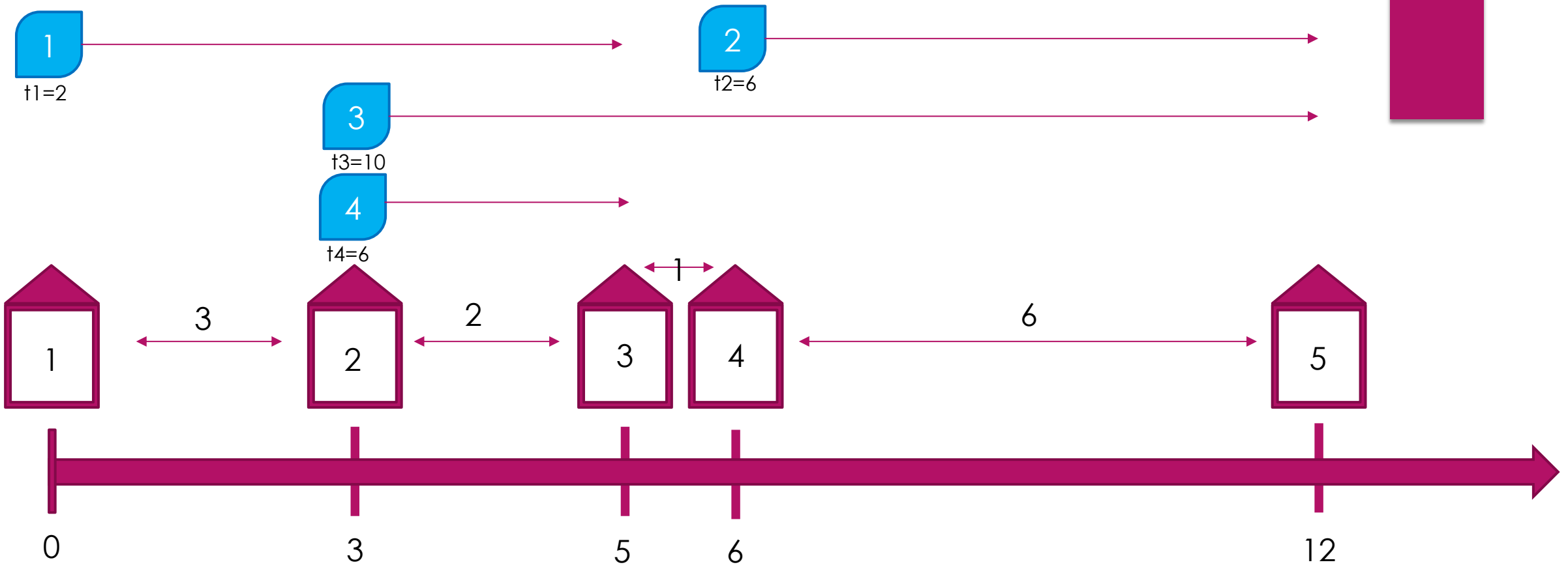
Sample Input 1

5 4 2
3 2 1 6
1 3 2
4 5 6
2 5 10
2 3 6

Sample Output 1

30



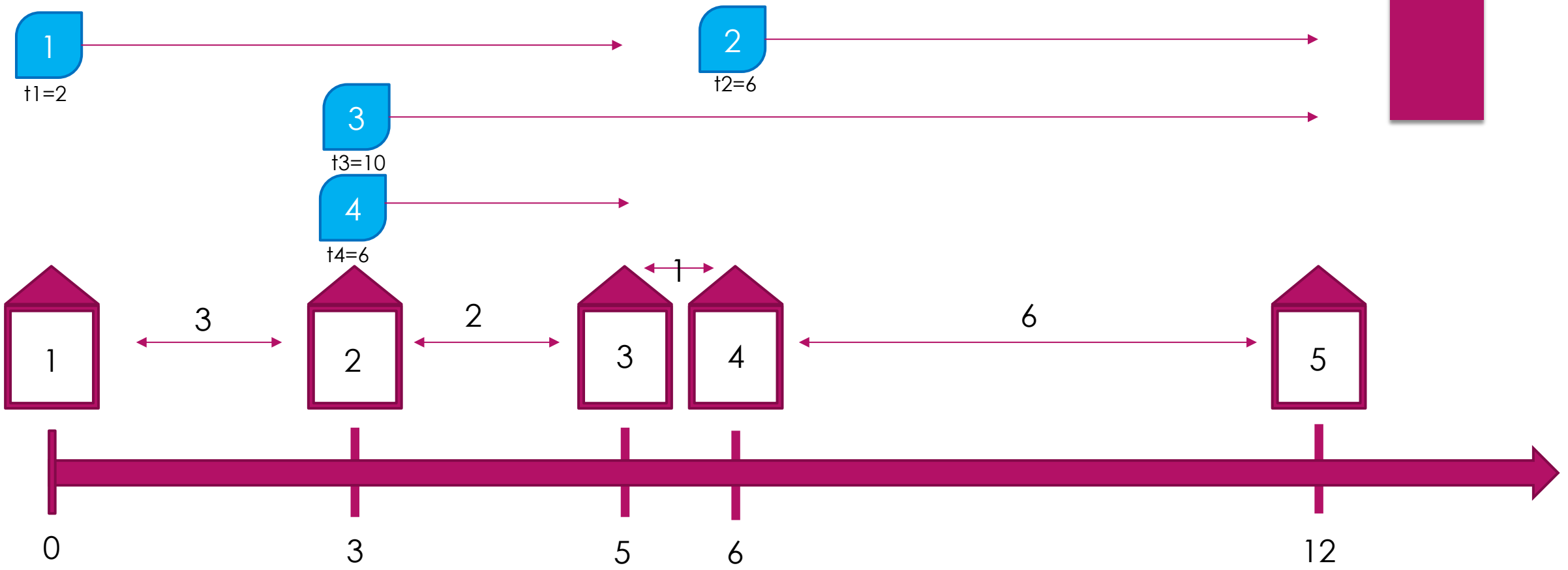


No running:

Time = 2, take letter 1 from house 1→2;
Time = 5, arrive house 2;
Time = 10, take letter 1,3,4 from house 2→3;
Time = 12, arrive house 3;
Time = 12, take letter 3,4 from house 3→4;
Time = 13, take letter 2,3 from house 4→5;
Time = 19, arrive house 5.

letter 1 wait 10, letter 4 wait 6.
letter 2 wait 13, letter 3 wait 9.

Total: **38**



Running K times, k=2:

Time = 2, take letter 1 from house 1→2;
Time = 5, arrive house 2;
Time = 10, take letter 1,3,4 from house 2→3;
Time = 10, running 2 times, arrive house 3;
Time = 10, take letter 3,4 from house 3→4;
Time = 11, take letter 2,3 from house 4→5;
Time = 17, arrive house 5.

letter 1 wait **8**, letter 4 wait **4**.

letter 2 wait **11**, letter 3 wait **7**.

