COMPUTER SCIENCE TRIPOS Part IB – 2016 – Paper 4

5   Databases (TGG)

(*a*) Define the concept of a *functional dependency*.   [3 marks]

(*b*) Suppose that relation R has m attributes. Give an upper bound on the number of functional dependencies that R could satisfy (including trivial dependencies).   [3 marks]

(*c*) Let $R(A, B, C, D, E)$ be a relational scheme with the following dependencies.

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

Which, if any, of these dependencies are redundant?   [4 marks]

(*d*) Suppose $R(A,\ B,\ C)$ is a relational schema with functional dependency $A \rightarrow B$. What can you deduce about the results of $\pi_{A,B}(R) \bowtie_A \pi_{A,C}(R)$? Justify your answer.   [3 marks]

(*e*) Suppose $R(A,\ B,\ C)$ is a relational schema. In addition, you know that the following is always true in any correct database instance.

$$
R = \pi_{A,B}(R) \bowtie_A \pi_{A,C}(R).
$$

What can you deduce about the dependencies between attributes A, B, and C? Prove any of your claims.   [7 marks]

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