Semester Report WS05/06 of

Name:	Alantha Newman
Supervisor(s):	Prof. Rolf Möhring
Field of Research:	Combinatorial Optimization
Topic:	Vertex Ordering Problems
Postdoc	at the program from September to December 2005

Field of Research

My focus is on approximation algorithms and graph optimization problems. In particular, I am interested in the quality of mathematical programming relaxations for graph problems in which the objective is to order the vertices or to position the vertices according to given assignment rules so as to optimize an objective function.

Current Research

I am interested in vertex ordering problems such as the *maximum acyclic subgraph* problem. In this problem, we are given a complete weighted directed graph and the goal is to find a maximum weight subset of the edges that is acyclic, i.e. contains no cycles. This is equivalent to the problem of finding a linear ordering of the vertices that maximizes the weight of edges (i, j) such that vertex i precedes vertex j in the ordering. This problem has many applications to other problems in scheduling and graph optimization. In [1, 2], I gave a new semi-definite programming formulation for this problem and it is an intriguing open problem and long-term goal to analyze the worst-case quality of this relaxation.

Other well-studied linear programming relaxations do not give good bounds on the value of an optimal solution in the worst case. However, an interesting problem is to characterize the graphs for which they give a bound that equals the integral optimal. This problem is complicated by the fact that the graphs are directed. It is conjectured that such graphs are those whose subgraphs contain no *möbius ladder* minor. This work is ongoing.

I obtained several nive (related) problems from traveling to INFORMS and from talking to students and faculty at TU, on which I intend to continue working.

Activities

During my time at TU Berlin:

- I attended the Monday lectures and colloquia of the CGC and gave a colloquia talk.

- I attended Eurocomb 05 at TU Berlin.

- I attended the CGC Annual Workshop at Hiddensee and gave a presentation.

- I attended INFORMS 2005 in San Francisco, where I gave a presentation.

- Sub-refereed three conference submissions.

Preview

Starting in January, I will be a postdoc at MPI in Saarbrücken.

References

[1] A. Newman, "Algorithms for String and Graph Layout", Ph.D. Thesis, M.I.T. 2004.

[2] A. Newman, "Cuts and Orderings: On Semidefinite Relaxations for the Linear Ordering Problem", *Proceedings of APPROX*, 2004.