Database Theory

Assume a database with one relation parent consisting of pairs \((a, b)\) where \(a\) is a parent of \(b\).

\(a\) Write a Datalog query which gives the set of pairs \((x, y)\) such that \(x\) and \(y\) have a common ancestor \(z\) and are the same number of generations from \(z\). [4 marks]

\(b\) Write a query in Datalog with stratified negation which gives the set of pairs \((x, y)\) such that \(x\) and \(y\) have a common ancestor but not one from which they are the same number of generations distant. You may use the program you defined for part \((a)\). [5 marks]

\(c\) Prove that the query defined in part \((b)\) above cannot be expressed in Datalog without negation. [7 marks]

\(d\) For each of queries in parts \((a)\) and \((b)\), give a bound on the running time to evaluate the query on a database with \(n\) entries. [4 marks]