

Figure 1: timing-pattern

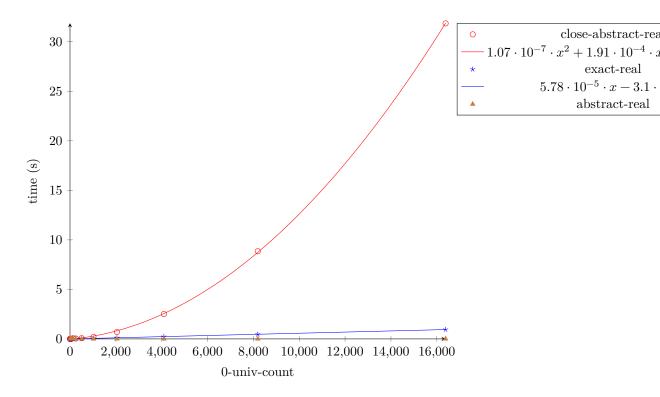
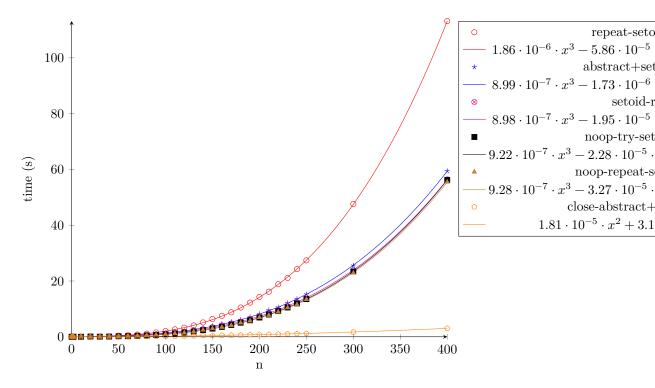


Figure 2: timing-n-polymorphic-universes param-1-n 0



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

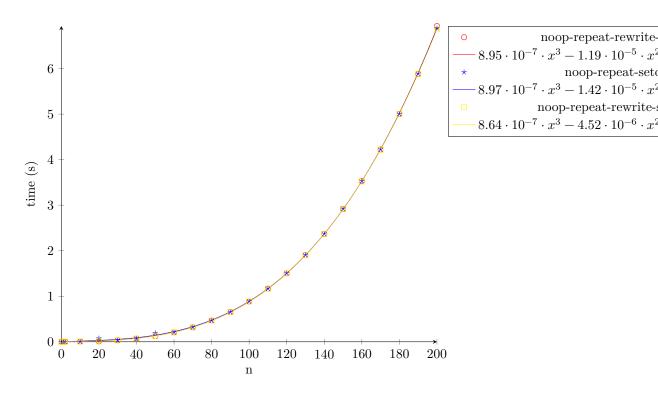
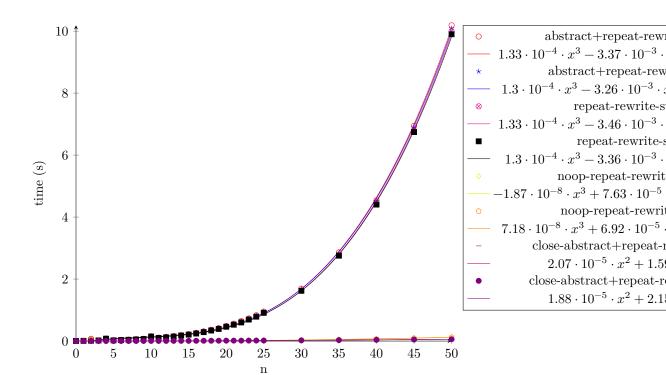
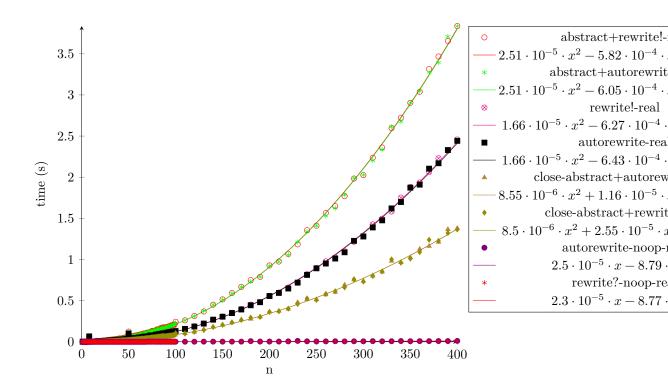


