

Figure 1: timing-pattern

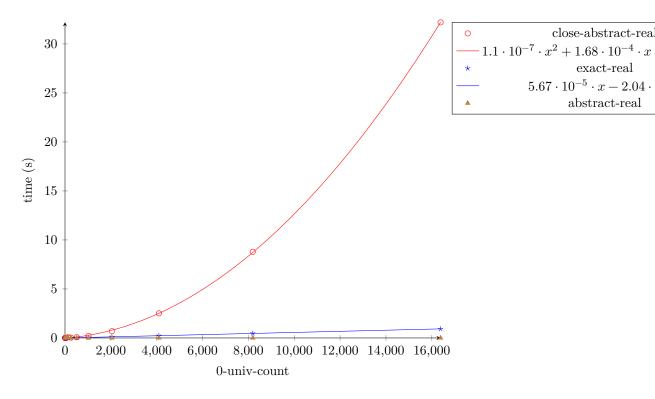
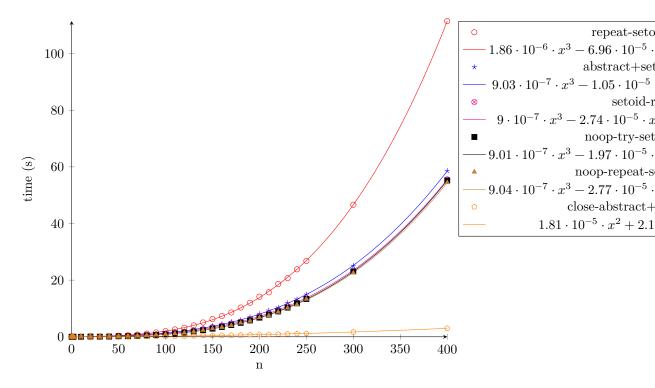


Figure 2: timing-n-polymorphic-universes param-1-n 0



 $Figure \ 3: \ timing-repeat-setoid-rewrite-under-binders$

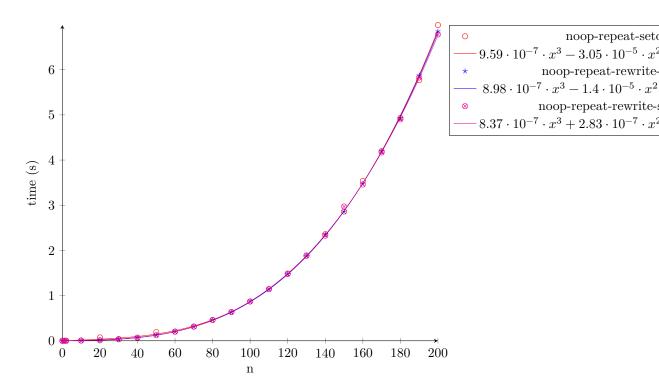
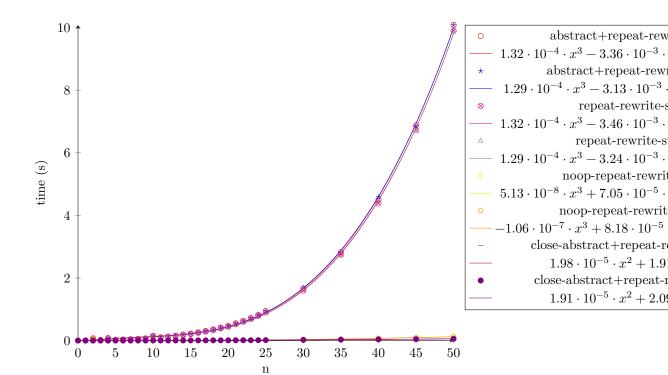
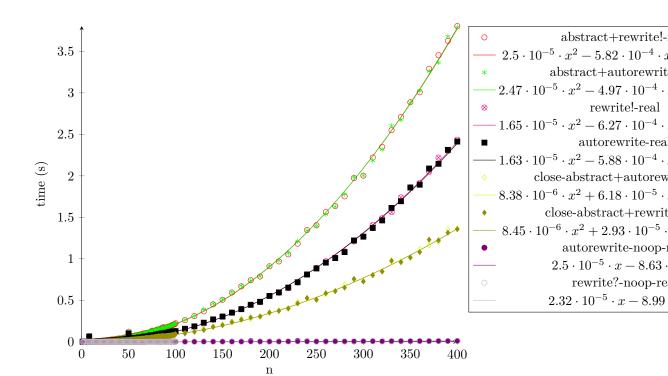


