Containment of tree patterns with restricted forms of negation

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Tree Pattern (TP) is a simple downward fragment of XPath [3]. The main axes that were considered for TP are child (/), descendant (//), filter expressions ([..]) and wildcard ($\star$). That is, a TP expression can be defined by the following grammar.

$$q \quad ::= \quad n \mid * \mid . \mid q/q \mid q//q \mid q[q].$$

By $\mathsf{TP}(S)$ we denote tree patterns using the axes from S. It is known that the containment problem in $\mathsf{TP}(/, //, [..]), \mathsf{TP}(/, //, \star)$ and $\mathsf{TP}(/, \star, [..])$ is in PTime [3]. The complexity of containment rises to the next level when all the axes are used, that is it becomes coNP-complete in $\mathsf{TP}(/, //, [..], \star)$ [1]. In [2] it was shown that adding disjunction does not alter the coNP complexity for containment.

In this talk we consider the containment problem for TP over multi-labeled trees in the presence of various restricted forms of negation. All have the form of binary complementation. The weakest negation we consider, guarded propositional negation, is of the form $p\complement q$, for p, q propositional variables, denoted as $\neg^{pgn}$. Propositional negation is of the form $*\complement q$, for p, q propositional variables, and is denoted by $\neg^{pn}$. Then we have two forms of guarded local rules: $p\complement\langle\downarrow\rangle(q\complement\varphi)$ for φ a TP. In XPath notation, this would be written as $.[p][not(./q[not(\varphi)])]$ $(.[p][not(.//q[not(\varphi)])])$, and holds at p-nodes whose q-children (descendants) are also φ nodes. To emphasize the rule like nature of these formulas we denote them as $p \wedge \Box(q \to \varphi)$ and $p \wedge \Box^+(q \to \varphi)$. We denote this fragment as lr (local rules). Our results for the containment problem as well as the previously known results can be summarized in the following table. All the bounds are tight and filter expression [..] is used in all the fragments.

	$/, //$	$/, //, \star$
no negation	PTime [3]	coNP [1]
$\neg^{pgn}$	PTime	coNP
$\neg^{p}$	PSpace	PSpace
$\neg^{pgn}, lr$	ExpTime	ExpTime

References

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