

Figure 1: timing-pattern

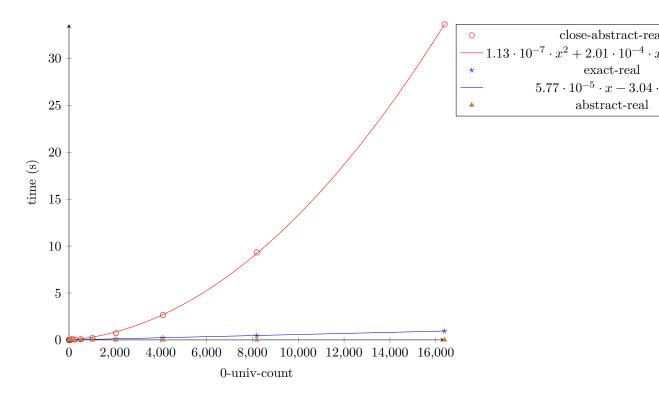


Figure 2: timing-n-polymorphic-universes param-1-n 0

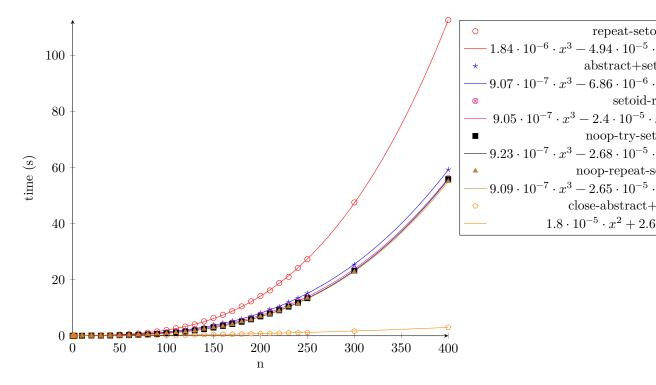
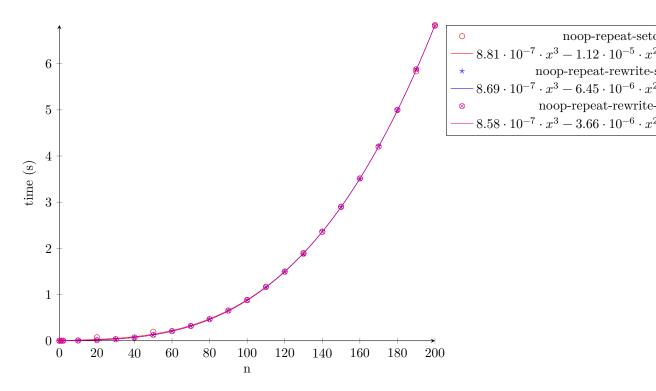
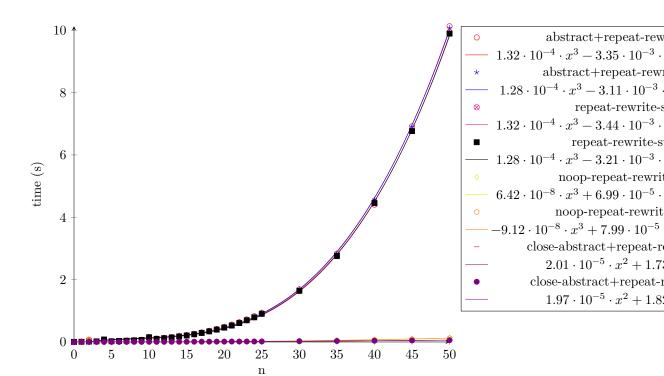


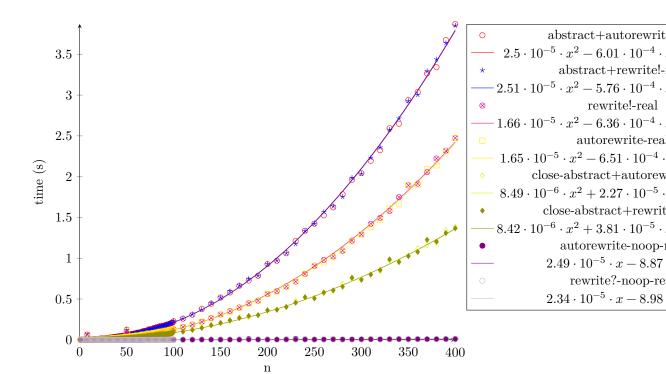
Figure 3: timing-repeat-setoid-rewrite-under-binders



