Geometric Graph Theory

Topics for the exam

1. Basic definition of graphs and planar graphs, Kuratowski's theorem*
2. Euler's formula about the number of vertices, edges and faces of planar graphs, corollaries, bound on the chromatic number of planar graphs
3. Straight-line drawings, canonical construction of triangulations, drawing on a small grid
4. Thrackles, definition, bound on the number of edges
5. Excluded subgraphs, Turán's theorem about excluding complete graphs, excluded geometric subgraphs
6. Partial orderings, Dilworth's theorem about chains and antichains and corollaries about no k pairwise disjoint edges and about finding many disjoint or many pairwise intersecting members in a family of convex sets
7. Davenport-Schinzel sequences, generalization, corollary about no k pairwise crossing edges
8. Crossing number and crossing lemma, crossing number of complete graphs
9. The number of unit distance pairs among n points in the plane
10. Szemerédi-Trotter theorem about incidences between points and lines
11. Sum-product theorem of Elekes
12. Koebe's theorem*, Helly's theorem*, Centerpoint theorem, Lipton-Tarjan separator theorem

*without proof