

COL216 Assignment 1

Pratyush Saini

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1 Preface

The Assignment involves the use of QtSpim Simulator for evaluating the area under curved formed by joining n coordinates in the x-y plane by a straight line, using MIPS Assembly language.

2 Input Format and Assumptions

a) The first line of Input contains the values of N , the number of coordinates under which the area needs to be calculated. The limit set for N is from 0 to 10^9 (i.e. Non negative), i.e. it is assumed that the value of N will not exceed **32 bits**.

b) Following $2N$ lines contains the coordinate values. One particular line contains single integer entry. For example, first two lines contains the point x_1 and y_1 , next two lines contains x_2 and y_2 .. and so on.

The assumption of coordinate entries is from -10^9 to 10^9 (i.e. both negative and positive values considered). It is assumed that the coordinate values are sorted by X coordinate and won't exceed **32 bits**.

Input is taken from Keyboard. The final area has been stored in 64 bit floating point register. It is assumed that final area will not exceed the assumed bits, failing which overflow may arrive.

3 Output format

The output contains a single floating point value, indicating the area under the curve formed by joining the input coordinates by straight lines.

4 Algorithm

a) For trivial cases, i.e. $N = 0$ and $N = 1$ outputs 0 as there is no positive area bounded by the given input coordinates.

b) For N greater than 2, the Algorithm breaks up the problem into many small segments. The loop runs $N-1$ times and at each iteration of the loop, calculates

i) If $y[i] * y[i+1]$ is Non negative, then calculates the positive area under the trapezium formed by both coordinates and the straight line joining them with the x-axis.

ii) If $y[i] * y[i+1]$ is negative, then there are two triangles formed by the coordinates and the line joining them with the x axis. The algorithm calculates the modulus of both the areas and adds them up to the total area.

Note: The Algorithm takes in account that the area is always positive, irrespective of whether it lies below the x-axis or above it.

5 Test cases

I have tested the Code on the following test cases, covering almost all the scenarios which may arrive.

Test Case given in problem statement

a) $N = 5$

Coordinates: (1,1) (3,4) (5,3) (6,7) (9,5)

Output: 35

Takes into account the area below X-axis

b) $N = 3$

Coordinates: (1,1) (2,-1) (3,1)

Output: 1.5

c) $N = 10$

Coordinates: (-1000, -1000) (1000, 1000)

Output: 1000000