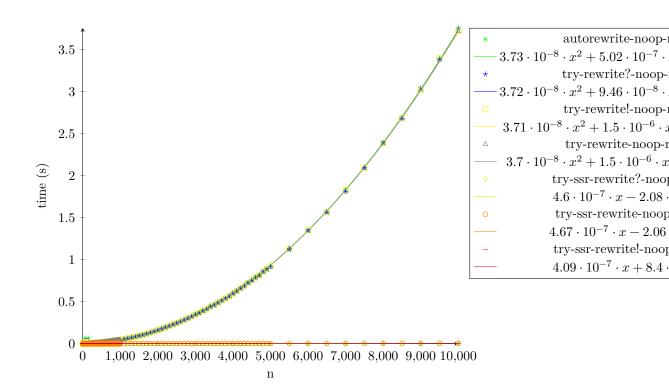
Figure 4: timing-repeat-setoid-rewrite-under-binders-noop



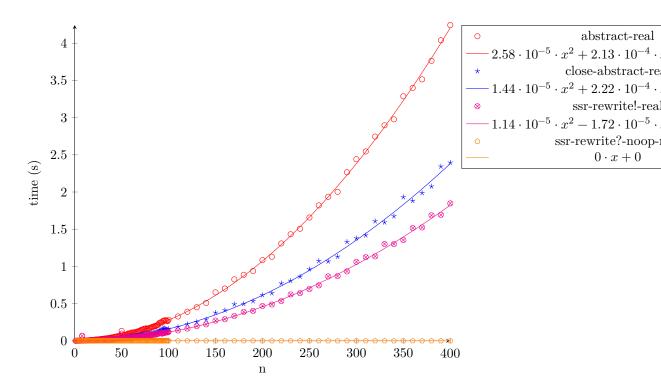
 $Figure\ 5:\ timing-rewrite-strat-under-binders$



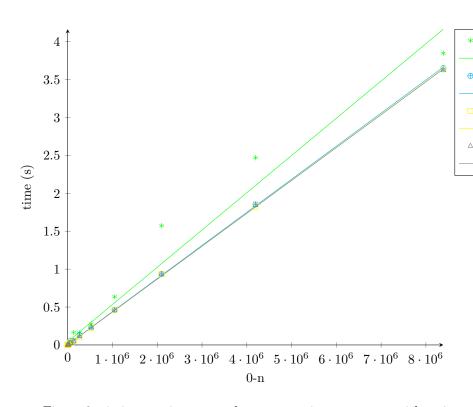
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$



 $Figure~7:~timing\mbox{-rewrite-repeated-app-autorewrite-noop}$



 $Figure \ 8: \ timing-rewrite-repeated-app-ssrrewrite \\$



try-ssr-rewrite!-cold-noop-rea

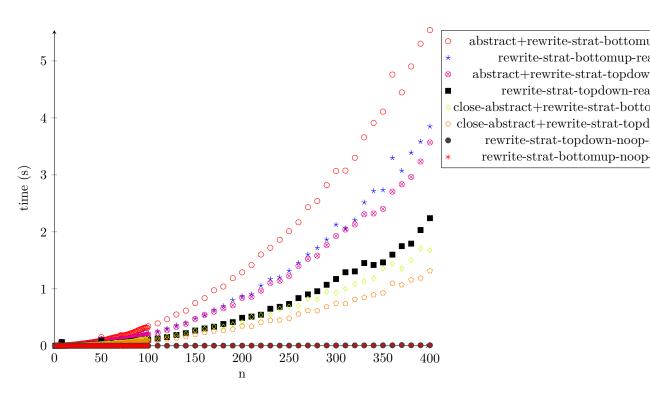
 $\begin{array}{l} 4.91 \cdot 10^{-7} \cdot x + 4.24 \cdot 10^{-2} \\ \text{try-ssr-rewrite!-noop-real} \end{array}$

 $\begin{array}{l} 4.37\cdot 10^{-7}\cdot x + 3.47\cdot 10^{-3}\\ \text{try-ssr-rewrite?-noop-real} \end{array}$

 $\begin{array}{l} 4.34\cdot 10^{-7}\cdot x + 3.54\cdot 10^{-4}\\ \text{try-ssr-rewrite-noop-real} \end{array}$

