CMPT 354
Assignment 3

Total marks: 60   2000-1
Due: March 15, 2000 by 20:30   Instructor: G. Louie

1. Relational Database Design.

   Given the relation schema R = (A, B, C, D, E, F, G, H) and the following set of functional dependencies:

   $$F = \{ \quad A \rightarrow B$$
   $$ABCD \rightarrow E$$
   $$EF \rightarrow G$$
   $$EF \rightarrow H$$
   $$ACDF \rightarrow EG \quad \}$$

   a) (4 marks) Compute the canonical cover for F. (Note: If this question looks familiar to you, you may be experiencing a case of déjà vu) Show your steps *clearly* to get full marks!

   b) (6 marks) Decompose R into 3rd Normal Form.

   c) (5 marks) Prove that your decomposition in part b) is a lossless join. Note: No marks will be given for stating that the algorithm used gives a lossless-join, dependency-preserving decomposition!

   d) (5 marks) Show that your decomposition in part b) is dependency preserving. Note that you are not asked to formally *prove* why, just to show that it is so.

2. (10 marks) Give a lossless join decomposition into Fourth Normal Form for the relation S = (F, G, H, I, J) if the following set of multivalued dependencies hold:

   $$F \twoheadrightarrow GH$$
   $$G \twoheadrightarrow HI$$
   $$J \twoheadrightarrow FI$$

3. (15 marks) Given the relation schema R = (A, B, C, D, E) and the canonical cover of its set of functional dependencies:

$$F_c = \{ \quad A \to BC$$
$$CD \to E$$
$$B \to D$$
$$E \to A \quad \}$$

Compute a lossless join decomposition in Boyce-Codd Normal Form for R. Show your steps clearly to get full marks!

4. (15 marks) Use the axioms for functional and multivalued dependencies to show the soundness of the difference rule.

If $\alpha \twoheadrightarrow \beta$ holds and $\alpha \twoheadrightarrow \gamma$ holds, then $\alpha \twoheadrightarrow \beta - \gamma$ holds and $\alpha \twoheadrightarrow \gamma - \beta$ holds.