

# Homework 3 for CSC 742: Database Management

## Collaborative Work

You may form teams of 1 - 4 members (of students in this class) to cooperate on this problem set. After discussing the problem, please write up your answers individually. Indicate the names of the other members in your team, if any.

### 1 ER to Relation Schema Mapping (30 points)

Problem 9.12 from Elmasri & Navathe.

### 2 Functional Dependency & Normalization (60 points)

Consider the attribute set  $R = ABCDEGH$  and the FD set  $F = \{AB \rightarrow C, AC \rightarrow B, AD \rightarrow E, B \rightarrow D, BC \rightarrow A, E \rightarrow G\}$ . For each of the following attribute sets, do the following:

- (i) Compute the set of dependencies that hold over the set and write down a minimal cover.
  - (ii) Name the strongest normal form that is not violated.
  - (iii) Decompose it into a collection of BCNF relations if it is not in BCNF.
- (a.) ABC; (b.) ABCD; (c.) ABCEG; (d.) DCEGH; (e.) ACEH.

## Independent Work

You must solve this problem set individually without any assistance from anyone. Mastery of the predicate calculus, and the ability to convert from English to the predicate calculus, is essential for success in this course.

### 3 Functional Dependency & Normalization

#### 3.1 (20 points)

Consider a relation  $R$  with five attributes  $ABCDE$ . You are given the following dependencies:  $A \rightarrow B$ ,  $BC \rightarrow E$ , and  $EC \rightarrow A$ .

1. List all keys for  $R$ . (10 points)
2. Is  $R$  in 3NF? Why? (5 points)
3. Is  $R$  in BCNF? Why? (5 points)

### 3.2 (20 points)

Suppose that we have the following three tuples in a legal instance of a relation schema  $S$  with three attributes  $ABC$  (listed in order):  $(1,2,3)$ ,  $(4,2,3)$ ,  $(5,3,3)$ .

1. Which of the following dependencies can you infer does *not* hold over schema  $S$ ? (15 points)  
(a)  $A \rightarrow B$ ; (b)  $BC \rightarrow A$ ; (c)  $B \rightarrow C$ .
2. Can you identify any dependencies that hold over  $S$ ? (5 points)