

Figure 1: timing-pattern

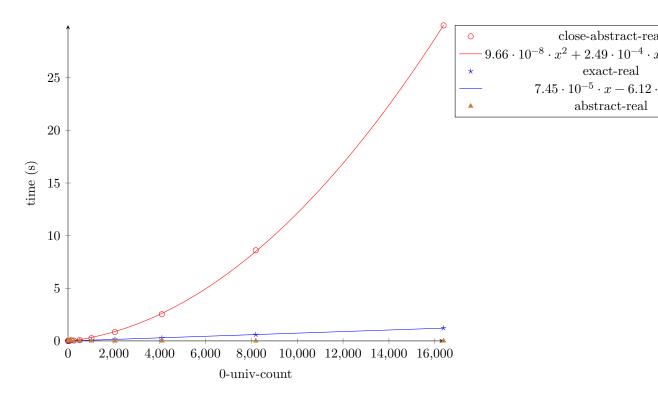
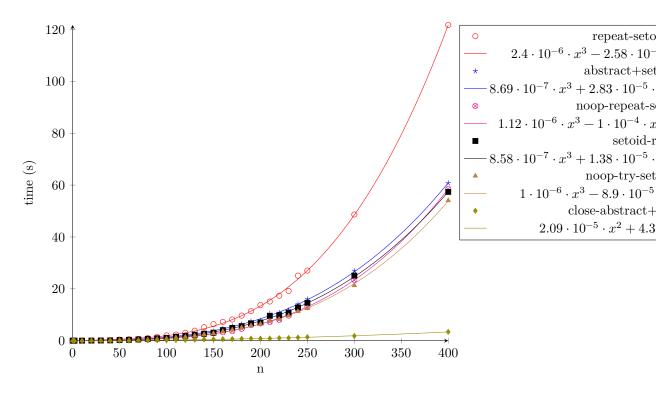


Figure 2: timing-n-polymorphic-universes param-1-n 0



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

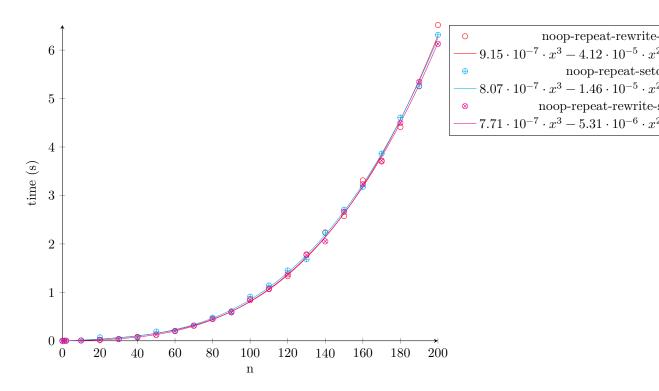
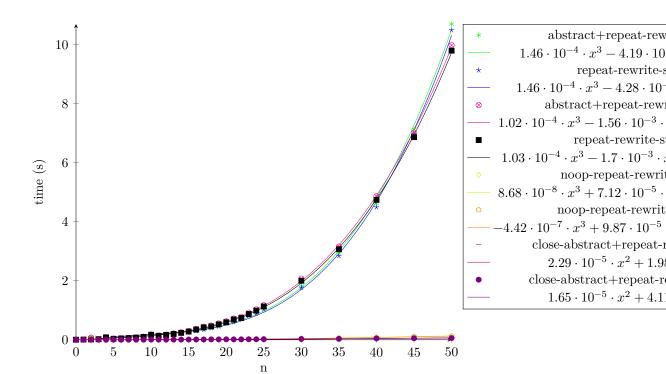
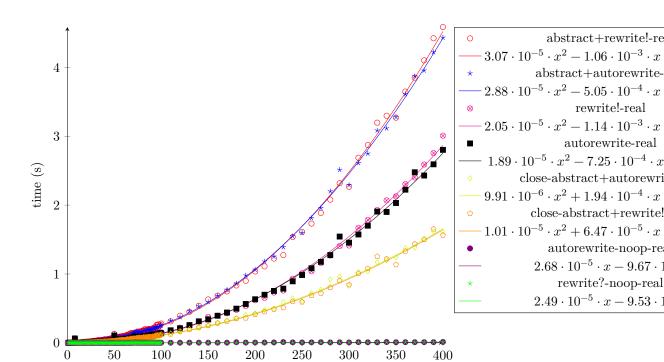


