Assignment #4
Due Tuesday October 31, 5:00 PM

Problems to Work and Hand In

1. (10 pts.) Suppose we have a relation $R(A,B,C,D)$ and FD's $AB \rightarrow C$ and $BC \rightarrow D$. What are the keys for this relation? (*Hint*: notice that if an attribute does not appear on the right of any FD, it must be part of every key.) Are there any BCNF violations? If so, give a decomposition. Are the resulting relations in BCNF? Describe their keys and their FD's.

2. (10 pts.) Consider a relation $R(A,B,C,D,E)$ with FD's $A \rightarrow BD$, $B \rightarrow C$, $C \rightarrow A$, $D \rightarrow E$, and $E \rightarrow A$. This relation is actually in BCNF. What are its keys? Explain why it is in BNCF. Now, suppose we decompose R into relations with schemas $S(A,B,C)$ and $T(A,D,E)$. (Note: this decomposition preserves information, because the intersection of the attributes of S and T functionally determines at least one of S and T's sets of attributes — in this case the intersection A determines both.) The decomposition is not required but permissible. Tell what are all the nontrivial FD's for the relation S.

3. (10 pts.) Suppose we have a relation $R(A,B,C)$ and the FD $A \rightarrow B$. Some other nontrivial FD's like $CA \rightarrow B$ follow from this FD, but there are other FD's that do *not* follow from $A \rightarrow B$. To show a FD $X \rightarrow Y$ does not follow from a given set of FD's F, we only need to find one instance of the relation (i.e., a particular set of tuples for the relation) that satisfies all the FD's in F but does not satisfy $X \rightarrow Y$. Prove that $B \rightarrow A$ does not follow from $A \rightarrow B$.

4. (10 pts.) Consider relation $R(A,B,C)$ with FD's $A \rightarrow B$ and $B \rightarrow C$. List *all* the nontrivial FD's that follow from these.

5. (10 pts.) Now, find an instance of relation R from Problem 4 that satisfies the given FD's $A \rightarrow B$ and $B \rightarrow C$, all those that follow from them, *but no other FD.* (This problem requires more than average thought, but don't give up!)

6. (10 pts.) Suppose we have a relation $Emps(EID, name, child, project)$ giving employees, their ID's, their names, the names of their children and the projects they work on. $EID \rightarrow name$ is a FD that holds for this relation, and $EID \twoheadrightarrow child$ is an MVD that holds. Give three other MVD's that follow logically from this FD and MVD.

7. (10 pts.) Now, decompose the relation of Problem 6 into Fourth Normal Form.

Fourth Step of Your Personal Database Application

1. (30 pts.) This week you will "practice" loading data into the relations you created in Sybase for your PDA. For one of the relations you created in Assignment #3, create a file containing a handful of records (5 or so) in the format prescribed by Sybase. Then use the Sybase bulk-loading facilities (see Handout #11) to insert those records as tuples into your relation. Turn in a listing showing the files you created, and the successful loading of the data into Sybase.

PDA preview: For the next assignment you will write a C program to generate large files of records in the same format as the records you're hand-creating this week. If your application involves existing "real" data, next week you will write a C program to convert that data into a format that can be bulk-loaded into Sybase.