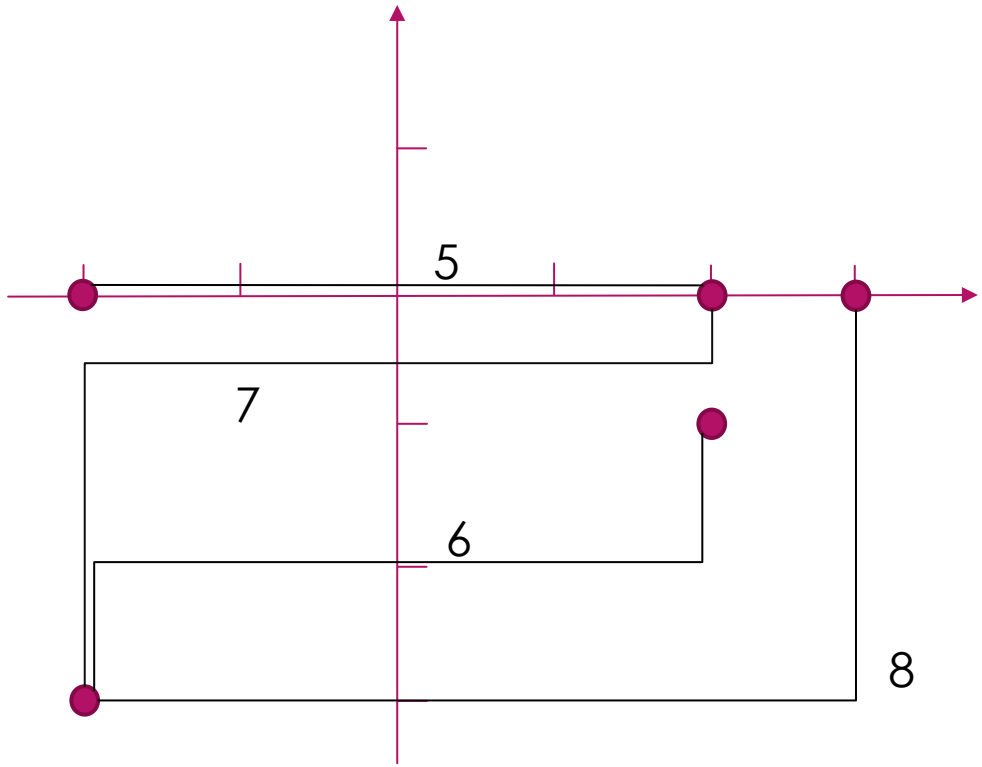
Total: **30**

Lab4.B: Servers

- N servers are scattered on a 2D plane. The coordinate of the i^{th} server is (x_i, y_i). No two servers share the same coordinate.
- The famous engineer, **RHC**, wants all N servers to be connected. Initially, there are no link among these servers. **RHC** can create as many undirected links as he wants between any pair of servers. If any two servers can reach to each other by these links, the N servers are said to be connected.
- However, if two servers connected by a link are too close to each other, interference will occur. Therefore, if **the Manhattan Distance** of two servers is less than some constant D, **RHC** will refuse to link them.
- With greater D comes greater performance of these servers. However, he still needs to guarantee their connectivity. Help **RHC** find the maximal D.

