5. Assignment on

Computational Geometry

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Due on 13. May 2013 in the tutorial session

Problem 1 Shortest Paths and Funnels *10 points*

(a) Let P be a simple polygon and let $s, t \in P$ be points in P. Assume general position. Show that there is exactly one shortest path from s to t inside P.

(b) Now, you are asked to prove the properties of the funnel we stated in class. Consider the shortest paths π_i^l and π_i^r inside the sleeve from s to the left and the right endpoint of d_i. Let v be the last common vertex of π_i^l and π_i^r.

(i) Show that $s \xrightarrow{\pi_i^l} v = s \xrightarrow{\pi_i^r} v$.

(ii) Show that all inner vertices of $v \xrightarrow{\pi_i^l} d_i^l$ lie on the left chain and that all inner vertices of $v \xrightarrow{\pi_i^r} d_i^r$ lie on the right chain.

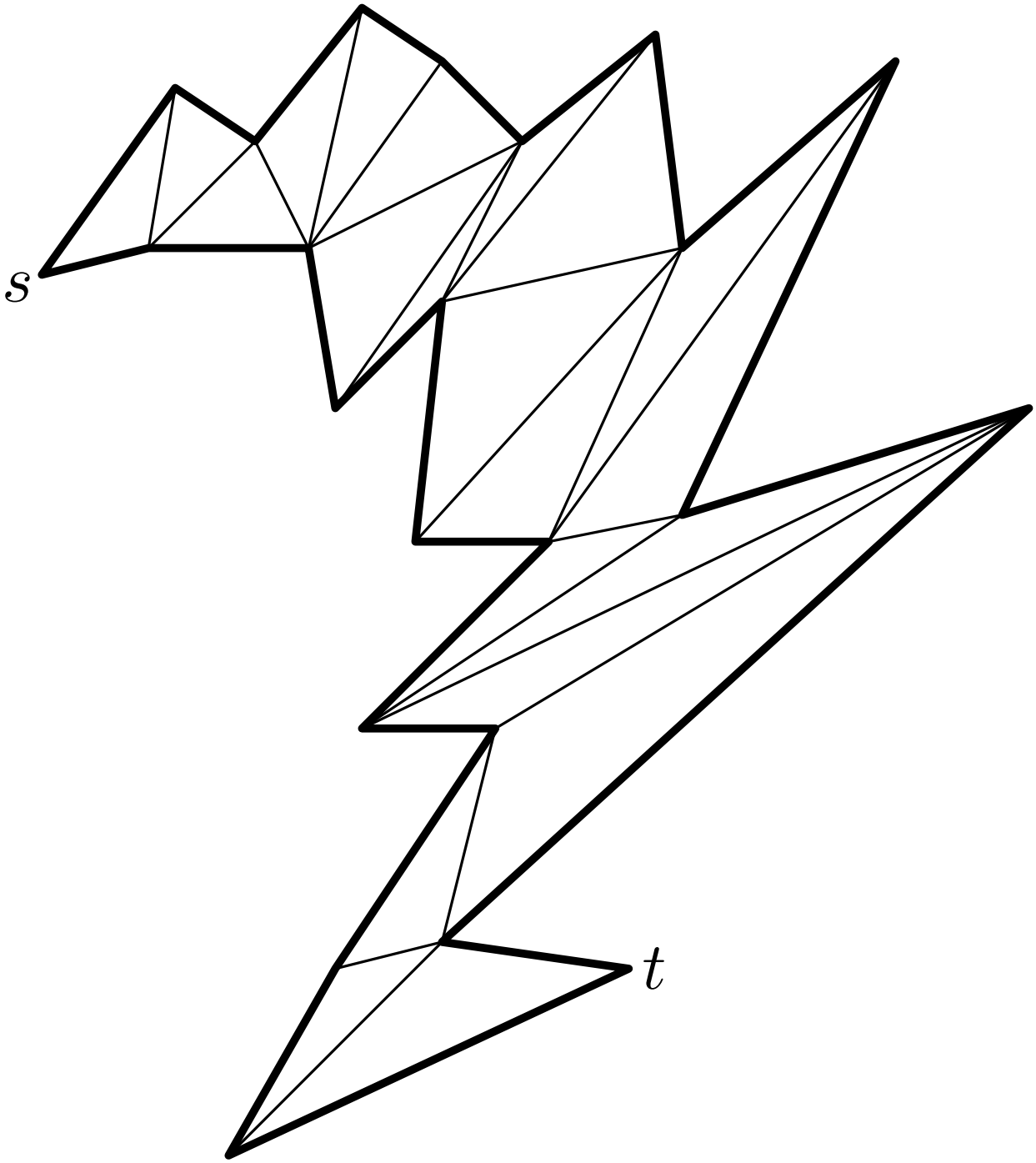
(iii) Show that $v \xrightarrow{\pi_i^l} d_i^l$, $v \xrightarrow{\pi_i^r} d_r^l$, and d_i form a simple polygon that is bounded by two inwardly concave chains.

Problem 2 Shortest Paths in Polygons *10 points*

On the next page you find a triangulated sleeve. Perform the shortest path algorithm from class on the sleeve. Show all your steps.

Problem 3 Constructions of Polygons *10 points*

Let P be a planar n-point set in general position. Show how to find in $O(n \log n)$ time a simple polygon whose vertices are exactly the points in P.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