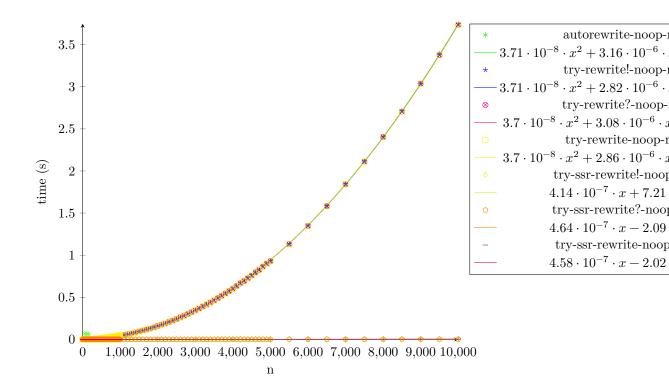
Figure 4: timing-repeat-setoid-rewrite-under-binders-noop



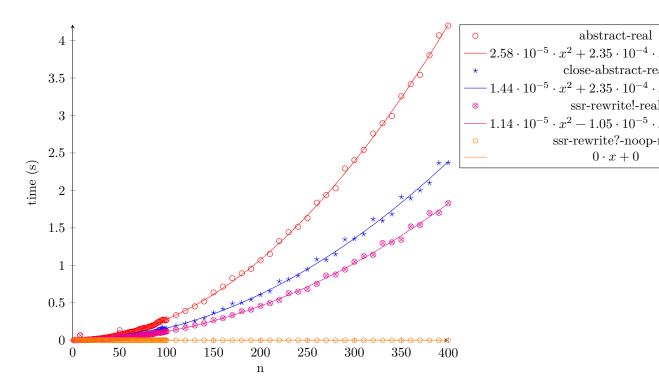
 $Figure\ 5:\ timing-rewrite-strat-under-binders$



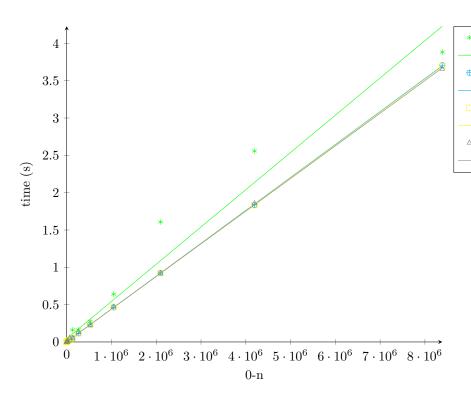
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$



Figure~7:~timing-rewrite-repeated-app-autorewrite-noop



 ${\bf Figure~8:~timing\text{-}rewrite\text{-}repeated\text{-}app\text{-}ssrrewrite}$



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

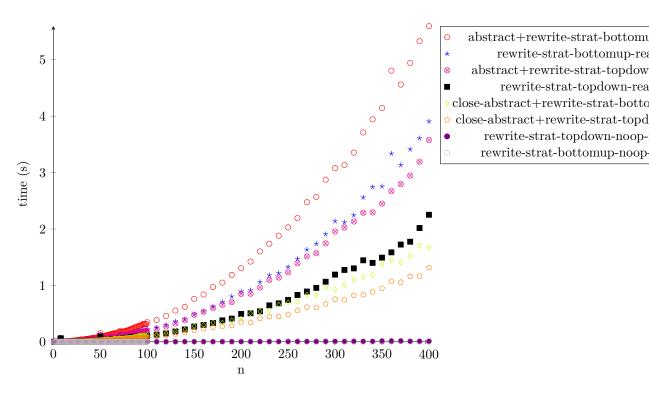
 $4.99 \cdot 10^{-7} \cdot x + 4.41 \cdot 10^{-2}$ try-ssr-rewrite?-noop-real

 $\begin{array}{l} 4.41\cdot 10^{-7}\cdot x - 8.3\cdot 10^{-4}\\ \text{try-ssr-rewrite-noop-real} \end{array}$

 $\begin{array}{l} 4.4 \cdot 10^{-7} \cdot x - 5.8 \cdot 10^{-4} \\ \text{try-ssr-rewrite!-noop-real} \end{array}$

