

Database Management System

Qualification Exam

Spring 2003 – 1 hour

Question 1. (30) Suppose that we would like to develop a database about genealogy. We would like to keep information about a `Person`, her/his name (as the only attribute) and the following relationships: `mother`, `father`, and `children`.

1. Give a class definition for the class `Person`.
2. Create an ER diagram representing the `Person` entity.

Question 2. (25) Given a relation $R(A,B,C,D,E)$ with the following functional dependencies: $AB \rightarrow E$, $AC \rightarrow D$, $BC \rightarrow D$, $D \rightarrow A$, and $E \rightarrow B$. What are the nontrivial functional dependencies of the relation $S(A,B,C)$ that is obtained from R by projecting out the two attributes D and E .

Question 3. (25) Consider the relation $R(A,B,C,D)$ with the functional dependencies $AB \rightarrow C$, $BC \rightarrow D$, $CD \rightarrow A$, and $AD \rightarrow B$. Is it possible to add one more functional dependency such that every subset of $\{A,B,C,D\}$ that contains two attributes is a key of R ? Justify your answer.

Question 4. (20) Consider the Datalog program

$$\begin{aligned} p(x,y) &\leftarrow q(x,z), r(z,y), \text{ not } q(x,y). \\ p(x,y) &\leftarrow q(x,y). \end{aligned}$$

The external database predicates q and r are given by the following atoms:

$$\begin{aligned} q(1,2). \\ q(1,3). \\ r(2,3). \\ r(3,1). \end{aligned}$$

Compute the intentional database predicate p . (Compute the value $p(x,y)$ for every possible assignment of x and y , for example $p(1,1)$, $p(2,1)$, etc.)