Rina Dechter, Fall-01

ICS 275A, Assignment 2

1. (Question 9 chapter 2) Find the minimal network of the crossword puzzle (Figure 2.3) when the problem is modeled as a binary set of constraints.

2. (Question 10 chapter 2) Consider the following relation ρ on variables x, y, z, t.

$$\rho(x, y, z, t) = \{(a, a, a, a)(a, b, b, b)(b, b, a, c)\}$$

   (a) Find the projection network $P(\rho)$. Is ρ representable by a network of binary constraints? Justify you answer.

   (b) Is the projection $\Pi_{xyz}\rho$ representable by a network of binary constraints?

   (c) A search space is backtrack-free along an order of its variables, d, if any partial solution along this order can be extended to a full solution. Can you find an ordering such that $P(\rho)$ is backtrack-free?

   (d) (extra credit) Is there a binary network representation of ρ that is backtrack-free in the order x, y, z, t? Is there a binary network representation of ρ that is decomposable?

3. (Question 12 chapter 2) Let $\mathcal{R}_1$ and $\mathcal{R}_2$ be two binary networks on n variables and the same domains. Prove that if $\mathcal{R}_1$ is tighter than $\mathcal{R}_2$ then the set of solutions of $\mathcal{R}_1$ are included in the set of solutions of $\mathcal{R}_2$, namely $sol(\mathcal{R}_1) \subseteq sol(\mathcal{R}_2)$.

4. (Question 13 chapter 2) Prove that for every binary network having a set of solutions ρ, $M(\rho) = P(\rho)$

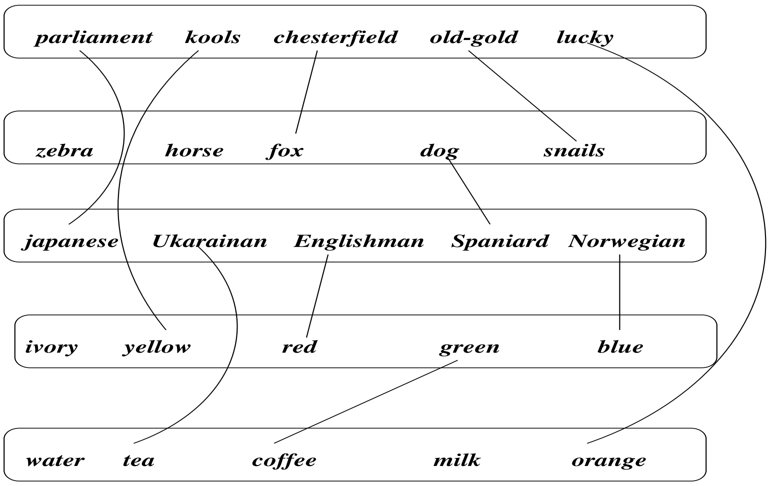
5. (extra credit) question 16 chapter 2.

6. Read chapters 3 and provide a short review answering the following questions.

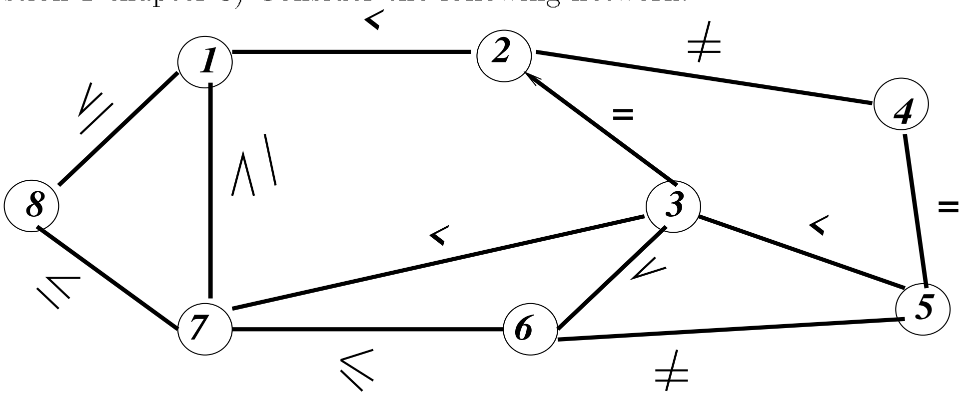
   - Is the chapter clear? readable?
   - Is the chapter technically difficlult?
   - Enough examples and illustrations?
   - Please provide an overall evaluation

7. Whenever you are asked to generate arc, path consistent network you should not only show the end-result but show also how it is derived. You can either implement one of the known algorithms hand-in your code, or hand-simulate one of the known algorithm. Stop when your simulation takes more then one page. (Question 2 chapter 3) Consider the CSP formulation of the Zebra problem Where you have 25 variables, divided into clusters and where the domains are the houses numbers (see attached figure). Is the

problem arc-consistent? If not specify an equivalent arc-consistent problem. Is the problem path-consistent?



8. (Question 1 chapter 3) Consider the following network.



Assume that each variable has a domain of $\{1, 2, 3, 4\}$. Find an equivalent arc and path-consistent network. Is the path-consistent network minimal? Is it backtrack-free?