Rina Dechter, Fall-2022

ICS 275, Assignment 6

Read chapters 7, 9, 10 and 13 and answer the following questions

1. (10 pts. question 3, chapter 7) Analyze the complexity of SLS local search step.
2. (15 pts.) Apply SLS to the problem in Figure 1. You can write your own code, or show a number of local steps. Terminate if you found a solution or if you executed up to 5 local search steps.
3. (15 pts. question 4, chapter 9) Consider a 3x3 grid problem with binary constraints. Describe a join-tree decomposition created by JTC.
   (a) What is the tree-width, hyper-width and separators of your decomposition.
   (b) What is the time and space complexity of CTE on the tree-decomposition.
   (c) Show schematically how CTE will work on this problem.
4. (10 pts. question 4 chapter 10) Given a graph $G = (V, E)$ with n noodes, and given constant b and r, can we decide if there is a b-cutset of size r in polynomial time? Explain your answer
5. (10 pts, chapter 10). Consider the constraint graph in Figure 10.9 and the 3 tree-decompositions in figure 10.10. Show scematically the messages that will flow over the tree-decomposition in part b.
6. (20 pts. 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.

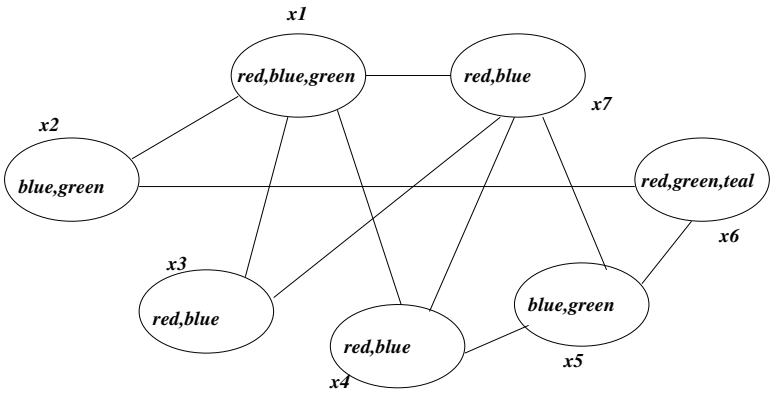

Figure 1: A modified coloring problem.