6.851 Advanced Data Structures (Spring'12)

Prof. Erik Demaine

Problem 5 *Due: Thursday, Mar. 22*

Be sure to read the instructions on the assignments section of the class web page. Remember to keep your solutions to one page!

Orthogonal line segment intersection. Given a set of N horizontal and vertical line segments, develop and analyze a cache-oblivious algorithm to find the number of vertical segments intersecting each horizontal segment in $O(\frac{N}{B} \log_{M/B} \frac{N}{B})$ memory transfers. You may assume that the endpoints of any two different line segments do not have the same x or y value.

Line segment visibility from a point. Given a set of N line segments and a point p, we would like to find the clockwise list of partial line segments visible from p. A (partial) line segment is visible from p if, for any point along the segment, a line can be drawn from that point to p without intersecting any other line segment. If a line segment is only partially visible from p, then only the segment that is visible should appear in the output list. A single line segment may contain many partial segments in the output list. Develop and analyze a cache-oblivious algorithm to accomplish this in $O(\frac{N}{B} \log_{M/B} \frac{N}{B} + \frac{K}{B})$ memory transfers, where K is the size of the output. You may assume that no two points in the input lie along the same line to p, and that no two line segments intersect.

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