CSE 462 Classwork #5: Relational Design

Name: _____ Date: March 07, 2011

***** Solved in class. *****

1. Consider a relation schema $R(A,B,C,D)$ and a set of FDs $\mathcal{F} = \{A \to B, B \to A, C \to D, D \to BC\}$ that hold in R. The goal of this problem set is to analyze and decompose R into BCNF relations.

1a) Compute the following attribute set closures.

$\{A\}^+ = \{$ $\}$

$\{B\}^+ = \{$ $\}$

$\{C\}^+ = \{$ $\}$

$\{D\}^+ = \{$ $\}$

$\{A,B\}^+ = \{$ $\}$

1b) Is it necessary to compute closures of any other subset of attributes of R? Justify your answer.

1c) A set of attributes X is closed if $X^+ = X$. List the closed subsets of attributes of R.

1d) List the key(s) of R.

1e) How many superkeys does R have?

2. Consider the set of FDs $\mathcal{G} = \{A \to B, B \to A, C \to D, D \to B, D \to C\}$ equivalent to $\mathcal{F}$. We would like to know whether $\mathcal{G}$ is a minimal basis for $\mathcal{F}$, so we must test each of the properties given in the definition of minimal basis.

a) Does every FD in $\mathcal{G}$ have a single attribute on its `rhs` (simple yes/no)?

b) If any FD is removed from $\mathcal{F}$, is the resulting set still a basis (i.e., equivalent to $\mathcal{F}$)? Briefly justify.

c) Is there an FD in $\mathcal{F}$ such that, by removing one attribute from its `lhs`, $\mathcal{F}$ remains a basis? If so, show it below.

d) From the above, can you conclude that $\mathcal{G}$ is a minimal basis (simple yes/no)?

3. It is easy to see that R is not in BCNF. Justify the claim by showing some FD that is in violatation of the BCNF definition.

4. Decompose R into BCNF relations using the algorithm covered in class. Each time step 2 of the algorithm succeeds, show the FD violating BCNF and the decomposed relations R_1 and R_2. Compute the FD sets and keys for the decomposed relations in the space below the table.

	Iteration #1	**Iteration #2**	**Iteration #3**
Relation	$R(A,B,C,D)$		
FDs	$\{A \to B, B \to A, C \to D, D \to BC\}$		
Key(s)			
FD Violating BCNF			
R_1			
R_2			

Computations: