CS218 Design and analysis of algorithms **Jan-Apr 2024**

Programming Assignment 1

Total Marks: 5

Area covered by union of Trapeziums We had seen the problem of computing the total area covered by a set of rectangular posters. Consider its variation where the posters are in the shape of trapeziums. These are right angle trapeziums: for any poster, its base is on the x-axis, two of its edges are parallel to y-axis. More precisely, the coordinates of the four corners of the i-th poster are of the form $(a_i, 0), (c_i, 0), (a_i, b_i), (c_i, d_i)$ for some positive numbers a_i, b_i, c_i, d_i. The goal is to compute the total area covered by the union of these posters and the total length covered on the x-axis. See the below figure.

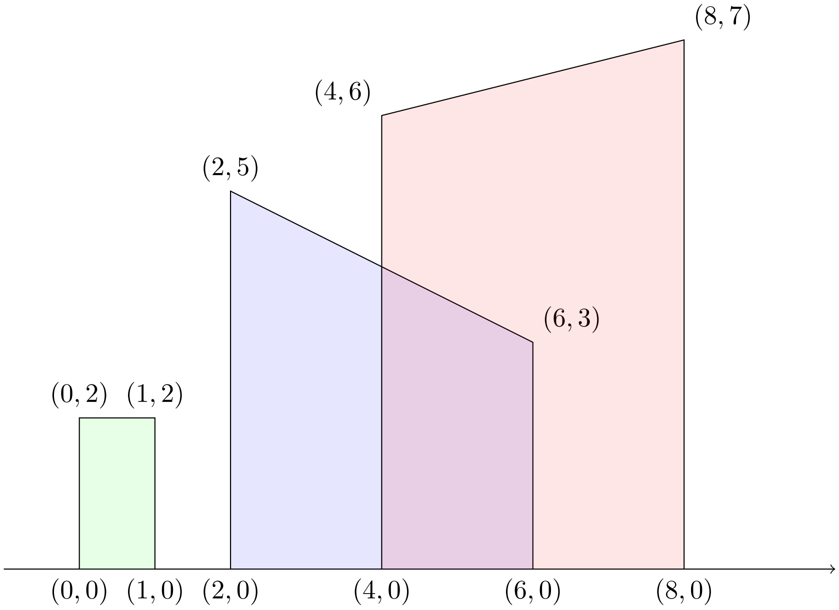

Figure 1: Three trapeziums. Total covered area is 37. Total covered length on x-axis is 7.

Instructions

Input contains $n + 1$ lines.

Line 1: n (the number of posters)
Line 2: a_1 b_1 c_1 d_1
$\vdots$
Line $n + 1$: a_n b_n c_n d_n

Output :
Line 1: total area covered by the posters (only the integer part)
Line 2: total length covered by the posters on the x-axis (only the integer part).

- Programming Language: C++. We will compile your code with g++. Make sure that it works.

- Submission: put your code in a file named XXX.cpp where XXX is your roll number. Also, write a short explanation (a paragraph) of what your algorithm does, put this in XXX.pdf. The two files should be uploaded on Moodle (do not zip/compress).
- Given files: In the `LineSegments` folder, you will find: (i) helper.cpp (a c++ code showing expected input/output, feel free to use) (ii) Few sample input and output files, (iii) two executable files, which can be used to get the correct output on any input.
- Running time: we will test your code on some similar size instances as given in the sample input files (few of small size, few of large size). If your time complexity is around $O(n \log n)$, your code will be easily successful on all test cases.
- Academic integrity: Mention all references if you have referred to any resources while working on this assignment in the pdf. You are supposed to do the assignment on your own and not discuss with anyone else. We will do a plagiarism check on your submission using MOSS. It's fairly sophisticated and can detect even when you have made modifications in someone else's code. Any cases found with significant overlap will be sent to DADAC. If DADAC finds it to be a case of plagiarism, then the penalty is zero in the assignment and final course grade reduced by 1 point.
- Grading: We will use mars.cse for testing, with a timeout of 5 seconds for each input. The test inputs will be of varying sizes. Total marks will be equally distributed for the test inputs. For each input, the distribution will be $0.3 + 0.7$ for the length covered and the area covered.