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

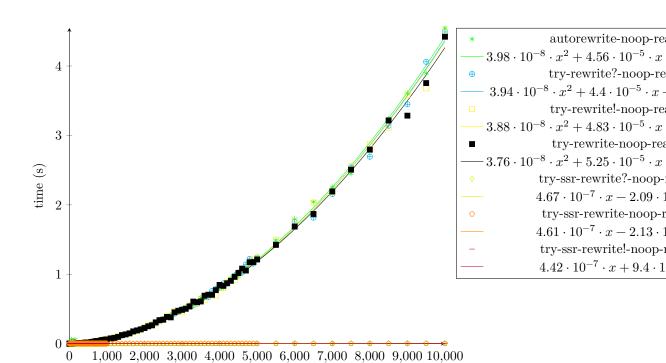


 $Figure\ 5:\ timing-rewrite-strat-under-binders$



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

n



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

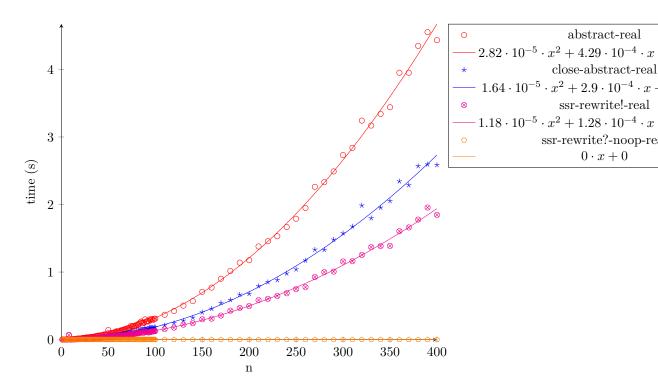
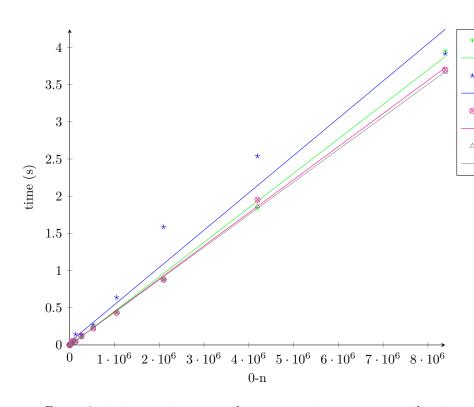


Figure 8: timing-rewrite-repeated-app-ssrrewrite



try-ssr-rewrite-noop-real

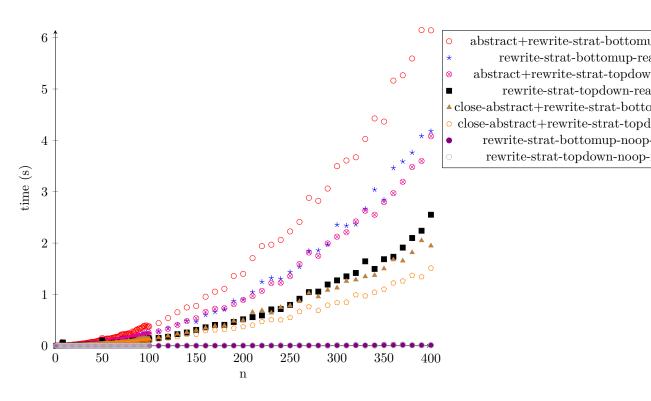
 $4.63\cdot 10^{-7}\cdot x - 9.89\cdot 10^{-3}$ try-ssr-rewrite!-cold-noop-rea

 $5.01 \cdot 10^{-7} \cdot x + 4.02 \cdot 10^{-2}$ try-ssr-rewrite!-noop-real

 $\begin{array}{l} 4.45\cdot 10^{-7}\cdot x - 1.1\cdot 10^{-3} \\ \text{try-ssr-rewrite?-noop-real} \end{array}$

