Rina Dechter, Fall-99

ICS 275A, Assignment 2

1. Let R_{xy} and R_{yz} be two relations defined by: $R_{xy} = \{(a,b)(c,d)(d,e)\}$ and $R_{yz} = \{(b,c)(e,a)(b,d)\}$. Compute
   (a) $R_{xy} \cup R_{yz}$,
   (b) $R_{xy} - R_{yz}$, (ignore variables name for this operation)
   (c) $R_{xy} \bowtie R_{yz}$,
   (d) $\Pi_x R_{xy}$
   (e) $\sigma_{x=c}(R_{xy} \bowtie R_{yz})$,
2. Find the minimal network of the crossword puzzle (Figure 1.2) when the problem is modeled as a binary set of constraints.
3. 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?
4. Let R_1 and R_2 be two binary networks on n variables and the same domains. Prove that if R_1 is tighter than R_2 then the set of solutions of R_1 are included in the set of solutions of R_2. Formally, prove that if $R_1 \leq R_2$ then $sol(R_1) \leq sol(R_2)$. (Note, $R^1 \leq R^2$ iff for each pair of variables x_i, x_j $R^1_{ij} \subseteq R^2_{ij}$.)