CS277 – Relational Database Systems
Homework 5 (Due on Nov 17 2003)

1. Let U be a set of attributes, and let Σ, Γ be sets of functional dependencies over U. Show that:
   1. $\Sigma \subseteq \Sigma^*$
   2. $(\Sigma^*)^* = \Sigma^*$
   3. If $\Gamma \subseteq \Sigma$, then $\Gamma^* \subseteq \Sigma^*$.
2. Prove or disprove the soundness of the following rule:
   - If X→Y and YW→Z, then XW→Z
   - If X→Y and Z→Y, then XY→Z
3. Given the following relation schema R(A,B,C,D) and dependencies Σ = {A→B, BC→D, D→B, A↠D},
   - Find a smallest instance of R that satisfies the above FDs and MVDs.
   - Find a smallest instance of R that does not satisfy the MVD A↠D.
   - Let Σ' = {A→B, BC→D, D→B}. Prove that $\Sigma' \models \Sigma$ from the FD and MVD inference rules.