COMP163 HW Assignment 1: Due Friday, September 23, 2022, 11:59PM

Reading: Chapter 1 in the Text. Three sets of 2D convex hull notes and the section on Convex Hulls in "Computational Geometry: A User's Guide" available by links located within the item "Lecture Notes" at the bottom of the website:

https://www.cs.tufts.edu/comp/163

Please consult other references as interest dictates.

General Information: Please type up your homework solutions (directions on how to use latex are included on the webpage) and submit the pdf – it is OK to hand-draw figures and "drop" them into the typed document. When describing an algorithm, do not forget to analyse its running time and explain why the algorithm is correct. Although we hope that you will discuss these problems in the preliminary stages with others, work submitted should be done individually and written in your own words **as clearly and succinctly as possible**. If you have any discussions with others (students, friends, TAs, faculty, ...) relative to a homework problem or if you gain information from a written (or video/audio) source other than your own notes from lecture, you are expected to identify your collaborator/source.

Problems:

1. Left Turn and Convexity:

   (a) Given points $A = (x_a, y_a)$, $B = (x_b, y_b)$, and $C = (x_c, y_c)$, the determinant $D =$

   $$\begin{vmatrix} x_a & y_a & 1 \\ x_b & y_b & 1 \\ x_c & y_c & 1 \end{vmatrix}$$

   gives twice the signed area of triangle ΔABC where the sign is $+$ if and only if A, B, C appear in counterclockwise order on the boundary of ΔABC. In other words, A, B, C forms a left turn if and only if $D > 0$. Use analytic geometry to derive and verify this fact.

   (b) Given a polygon P specified by a circularly linked list of its n vertices in order, provide an algorithm to test whether the polygon P is convex and prove its correctness.

2. TO BE POSTED ON MONDAY

3. TO BE STARTED AS AN IN-CLASS PROBLEM-SOLVING EXERCISE AND THEN WRITTEN UP INDIVIDUALLY