 $4.34\cdot 10^{-7}\cdot x + 1.36\cdot 10^{-3}$

Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn $\ 1$

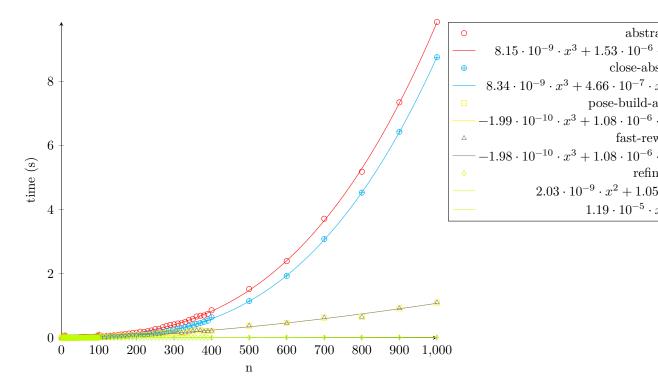


rewrite-strat-bottomup-real

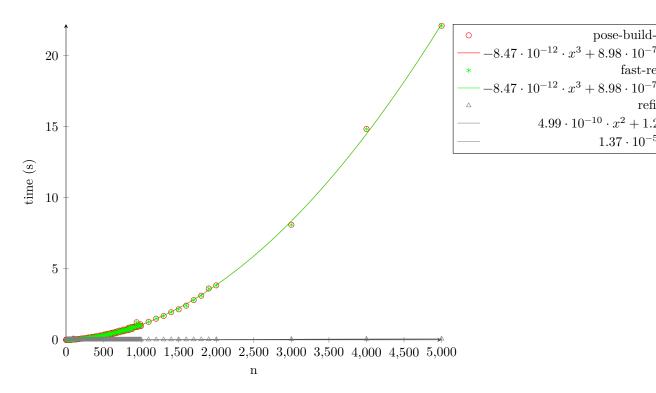
abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

rewrite-strat-topdown-nooprewrite-strat-bottomup-noop-

 $Figure~10:~timing\mbox{-rewrite-repeated-app-rewrite-strat}$



 $Figure~11:~timing\mbox{-rewrite-repeated-app-fast-rewrite}$



 ${\bf Figure~12:~timing\text{-}rewrite\text{-}repeated\text{-}app\text{-}fast\text{-}rewrite\text{-}no\text{-}abstract}}$

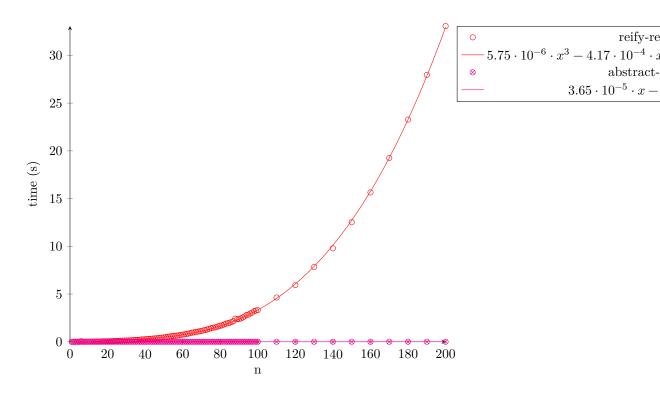
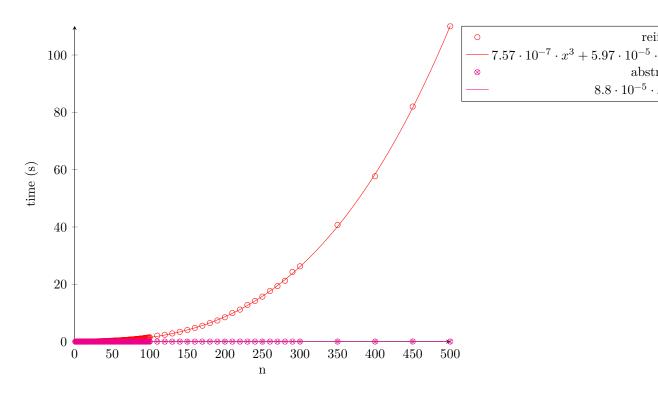
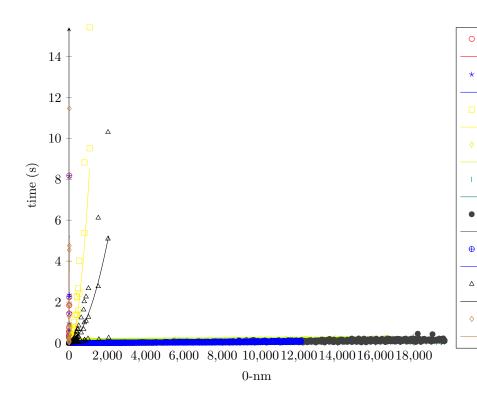


