Third exercise sheet for the lecture

# XML and Programming Languages

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**Exercise 11**
Prove the following CoreXPath equivalences:

1. $\mathsf{descendant}::t_1[q_1]/\mathsf{parent}::t_2[q_2] \equiv \mathsf{descendant\text{-}or\text{-}self}::t_2[q_2 \wedge t_1[q_1]]$
2. $t_1[q_1 \wedge (\mathsf{parent}::t_2[q_2])] \equiv \mathsf{self}::t_2[q_2]/t_1[q_1]$ ◇

**Exercise 12**
Provide a rule for eliminating the reverse axis step in a situation as follows:

$$\mathsf{descendant}::t_1[q_1]/\mathsf{preceding\text{-}sibling}::t_2[q_2]\,.$$ ◇

**Exercise 13**
Provide a general rule that could eliminate the reverse axis step in the Core-XPath expression "$/a/b/..$". ◇

**Exercise 14**
Provide a rule for dealing with an interaction of $\mathsf{following}$ with, i.e. followed by, $\mathsf{parent}$. ◇

**Exercise 15**
Check query containment for each combination of the following CoreXPath expressions: $a/b/c$, $a/b[c]/*$, $a/b[*]/c$, $a/*/c$, and $*/b/c$. ◇

**Exercise 16**
Find a minimal, equivalent Simple CoreXPath expression for $r[(a[b]/c) \wedge d]/d$. What further simlification would be possible if we knew that all inputs satisfy the DTD $(r, \{r \to a^*de,\ a \to (b|f|\epsilon)c,\ b \to c|\epsilon,\ c \to d,\ d \to \epsilon\})$? ◇

**Exercise 17**
Consider the CoreXPath filter expression $q = \mathsf{child}::\sigma/\mathsf{descendant}::*[\mathsf{child}::\delta]$. Give an equivalent formula $\phi(x)$ in first-order logic using only two variables. ◇