

T-79.7001 Computational Geometry (5 cr) P

Exam, 11 Dec 2014, 13:00–16:00

Write down on each answer sheet:

- Your name, degree program, and student number
- The text: “T-79.7001 Computational Geometry 21.10.2014”
- The total number of answer sheets you are submitting for grading

Remark: Please write your answers in English.

1. *Crossing numbers.* Recall that the crossing number lemma says that if G has v vertices and $e \geq 4v$ edges, then $\text{cr}(G) \geq \frac{1}{64}e^3/v^2$. Now assume that G is bipartite. Show that the hypothesis on e can be weakened. (You may assume the proof of the crossing lemma from class.)
3. *Distances.* Let $P \subset \mathbb{R}^2$ be a set of n points. Give the best upper bound you can on the number of pairs of points in P that are at distance 1 or distance 2 from each other.
2. *Point sets inducing many lines.* Suppose that you have n red points and n blue points. Call a line r -red rich if it has at least r red points on it and similarly r -blue rich if it has at least r blue points on it.
Give the best lower bound you can on the number of lines with at least one point of each color on it, assuming that every line is at most $n/2$ -red rich and $n/2$ -blue rich.

Grading: Each problem 20p, total 60 p.

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