Homework Assignment 5
(due on Tuesday November 18, 2003)

• Continue reading Chapter 7 of the Database System Concepts book and also read Chapter 2.

• Exercises 7.4 (list non-trivial dependencies only), 7.7, 7.11, 7.12, 7.15 (solve the first part only),

• Let $R$ be a relation schema with attributes $A, B, C, D, E$ and let $r$ be the following instance of $R$

\[
\begin{array}{ccccccc}
 & A & B & C & D & E \\
a_1 & b_1 & c_1 & d_1 & e_1 \\
a_1 & b_2 & c_2 & d_2 & d_1 \\
a_2 & b_1 & c_3 & d_3 & e_1 \\
a_2 & b_1 & c_4 & d_3 & e_1 \\
a_3 & b_2 & c_5 & d_1 & e_1
\end{array}
\]

Consider the following functional dependencies:

\[A \rightarrow D, \ AB \rightarrow D, \ C \rightarrow BE, \ E \rightarrow A, \ B \rightarrow A.\]

Which of these dependencies does $r$ satisfy? Explain why.

• Let $R(A, B, C, D, E)$ be a relation schema with the indicated attributes and assume that the following dependencies hold: $A \rightarrow B, BC \rightarrow E, ED \rightarrow A$.

Find all candidate keys of this relational schema $R$.

• We say that two sets $F$ and $G$ of functional dependencies are equivalent if $F^+ = G^+$, i.e., if they imply exactly the same functional dependencies. Show that the sets

\[F = \{A \rightarrow B, B \rightarrow C, C \rightarrow A\}\]

and

\[G = \{A \rightarrow BC, B \rightarrow A, C \rightarrow A\}\]

are equivalent. Note: You may compute $F^+$ and $G^+$ if you want, but there are easier ways to show that $F$ and $G$ are equivalent, namely it suffices to show that $F \subseteq G^+$ and $G \subseteq F^+$ (why?)