

# Various Results in Discrete Mathematics

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Description: Thus far I have spent considerable time working problems from Lovasz's *Combinatorial Problems and Exercises*, reading texts such as Alon and Spencer's *The Probabilistic Method*, Bollobas's *Combinatorics*, and Babai and Frankl's *Linear Algebra Methods in Combinatorics*, and perusing journals like the *Journal of Combinatorial Theory and Discrete Mathematics*. In addition, I spent the summer of 2000 working on various problems in discrete math at the University of Minnesota, Duluth REU. I have submitted a paper based on work I completed there to *Discrete Mathematics*, and it is currently under consideration. Presumably, I would continue my excursions into the aforementioned books and journals through next year as my ideas gel for a specific thesis topic.

Already I have some topics in mind; in particular, a conjecture of Frankl on union-closed families stands out to me at the moment. The conjecture goes as follows: Suppose we have a finite collection of sets which is closed under unions. Then there is some element contained in at least half of the sets. Surprising in its simplicity, this conjecture has nonetheless remained open for over twenty years. The following central reference was my first encounter with it: Poonen, Bjorn, "*Union-Closed Families*," JCTA 59, 253-268 (1992). The conjecture remains fairly wide open, and I think I'd like to take a stab at it. Other possible thesis directions include hypergraph colorings, perfect graphs, and information theory.