II. TREES PROBLEM (Finalist tasks for IOI'91)

A farmer wants to preserve a rare class of ancient cypress trees. In order to do that he has taken note of the position of each tree and he has decided to surround the trees with wire drawing a polygon such that they lie entirely inside it. In order to reduce his costs, he needs to minimize the length of wire. The farmer wants to build a rectangular house, one of its sides being parallel to the X-axis, and he needs to know the relative location of the house:
(1) The house is outside the polygon.
(2) The house is inside the polygon.
(3) The wire divides the house in two regions whose areas are different from zero.

Write a program capable of accomplishing the following tasks:
(A) Finds the trees that will be the vertices of the polygon.
(B) Calculates the length of wire that will be used.
(C) Indicates in which of the above mentioned locations (1,2,3) the farmer's house is.

Input:
   - On the first line, N: The number of the trees.
   - From line 2 to line N+1, line 1+i contains two integers Xi Yi, for $1 <= i <= N$, $N <= 20$, $Xi, Yi > 0$; The coordinates of the points corresponding to each tree.
   - On line N+2, four integers a, b, c, d, $(a,b,c,d > 0;$ $a < c;$ $b < d)$; The beginning (a,b) and ending points (c,d) of the house's main diagonal.

Output:
   - A sequence of M points $(1 <= M <= N)$ with the property that if we trace through the points in the order in which they appear, we trace the outline of the polygon.
   - The length of wire that will be used.
   - The indication of the position of the house in the form "1","2", or "3".