Figure 13: timing-typeclass-reification-let-in-HOAS



 ${\bf Figure~14:~timing-type class-reification-let-in-PHOAS}$



rewrite-strat(bottomup-bot $2.6 \cdot 10^{-3} exp(0.5 \cdot (0.5))$

rewrite-strat(topdown-bot) $5.5 \cdot 10^{-3} \exp{(0.46 \cdot (0.46 \cdot ($

 $7.46\cdot 10^{-6}\cdot x^2 - 1.18\cdot 10^{-4}\cdot x^2 + 1.18\cdot 1$

 $1.07 \cdot 10^{-10} \cdot x^2 + 5.03 \cdot 10^{-6} \cdot$

 $1.04 \cdot 10^{-10} \cdot x^2 + 3.61 \cdot 10^{-6} \cdot$

 $2.12 \cdot 10^{-10} \cdot x^2 + 4.66 \cdot 10^{-6}$

 $1.4 \cdot 10^{-10} \cdot x^2 + 5 \cdot 10^{-6} \cdot x$

 $1.04 \cdot 10^{-6} \cdot x^2 + 3.78 \cdot 10^{-4} \cdot x^2$

 $-6.68 \cdot 10^{-3} \cdot x^3 + 0.21 \cdot x^2 -$

cps+cbn-real

cps+cbv-real

cps+lazy-real

cps+simpl-real

setoid-rewrite-re

cps+vm-compute-

cps+native-compute

Figure 15: timing-rewrite-lift-lets-map param-1-n 1, param-2-m 1

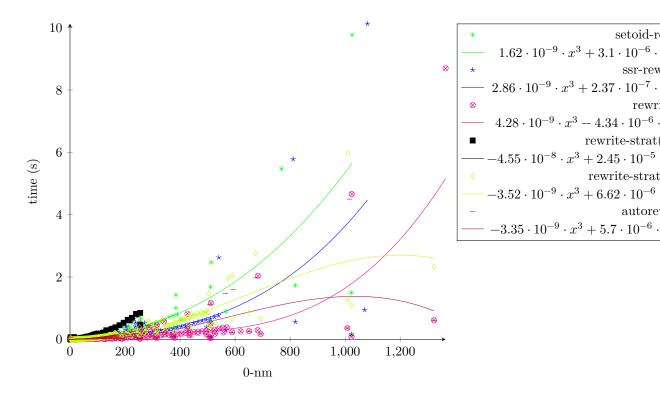
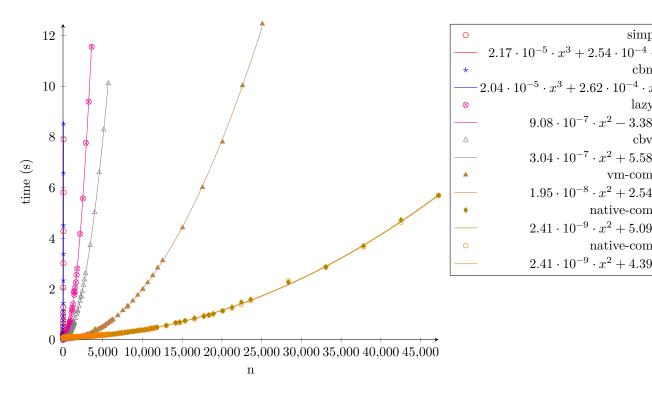


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $2.17 \cdot 10^{-5} \cdot x^3 + 2.54 \cdot 10^{-4}$

 $9.08 \cdot 10^{-7} \cdot x^2 - 3.38$

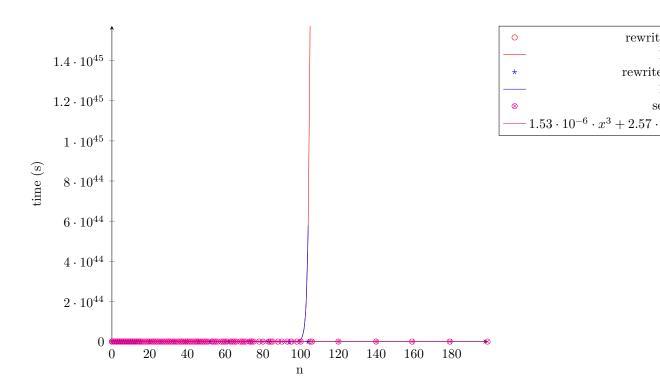
 $3.04 \cdot 10^{-7} \cdot x^2 + 5.58$

 $1.95 \cdot 10^{-8} \cdot x^2 + 2.54$

 $2.41 \cdot 10^{-9} \cdot x^2 + 5.09$

 $2.41 \cdot 10^{-9} \cdot x^2 + 4.39$

Figure 17: timing-sieve-of-eratosthenes



rewrite

Figure 18: timing-rewrite-under-lets-plus-0 $\,$