2009 Paper 4 Question 8

Databases

(*a*) Define the concept of a *functional dependency*.   [2 marks]

(*b*) Let $R(A,\ B,\ C,\ D,\ E,\ F)$ be a database schema with functional dependencies

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

   (*i*)   Compute the closure of $\{A,\ B\}$.   [3 marks]

   (*ii*) Is $A, B \rightarrow D, F$ a functional dependency over R? Justify your answer.
   [1 mark]

(*c*) Define the concept of a *multivalued dependency*.   [2 marks]

(*d*) Suppose the functional dependency $X \rightarrow Y$ holds on a relational schema. Does this mean that the multivalued dependency $X \twoheadrightarrow Y$ holds? Justify your answer.   [3 marks]

(*e*) Define the concept of a *lossless-join decomposition*.   [3 marks]

(*f*) Let $R(X)$ be a database schema, where X is a set of attributes. Show that $S(Y \cup Z)$ and $T(Y \cup (X - Z))$ is a lossless-join decomposition of $R(X)$ if and only if the multivalued dependency $Y \twoheadrightarrow Z$ holds over R.   [6 marks]