

2011 Paper 4 Question 5

Databases

The lecture notes defined 2nd Normal Form (2NF) as follows. A relational schema R is in 2NF if for every functional dependency $\mathbf{X} \rightarrow A$ either

- $A \in \mathbf{X}$, or
 - \mathbf{X} is a superkey for R , or
 - A is a member of some key, or
 - \mathbf{X} is not a proper subset of any key.
- (a) Present a relational scheme with functional dependencies that is not in 2NF and explain why 2NF is violated. [3 marks]
- (b) Describe an *update anomaly* that could be experienced in a DBMS implementing your schema. [3 marks]
- (c) Decompose your schema into smaller relations that are in 2NF. Justify your answer. [3 marks]
- (d) Is every 2NF schema free from update anomalies? Explain. [3 marks]
- (e) Let us define **Paper 4 Question 5 Normal Form (P4Q5NF)** as follows. A relational schema $R(\mathbf{X})$ with functional dependencies F is in P4Q5NF if for every attribute $A \in \mathbf{X}$ and every key $\mathbf{Y} \subseteq \mathbf{X}$, if $\mathbf{Y} \rightarrow A \in F^+$, then A is prime.

Either prove that P4Q5NF is logically equivalent to 2NF, or provide an example showing that this is not the case. [8 marks]