Sample Input

5
-2 -3
-2 0
2 -1
2 0
3 0

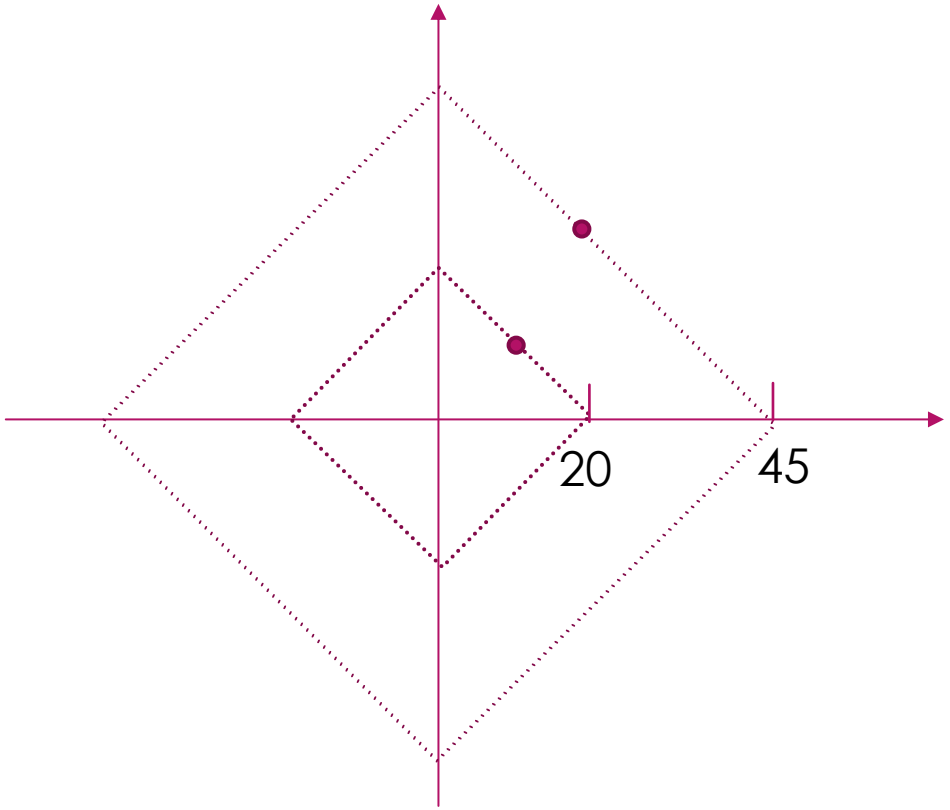


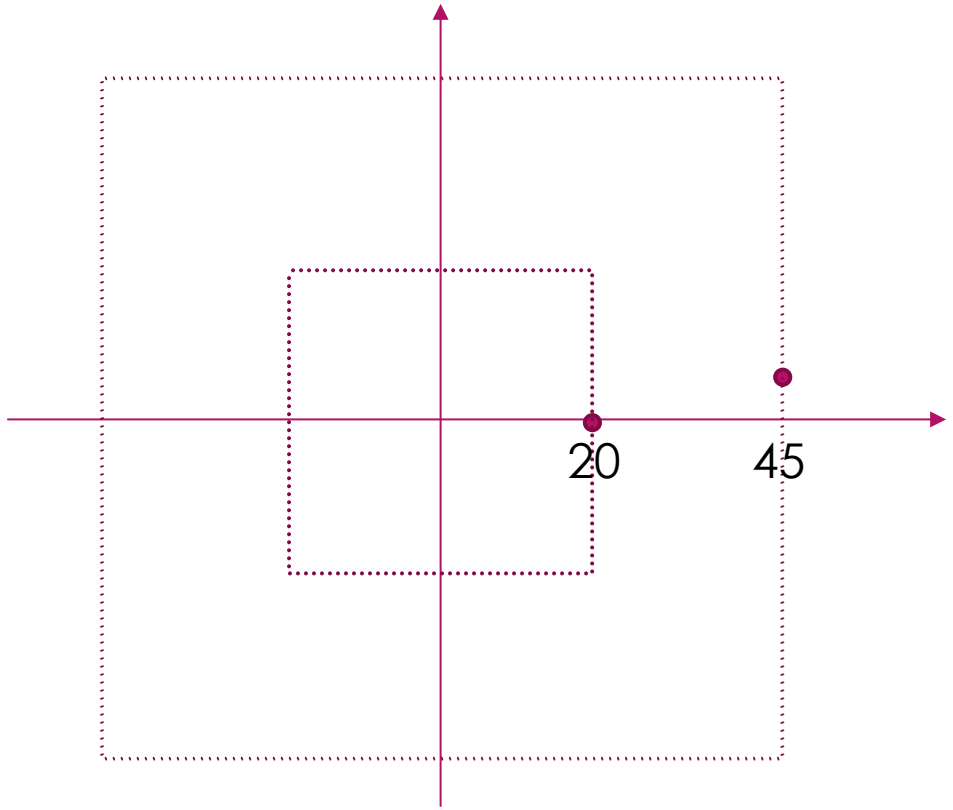
Sample Output

5

Hint

1.Manhattan Distance of (x_1, y_1) and (x_2, y_2) : $d_m(p1, p2) = |x_1 - x_2| + |y_1 + y_2|$.
2.Chebyshev Distance of (x_1, y_1) and (x_2, y_2): $d_c(p1, p2) = \max(|x_1 - x_2|, |y_1 + y_2|)$.
3.Let $x' = x + y, y' = x - y$, $then\ d_m(p1, p2) = d_c(p1', p2')$.





p1 (25,20)
p2 (10,10)

p1' (45,5)
p2' (20,0)

Cave Cows 3

- Question link: https://www.luogu.com.cn/problem/P5098
- To do: seeking the largest Manhattan distance between any two coordinates.

$$(x, y) \xrightarrow{(x+y,\, x-y)} (x', y')$$

$$\max(\max\_x' - \min\_x', \max\_y' - \min\_y')$$