Computational Geometry (CS60064)
Spring 2024-25

Instructions

1. The submission deadline is hard. There may be unforeseen glitches during submission. So, for safety, submit your files well ahead.

2. All submissions should be on moodle only. No email submission will be accepted, excepting medical reasons.

3. Do not forget to typeset your solutions. In particular, every mathematical expression must be properly typeset, e.g., the square of n must appear as n^2 and not as `n^2`. Improper typesetting may incur up to 25% deduction in marks.

   You can use LaTeX for writing (that is what we recommend); else, typeset in Word and convert to pdf.

   Handwritten text—converted to images or to pdf—will not be evaluated.

4. You must submit all the source files and the final pdf as a single zip file. The name of the zip should be your roll number, followed by a hyphen, followed by the assignment number. For example, if your roll number is `XY190047`, then the zip file for the 1st assignment should be named as `XY190047-a1.zip`. For subsequent assignments, your zip files should be named as `XY190047-a2.zip`, `XY190047-a3.zip`, ...

   If you typeset in LaTeX, then the zip should contain one tex file, image files if any, and the final pdf.

   If you typeset in Word, then the zip should contain one odt/doc/docx file and the final pdf. Image files get embedded in a Word file, so image files are not needed.

   Failing this, your assignment will not be evaluated.

Assignment 1

Submission deadline: 19-Jan-2025, 11:55 PM

1.1 Polygon Construction

Given n points on the xy-plane, design an algorithm to construct a simple polygon P such that all the given points serve as vertices of P, and no other points are included as vertices. Provide a proof of correctness for your algorithm and deduce its time complexity. (A *simple polygon* is defined as one in which no two edges intersect, except possibly at their endpoints.) $\boxed{4 + 3 + 3 = 10 \text{ marks}}$

1.2 Point Location

A convex polygon P is provided as a counter-clockwise ordered sequence of n vertices, with their locations specified as (x, y) coordinates. Given a query point q, develop an algorithm to determine whether q lies inside P in $O(\log n)$ time, using $O(n)$ space, including any necessary preprocessing. Justify the time and space complexities of your algorithm. $\boxed{6 + 2 + 2 = 10 \text{ marks}}$