

### COP4710 homework 3

Due : 11:55pm, 11/05/2009 (Thursday)

Submit via Blackboard. Attention: always justify your answers step by step for partial credits.

I. Prove the following inference rules for functional dependencies. A proof can be made by using the six inference rules discussed in class.

(a)  $\{W \rightarrow Y, X \rightarrow Z\} \models \{WX \rightarrow Y\}$

(b)  $\{X \rightarrow Y\}$  and  $Z$  is a subset of  $Y \models \{X \rightarrow Z\}$

(c)  $\{X \rightarrow Y, X \rightarrow W, WY \rightarrow Z\} \models \{X \rightarrow Z\}$

(d)  $\{X \rightarrow Y, XY \rightarrow Z\} \models \{X \rightarrow Z\}$

II. Given a relation  $R(A, B, C, D, E, F, G)$  and the following FDs:

$$A \rightarrow B$$

$$BC \rightarrow DE$$

$$AEF \rightarrow G$$

Compute the closure  $\{AC\}^+$  and find the candidate keys of  $R$  (if there is any).

III. Consider the relation  $R = \{A, B, C, D, E, F, G, H, I, J\}$  and the set of functional dependencies  $F = \{ \{A, B\} \rightarrow \{C\}, \{A\} \rightarrow \{D, E\}, \{B\} \rightarrow \{F\}, \{F\} \rightarrow \{G, H\}, \{D\} \rightarrow \{I, J\} \}$ . What is the key for  $R$ ? What normal form is  $R$  in?

IV. Consider the following relation:

$R$  (Doctor#, Patient#, Date, Diagnosis, Treat\_code, Charge)

In this relation, a tuple describes a visit of a patient to a doctor along with a treatment code and daily charge. Assume that diagnosis is determined (uniquely) for each patient by a doctor. Assume that each treatment code has a fixed charge (regardless of patient). Is this relation in 2NF? If yes, is this relation also in 3NF? Justify your answer.