

CMPS277 Principles of Database Systems Fall 2007  
**Homework Assignment 3**

Due in class on November 6, 2007

1. Let  $Q$  and  $Q'$  be two conjunctive queries. Show that the problem of deciding whether there is a homomorphism (or containment mapping) from  $Q'$  onto  $Q$  is NP-complete.  
(*Hint: Show your reduction with the 3-colorability problem.*)
2. Prove or disprove the following statements:
  - (a) Let  $\Sigma = \{X \rightarrow Y, YW \rightarrow Z\}$  and let  $\sigma = XW \rightarrow Z$ . It is the case that  $\Sigma \models \sigma$ .
  - (b) Let  $\Sigma = \{X \rightarrow Y, Z \rightarrow Y\}$  and let  $\sigma = XY \rightarrow Z$ . It is the case that  $\Sigma \models \sigma$ .
3. Let  $U$  be a set of attributes, and let  $\Sigma$  and  $\Gamma$  be sets of functional dependencies over  $U$ . Prove the following statements:
  - (a)  $\Sigma \subseteq \Sigma^*$
  - (b)  $(\Sigma^*)^* = \Sigma^*$
  - (c) If  $\Gamma \subseteq \Sigma$ , then  $\Gamma^* \subseteq \Sigma^*$ .