

Exercise Sheet 9: Semi-Positive Datalog

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Exercise 9.1. Show that any Datalog program can be expressed as a safe Datalog program that is polynomial in size of the original program and given schema.

Exercise 9.2. Assume that the database uses a binary EDB predicate *edge* to store a directed graph. Try to express the following properties in semi-positive Datalog programs with a successor ordering, or explain why this is not possible.

1. The database contains an even number of elements.
2. The graph contains a node with two outgoing edges.
3. The graph is 3-colourable.

Exercise 9.3. A Horn logic program is in *propHorn2* if every rule it contains is of the form $H \leftarrow$ or $H \leftarrow B_1 \wedge B_2$.

It was claimed that entailment checking in *propHorn2* is P-hard. To support this claim, explain how entailment in propositional Horn logic can be reduced to entailment in *propHorn2*. Argue how this reduction can be accomplished in logarithmic space.

Exercise 9.4. Sketch a proof for showing that entailment checking in propositional Horn logic is P-hard. For this, answering the following questions can be helpful:

1. What is the general proof idea?
2. What role does the grounding of a Datalog program play here?
3. What ingredients would you need to build the configuration grid?