Exercise Sheet 10: Normalization
(until Thursday 19.01.2012)

Please note that you need **50%** of all exercise points to receive the "Studienleistung". Exercises have to be turned in until **Thursday** of each respective week and must be completed in teams of two students each. You may hand in your solutions either on paper **before the lecture** or into the mailbox at the IFIS floor (Mühlenpfordtstraße 23, 2nd floor). Please do not forget your "Matrikelnummer" and your tutorial group number on your solutions. Your solutions may be in German or English. Please note: To pass the "RDB 1 Modul" you need the exercise points and the exam!

Exercise 10.1 (7 points)

Given the following relation R with the given set F of functional dependencies:

R = {A, B, C, D, E}

F = { {A} $\rightarrow$ {B, C}, {C} $\rightarrow$ {D}, {B, C} $\rightarrow$ {E}, {E} $\rightarrow$ {B, D} }

   a) What is the closure for {B, C} under F? (1 point)
   b) What properties are necessary for a set of attributes to be a candidate key for a relation? (2 points)
   c) Explain in your own words what you have to do to find all candidate keys for a set of functional dependencies! (2 points)
   d) What are the candidate keys for F? Explain your answer. (2 points)

Exercise 10.2 (4 points)

Find a minimal equivalent for the following set of functional dependencies. Explain how you derived your solution and why your solution is correct. (To simply the notation, we just write $X_1X_2...X_k$ instead of {$X_1,X_2, ... ,X_k$ }.)

$$\{A \rightarrow E, \ ADF \rightarrow BE, BCF \rightarrow C, B \rightarrow E, CE \rightarrow DF\}$$

Exercise 10.3 (10 points)

Let R(A, B, C, D, E, F, G, H, I, J) be a relation schema with the following functional dependencies.

{C $\rightarrow$ BD, E $\rightarrow$ AC, E $\rightarrow$ D, G $\rightarrow$ J, BG $\rightarrow$ F, F $\rightarrow$ H}.

Normalize R into 3NF. Explain all your steps.