 $4.37 \cdot 10^{-7} \cdot x + 3.17 \cdot 10^{-3}$

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



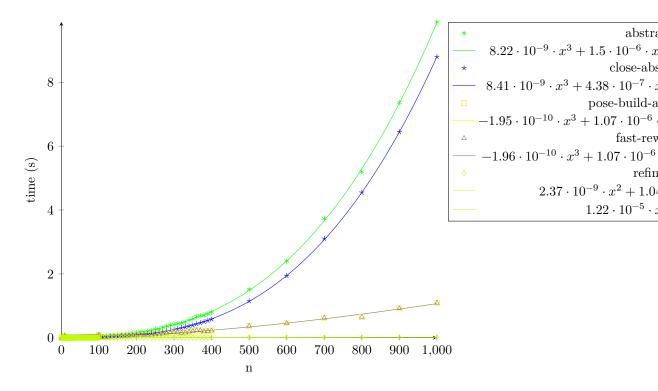
 $abstract + rewrite - strat - bottom \\ \\$ rewrite-strat-bottomup-rea

abstract + rewrite - strat - topdow

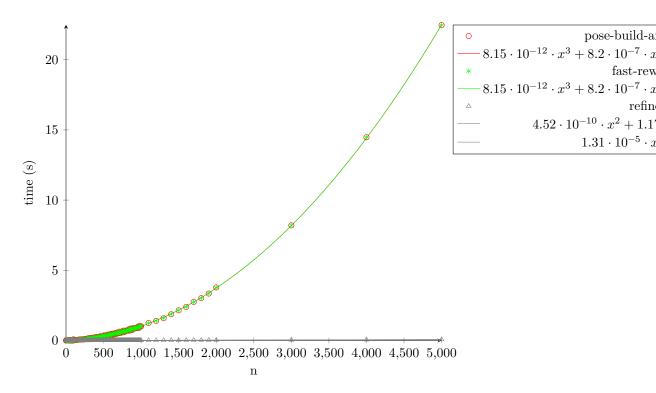
rewrite-strat-topdown-rea

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

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



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



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

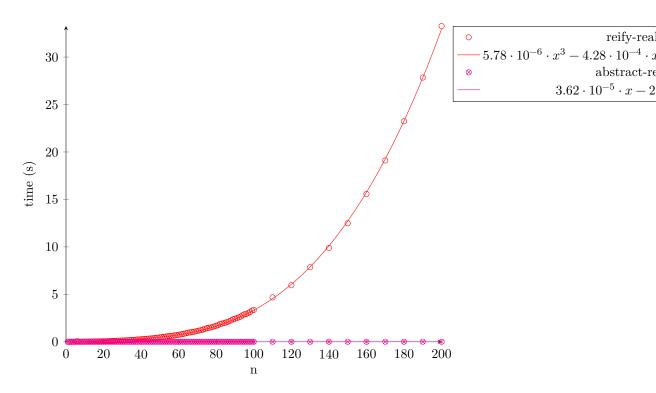


Figure 13: timing-typeclass-reification-let-in-HOAS

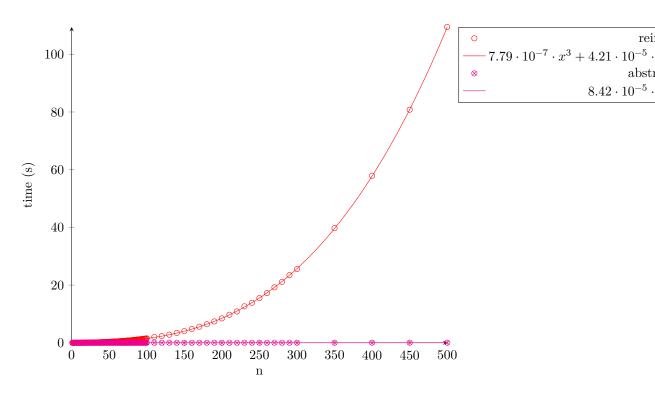
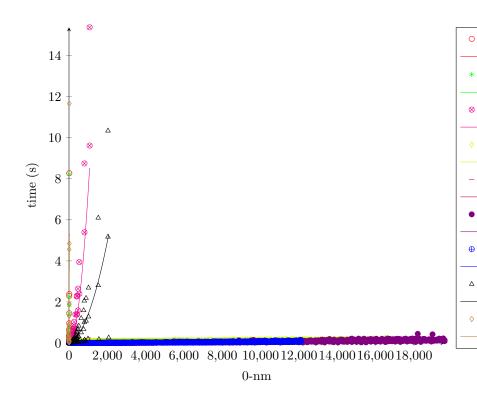


