

2006 Paper 12 Question 8

Databases

- (a) Define Boyce–Codd normal form. [3 marks]
- (b) Suppose that a relation R has n attributes. How many distinct functional dependencies could be defined for R ? [3 marks]
- (c) The *union rule for functional dependencies* states that if $F \models X \rightarrow Y$ and $F \models X \rightarrow Z$, then $F \models X \rightarrow Y \cup Z$ (this can also be written as $F \models X \rightarrow Y, Z$).

Prove this rule using only Armstrong's axioms. [5 marks]

- (d) *Heath's Theorem* states that if $R(A, B, C)$ satisfies the functional dependency $A \rightarrow B$, where A , B , and C are disjoint non-empty sets of attributes, then

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

where \bowtie_A is the equi-join on the attributes of A . Prove this theorem.

[9 marks]