

2010 Paper 4 Question 5

Databases

(a) Suppose that $R(A, B, C)$ is a relational schema with functional dependencies $F = \{A, B \rightarrow C, C \rightarrow B\}$.

(i) Is this schema in 3NF? Explain. [2 marks]

(ii) Is this schema in BCNF? Explain. [2 marks]

(b) Decomposition plays an important role in database design.

(i) Define what is meant by a *lossless-join decomposition*. [2 marks]

(ii) Define what is meant by a *dependency preserving decomposition*. [2 marks]

(c) Let $R(A, B, C, D, E)$ be a relational schema with the following functional dependencies

$$\begin{aligned}A, B &\rightarrow C \\D, E &\rightarrow C \\B &\rightarrow D\end{aligned}$$

(i) What is the closure of $\{A, B\}$? [2 marks]

(ii) What is the closure of $\{B, E\}$? [2 marks]

(iii) Decompose the schema to BCNF in **two** different ways. In each case, are all dependencies preserved? Explain. [4 + 4 marks]