# Assignment no. 1

due: Tuesday, Dec. 13$^{\text{th}}$, 2022

You may work on and submit this assignment **in pairs**.

Exercise 1.1:   Write a program that sorts a given set on n integers utilizing a function that computes the convex hull of a set of points in the plane.

Exercise 1.2:

1. Write a program that sorts a given set P of points into a counterclockwise circular order about an anchor point (o in the picture below) that is strictly inside the convex hull of P, e.g., the center of mass of the points (their average).

   - Assume that a point that lies on the positive x-axis is smaller than a point that does not.
   - You may assume (but you don't have to) that the points are in general position; that is,
     - no three points, including the anchor point, are collinear, and
     - the center of mass is not a member of P.
   - You can use, e.g., the CGAL kernel functor Kernel :: Counter_clockwise_in_between_2.

2. Given a set P of n points in the plane sorted in circular order about some point strictly inside the convex hull of P, devise an algorithm that computes the convex hull of P in linear time. Implement your algorithm.
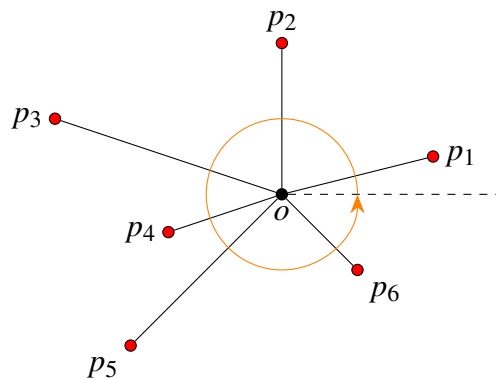
Exercise 1.3   Given k convex polygons $\mathscr{P} = P_1, \ldots, P_k$ in the plane (not necessarily disjoint) with overall n vertices, devise an algorithm that computes the convex hull of $\mathscr{P}$ in time $O(n \log(k))$.

Exercise 1.4   (difficult, optional, bonus)

1. Given k convex polygons $P_1, \ldots, P_k$ in the plane (not necessarily disjoint) with overall n vertices, compute their convex hull C in time $O(kh + n)$, h is the number of vertices of the convex hull C.

2. Assuming knowledge of the number h of the number of vertices of the convex hull of a given set S of n points in the plane, compute the convex hull C of S in time $O(n \log h)$.