COMPUTER SCIENCE TRIPOS Part IB – 2015 – Paper 4

5 Databases (TGG)

(a) The relational schema $R(A, B, C, D, E)$ has the following functional dependencies.

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

Decompose this into a set of relations in BCNF. Show your working. [5 marks]

(b) By inspecting your answer to (a), describe a possible interpretation in the language of Entity-Relationship modelling. [5 marks]

(c) Heath's Rule tells us that if $R(A, B, C)$ is a relational schema with functional dependency $A \to B$, then

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

This rule is often applied in the relational decomposition process that seeks to arrive at relations in a particular normal form. For example, we might decompose R into two implemented relations $R_1(A, B)$ and $R_2(A, C)$. Some people have been very critical of this approach since it ignores the fact that the implementation of such a decomposition is normally associated with *foreign key constraints* between tables.

What is missing? Can you express, in the relational algebra, what such a missing constraint might look like for the decomposition described above using Heath's rule? Justify your answer. [5 marks]

(d) Using your answer to (c), discuss which constraints might be missing from your decomposition in question (a). [5 marks]