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 $R ÷ S$, that will return a relation over attributes $A$. The relation $R ÷ S$ 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 $(R ÷ S) = T$ and $(R ÷ T) = S$.

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

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