 $4.38\cdot 10^{-7}\cdot x - 1.6\cdot 10^{-3}$

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



rewrite-strat-bottomup-rea

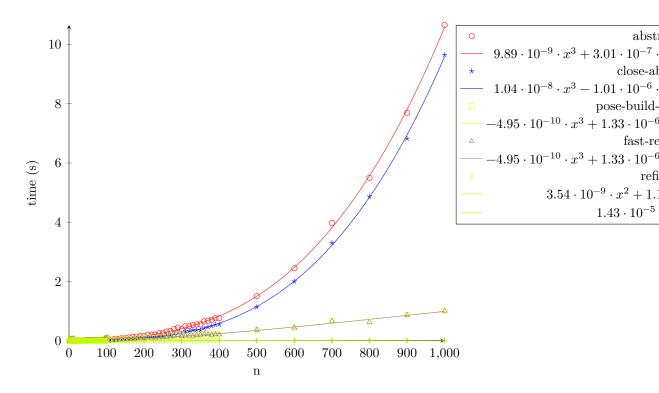
rewrite-strat-topdown-rea

abstract + rewrite - strat - topdow

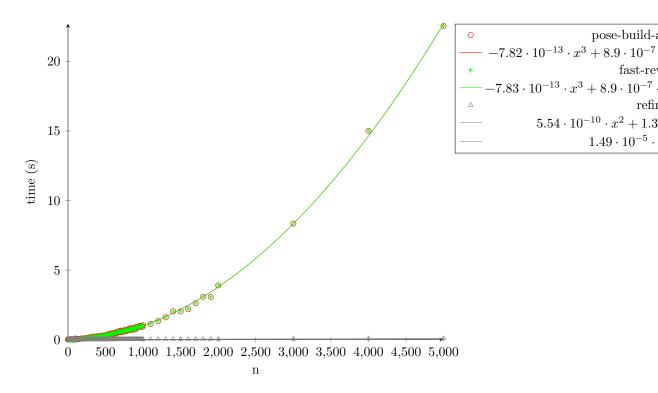
rewrite-strat-bottomup-noop-

rewrite-strat-topdown-noop-

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



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



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

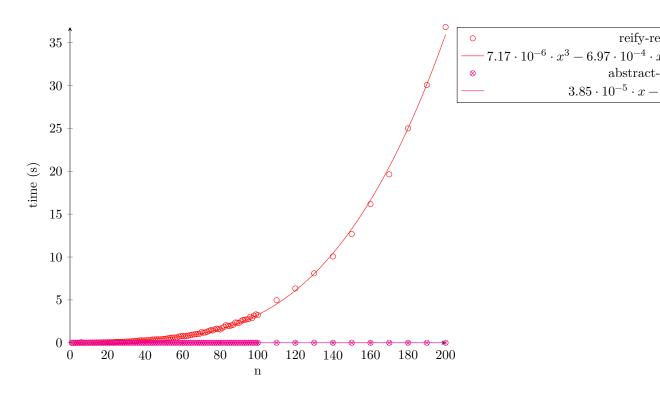


Figure 13: timing-typeclass-reification-let-in-HOAS

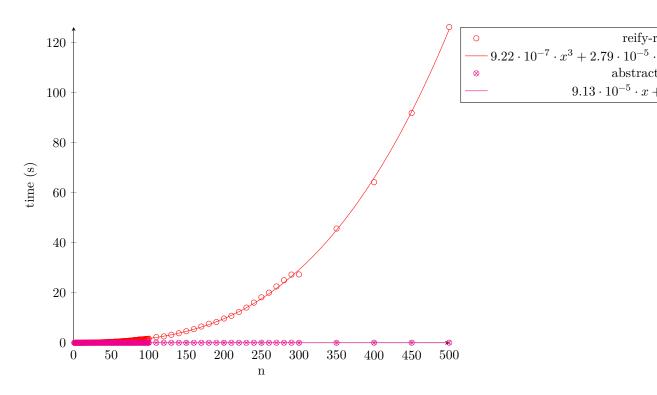
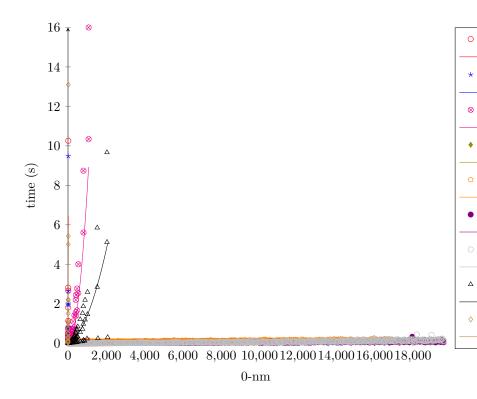