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(topdown-bot) $5.47 \cdot 10^{-3} exp(0.46 \cdot ($

rewrite-strat (bottomup-bot 5.16 \cdot $10^{-3} \exp{\left(0.46 \cdot \left(\right.\right)}$

 $7.48\cdot 10^{-6}\cdot x^2 - 1.47\cdot 10^{-4}\cdot x^{-2} + 1.47\cdot 1$

 $5.56\cdot 10^{-11}\cdot x^2 + 5.74\cdot 10^{-6}\cdot \\$

 $1.06 \cdot 10^{-10} \cdot x^2 + 3.52 \cdot 10^{-6} \cdot$

 $2.11 \cdot 10^{-10} \cdot x^2 + 4.61 \cdot 10^{-6} \cdot$

 $1.36\cdot 10^{-10}\cdot x^2 + 5.07\cdot 10^{-6}\cdot$

 $1.06 \cdot 10^{-6} \cdot x^2 + 3.58 \cdot 10^{-4} \cdot x^2 + 3.58 \cdot 10^{-4}$

 $-6.77 \cdot 10^{-3} \cdot x^3 + 0.22 \cdot x^2 -$

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

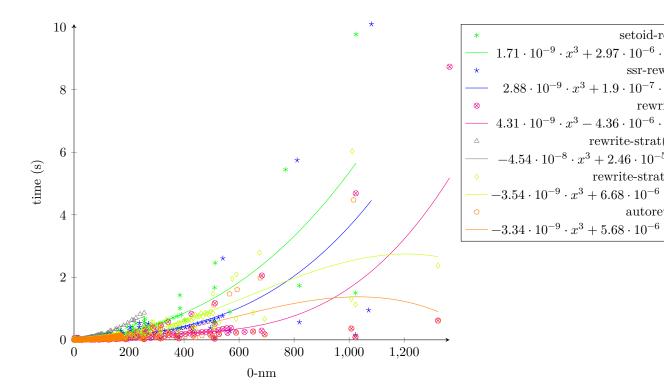
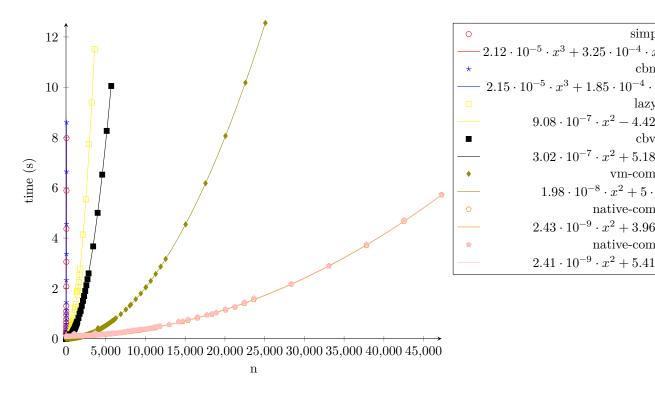


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $2.15 \cdot 10^{-5} \cdot x^3 + 1.85 \cdot 10^{-4}$

 $9.08 \cdot 10^{-7} \cdot x^2 - 4.42$

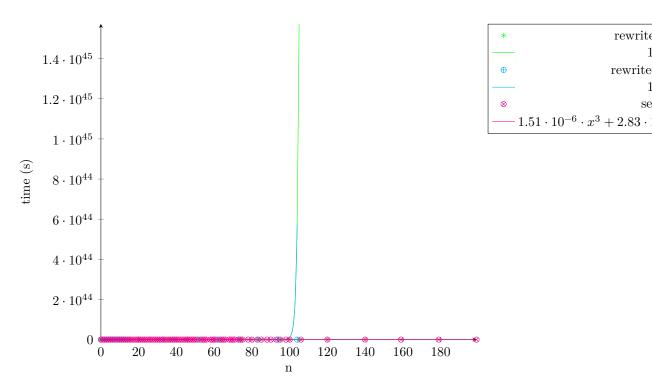
 $3.02 \cdot 10^{-7} \cdot x^2 + 5.18$

 $1.98 \cdot 10^{-8} \cdot x^2 + 5$

 $2.43 \cdot 10^{-9} \cdot x^2 + 3.96$

 $2.41 \cdot 10^{-9} \cdot x^2 + 5.41$

Figure 17: timing-sieve-of-eratosthenes



rewrite

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