Semester Report WS03/04 of Taral Guldahl Seierstad

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Topic:	Random graphs and random greedy processes
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Background

In my Master's thesis [2], I wrote about the Reconstruction problem for graphs; I mostly studied the bipartite case. My main result was that if G is a bipartite graph, such that one of the colour classes has no more than five vertices, then G is reconstructible. In addition I proved some other lemmas that can be helpful when reconstructing general bipartite graphs.

Field of Research

The first weeks at CGC I spent familiarising myself with the topic of random graphs. One problem that captured my interest and I will work further on is the following:

Consider the following random graph process: We are given a monotone graph property P. To each edge in the complete graph K_n we randomly assign a value t, with $0 \leq t \leq 1$. This is called the "birthtime" of the edge. Then we start with the empty graph on n vertices at time $t = 0$, and increase t gradually. Whenever t reaches the birthtime of an edge, that edge is added to the graph, provided that the resulting graph satisfies P. When $t = 1$ we have a graph which is maximal with respect to satisfying P, and we want to determine the properties of this graph, such as the number of edges.

In [1] Erdős, Suen and Winkler considered the case where P is "2-colourable". In the latter case the resulting graph is almost always a balanced complete bipartite graph. I will try to see what happens when this is changed to k-colourable. The proof in [1] does not seem to carry over to the k-colourable case, since it relies on the fact that a bipartition of a connected graph is unique, while the k-partition of a graph is generally not, when $k \geq 3$.

Activities

From January 26 to March 2 2004, I am attending the block courses *Permutation groups, structures, and polynomials* by Peter Cameron, and *Arrangements in Computational and Combinatorial Geometry* by Micha Sharir, at the Charles University in Prague.

References

[1] Paul Erdős, Stephen Suen, and Peter Winkler. On the size of a random maximal graph. *Random Struct. Algorithms*, 6(2-3):309–318, 1995.

[2] Taral Guldahl Seierstad. Ulam's reconstruction problem for graphs. Master's thesis, University of Bergen, Norway, 2002.