ECE 3484 - Combinatorial Optimization

Project Overview

The following gives some information about the research projects that you will be working on this quarter. Each group should contain no more than two people, and two is the preferred size. Let me know as soon as possible if you do not have a partner and would like one. Network students can work in larger or smaller groups.

Each group will select one optimization problem to concentrate on for the rest of the quarter. As we cover different optimization techniques you will apply them to your problem and evaluate their effectiveness. You will also research previous attempts to solve your problem and apply and evaluate those specialized techniques. By the end of the quarter you should know everything there is to know about the computational solution of your problem.

Good combinatorial optimization problems to study have the following properties: they are relatively easy to state, which makes them widely applicable; they are NP-complete; and researchers have studied the problem and there are some interesting results to get you started. The following is a suggested list of problems. You can also select problems that are not on this list, but you will need to discuss this with me. The problems are described generally and you should check the exact problem statements in Garey and Johnson.

The homework deadlines are firm, but the project deadlines up until the end of the quarter are flexible in general. The project is very time consuming and it is OK for you to miss a deadline if you are making good progress. To request a delay in a deadline, email me a brief summary of what you have accomplished, what you have left to do, and when you expect to be finished. However, the students who are most successful at completing their projects, and who learn the most, usually make good progress throughout the quarter.

1. **Bin Packing:** Given a set of objects with sizes, can the objects be placed into K subsets of fixed size?

2. **Graph K-Colorability:** Given a graph and an integer K, can the graph be colored with K colors?

3. **Integer Knapsack:** Given a set of objects with weights and values and a weight bound, select a maximum weight set of objects where the same object can be selected more than once.

4. **Knapsack:** Given a set of objects with weights and values and a weight bound, select a maximum weight subset.

5. **Minimum Cover:** Given a collection of subsets C of a set S and an integer K, are there K subsets such that every element of S is in at least one of the K subsets?

6. **Satisfiability:** Given an expression that consists of a set of clauses, does the expression have a satisfying truth assignment?

7. **Subset sum:** Given a set of integers and a target value, is there a subset of the integers whose sum equals the target?