ICS 275, Assignment 7

This homework is based on Chapter 13 and on the AIJ 2007 paper. It has 2 required questions, one optional and one extra credit.

1. (Optional, question 1 chapter 13) The Golumb ruler is the following: place a set of n markers $X_1 > ... > X_n$ on the integer line, (assigning a positive integer to each marker) such that the distances between any two markers are all different, and such that the *length of the ruler*, namely the assignment to X_n, is the smallest possible.

   (a) Provide two ways of formulating the Golumb ruler as a constraint optimization problem. (you can find papers describing this problem online). Demonstrate your formulation on a problem of small size (5 variables).

   (b) Discuss briefly the solution of the problem by Branch and bound and by bucket-elimination

2. (Question 2 chapter 13). The combinatorial auction problem was described in chapter 13 and in exercise 13 of chapter 5.

   (a) Provide one way of formulating this problem as a constraint optimization problem. Demonstrate your formulation over a small problem (5 variables).

   (b) Discuss the pros and cons of solving this problem by Branch and Bound algorithms vs bucket elimination.

3. (Question 4 chapter 13) consider a graph-coloring problem that has 5 variables (A, B, C, D, E), where the domains of A and C are $\{1, 2, 3\}$ and the domains of B and D and E are $\{1, 2, \}$. The constraints are not equal constraints between adjacent variables. Apply the elim-count algorithm to this problem. Compare its performance with a simple search algorithm for counting. Do this for two cases:

   (a) A chain graph structure where A is connected to B, B is connected to C, C is connected to D and D to E.

   (b) A tree graph structure where A is connected to B, A is connected to C, C is connected to D and C is connected to E.

4. (extra credit) Question 6 chapter 13.