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(topdown-bot) $7.19 \cdot 10^{-3} exp(0.45 \cdot ($

rewrite-strat(bottomup-bot $7.57 \cdot 10^{-3} exp(0.44 \cdot ($

 $7.96 \cdot 10^{-6} \cdot x^2 - 2.98 \cdot 10^{-4} \cdot x^2 = 2.98 \cdot 10^{-4} \cdot x^2$

 $9.1 \cdot 10^{-11} \cdot x^2 + 4.92 \cdot 10^{-6} \cdot x^2$

 $4.91 \cdot 10^{-11} \cdot x^2 + 5.59 \cdot 10^{-6} \cdot$

 $1.19 \cdot 10^{-10} \cdot x^2 + 3.23 \cdot 10^{-6} \cdot$

 $2.34 \cdot 10^{-10} \cdot x^2 + 3.92 \cdot 10^{-6} \cdot$

 $9.71 \cdot 10^{-7} \cdot x^2 + 4.46 \cdot 10^{-4}$

 $-7.5 \cdot 10^{-3} \cdot x^3 + 0.24 \cdot x^2 - \\$

cps+cbn-real

 $_{\rm cps+cbv\text{-}real}$

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 $\,$

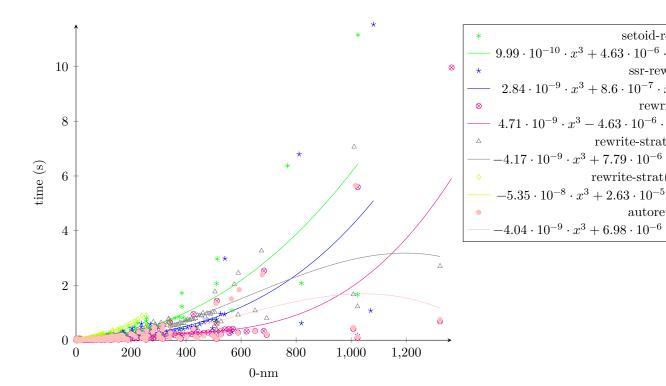
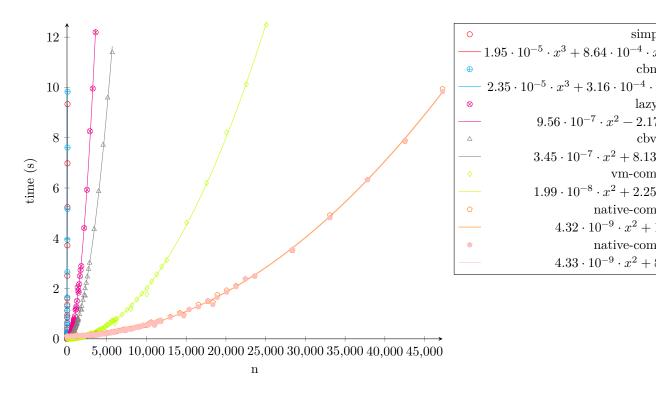


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com $4.32 \cdot 10^{-9} \cdot x^2 + 1$

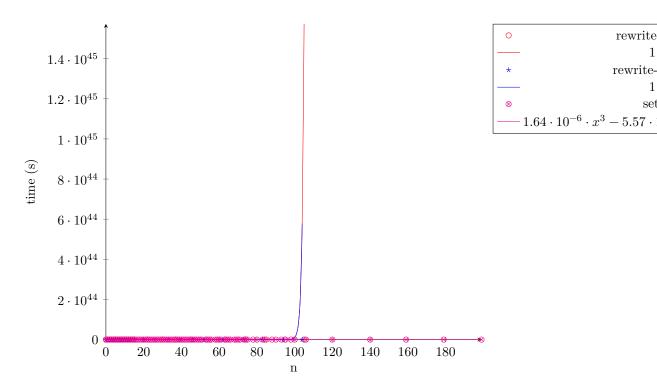
native-com $4.33 \cdot 10^{-9} \cdot x^2 + 8$

 $9.56 \cdot 10^{-7} \cdot x^2 - 2.17$

 $3.45 \cdot 10^{-7} \cdot x^2 + 8.13$

 $1.99 \cdot 10^{-8} \cdot x^2 + 2.25$

 $Figure\ 17:\ timing\mbox{-sieve-of-eratos} thenes$



rewrite

rewrite-

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