2005 Paper 12 Question 8

Databases

(*a*) Define the core operators of the relational algebra. [5 marks]

(*b*) Describe *two* differences and *two* similarities between the relational algebra and SQL. [4 marks]

(*c*) Suppose that $S(a,\ b,\ \ldots)$ and $R(a,\ \ldots)$ are relations (the notation indicates that attribute a is in the schema of both S and R, while attribute b is only in the schema of S). Suppose that v is a value; is the following equation always valid?

$$\sigma_{(a=v \text{ or } b=v)}(R \bowtie S) = (\sigma_{a=v}(R)) \bowtie (\sigma_{b=v}(S))$$

If yes, provide a short proof. If no, provide a counter-example. [2 marks]

(*d*) Various *normal forms* are important in relational schema design.

    (*i*) Define Third Normal Form (3NF). [3 marks]

    (*ii*) Define Boyce-Codd Normal Form (BCNF). [3 marks]

    (*iii*) For databases with many concurrent update transactions, explain why schemas in normal form are important for good performance. [3 marks]