

# COL226 Assignment 1

Kuldeep Meena

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## Approach

### 1. Input Output Specification

The program takes input  $n$  which is followed by  $n$  coordinates (as  $X$  and  $Y$  coordinates respectively) such that the coordinates are sorted with respect to  $X$  coordinates

### 2. Some design decisions

a. Since it is common to take inputs of test cases with a line break I have opted for the same convention

b. I assume that we are concerned with the area bounded by points and the  $X$  axis

c. I assume that we are interested in area and not in integration so both area above and below axis are taken positive

d. The points are sorted only by  $X$  coordinates and not by  $Y$  when  $X$  is same. My algorithm design is such that it works on parts of the curve formed by the points such that one part have unique points and other part takes  $(X, Y)$  such that  $Y$  is maximum, this is a design decision and has no specific reason as the problem statement does not mention any convention for connection of points. There are other design decision possible that include always maximising or minimising area but to me my design decision sounds intuitive as it can be expanded to an independent of  $n$  program.

### Working of algorithm

The algorithm is such that it can be extended to any number of coordinates as it holds the invariant that after  $i$  points area is the area under the curve by the coordinates seen upto that point. The algorithm takes in care all possible cases i.e. points with  $y$  positive,  $y$  negative or a transition from positive to negative or zig zag curve. Algorithm works on standard mathematical notion of area calculation under line joined by points and proof of correctness is easy to see.

### Some Test Cases

1. Test Case (All Positives):

$(-8,10), (-4,10), (-4,8), (-4,12), (6,9), (8,0)$   
Area = 154

2. Test Case (All Negatives):

$(-8,-10), (-4,-10), (-4,-8), (-4,-12), (6,-9), (8,0)$   
Area = 154

3 .Test Case (Positive to Negative):

$(-8,5), (-4,4), (-2,9), (1,-18), (3,0)$   
Area = 71.5

4. Test Case (Zig Zag):

$(-6,3), (-2,-9), (-1,-5), (3,15), (4,-5)$   
Area = 53.25