MA-INF 1203 Discrete and Computational Geometry

Wintersemester 2019/20
Assignment 7

Deadline: **26** November before noon (To be discussed: **26/27**. November 2019)

1 Computing the intersection of half-spaces

Modify the randomized incremental algorithm for computing the convex hull in $\mathbb{R}^3$ so that it computes the intersection of half-spaces. Your algorithm should maintain the intersection of the current set of half-spaces. To figure out where to insert a new half-space, maintain a conflict graph between the vertices of the current intersection and the half-spaces that are still to be inserted.

2 Point location

A planar subdivision is a crossing-free, straight-line drawing of a planar graph. Show that, given a planar subdivision S with n vertices and edges and a query point q, the face of S containing q can be computed in time $O(n)$. Assume that S is given in a doubly-connected edge list (DCEL).

3 Trapezoidal decomposition

a) Draw the trapezoidal decomposition of the segments depicted in Figure 1.

b) Draw the point location data structure that results from inserting the segments depicted in Figure 1, assuming that the insertion order is s_1, s_2, s_3, s_4, s_5.

c) Give the pseudocode for an algorithm which inserts a new segment to the search data structure. Assume that the new segment does not touch any of the segments already stored.

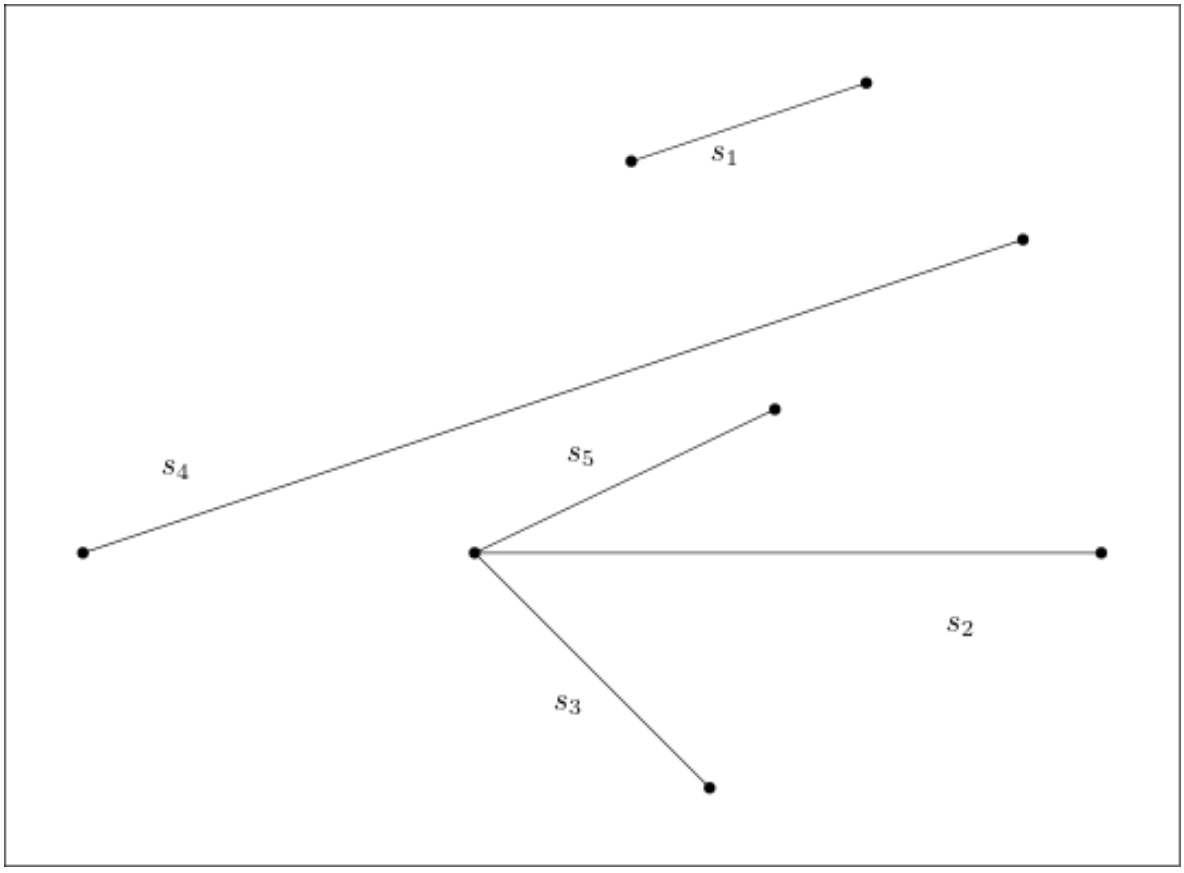

Figure 1