2007 Paper 5 Question 8

Databases

(*a*) The Entity/Relationship model is based around the concepts of *entity*, *attribute*, and *relationship*. Describe how these can be represented in the relational model. [6 marks]

(*b*) Data normalisation is often an important component in database design. Discuss why this is so, and give examples of situations where normalisation is *not* important. [6 marks]

(*c*) Let A and B be disjoint non-empty sets of attributes. Let R be a relation over attributes $A \cup B$ and let S be a relation over attributes B.

Suppose that we want to introduce a new relational operation called *division*, denoted $R \div S$, that will return a relation over attributes A. The relation $R \div S$ is made up of all tuples t such that for all $s \in S$ we have $ts \in R$ (ts is the concatenation of t and s).

Note that in the special case that $R = T \times S$ for some relation T, then $(R \div S) = T$ and $(R \div T) = S$.

In other words, $\div$ can be treated as an inverse to the Cartesian product.

Can we define $R \div S$ in the relational algebra? Prove that your answer is correct. [8 marks]