7.1 Datalog

Given the following recursive Datalog query:

\[
\text{fp}(x, y) :- e(x, y).
\]
\[
\text{fp}(x, y) :- e(y, x), \text{fp}(x, z).
\]

Find a non recursive Datalog program and an expression of the relational algebra which calculate the same result set.

7.2 Datalog Programming

Given the following database containing fact sets for following predicates.

- **Male(X):** Person X is male
- **Female(X):** Person X is female
- **Married(X, Y):** Person X and Y are married
- **Child(X, Y):** Person X is a child of person Y
- **Lives(X):** Person X has not died so far

Please formulate Datalog rules for following connections:

- a) Daughter
- b) Brother
- c) Niece
- d) Only child
- e) Brother-in-law
- f) Widow
- g) Grandchild
- h) Male Ancestor
- i) Orphan

7.3 Datalog & Fixpoints

Consider a tennis tournament database with information about players with predicates

- **beats(X1, X2):** X1 beats X2
- **superior(X1, X2):** X1 is superior to X2.

Assume that if a player beats another player he is superior to that player and assume that if player 1 beats player 2 and player 2 is superior to player 3 then player 1 is superior to player 3.

a) Construct a set of recursive rules using the above predicates
b) Populate data for beats relation with 10 players playing 3 matches each.
c) Show the computation of the minimal Herbrand Model (computing the least fixpoint of the consequence operator $T_D$) using this data.
d) Does the computation of the superior table have a fixpoint? Why or why not? Is this always the case? Explain!