**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 → E, AC → D, BC → D, D → A, and E → 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 → C, BC → D, CD → A, and AD → 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

\[
p(x,y) \leftarrow q(x,z), r(z,y), \text{not } q(x,y).
\]
\[
p(x,y) \leftarrow q(x,y).
\]

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

q(1,2).
q(1,3).
r(2,3).
r(3,1).

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.)