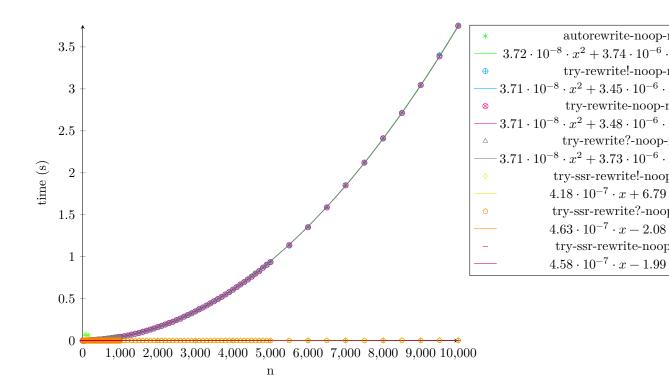
 $Figure\ 4:\ timing-repeat-setoid-rewrite-under-binders-noop$



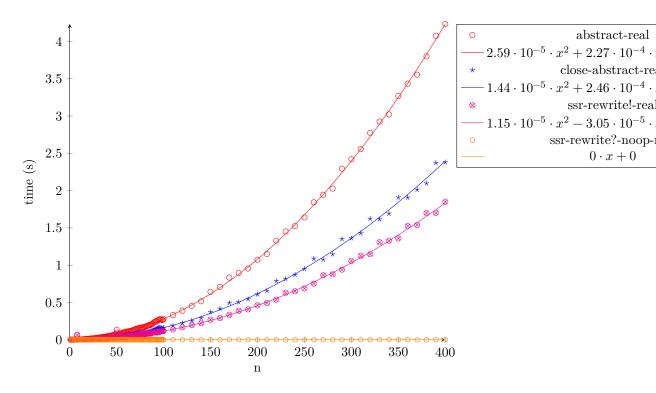
 $Figure \ 5: \ timing-rewrite-strat-under-binders$



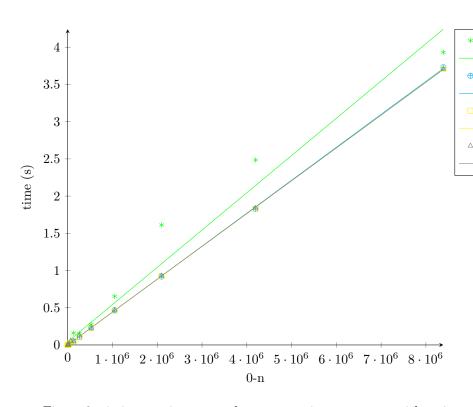
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$



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



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



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

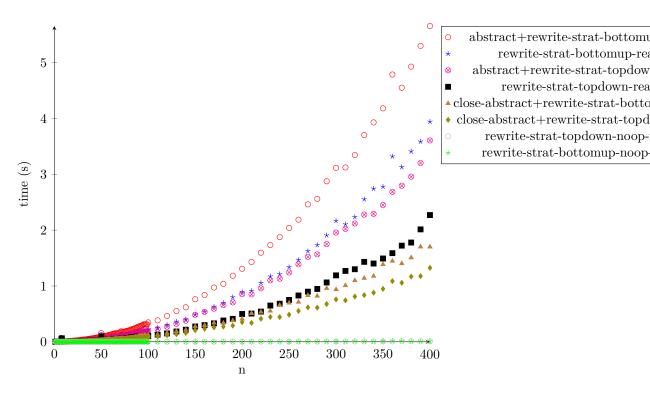
 $5.01 \cdot 10^{-7} \cdot x + 4.2 \cdot 10^{-2}$ try-ssr-rewrite?-noop-real

 $\begin{array}{l} 4.43 \cdot 10^{-7} \cdot x - 2.04 \cdot 10^{-3} \\ \text{try-ssr-rewrite-noop-real} \end{array}$

 $\begin{array}{l} 4.41 \cdot 10^{-7} \cdot x - 1.68 \cdot 10^{-3} \\ \text{try-ssr-rewrite!-noop-real} \end{array}$

 $4.41\cdot 10^{-7}\cdot x + 1.41\cdot 10^{-3}$

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

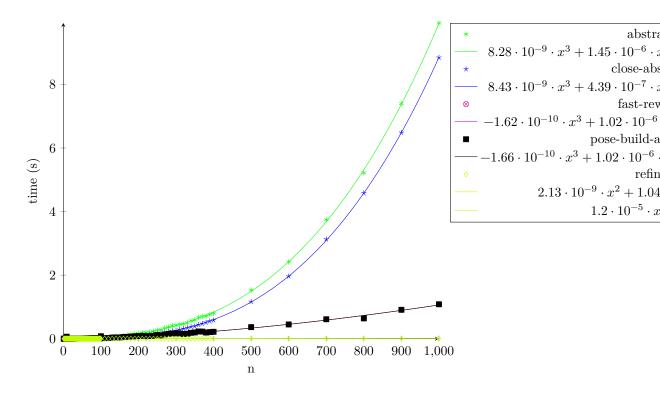


rewrite-strat-bottomup-rea

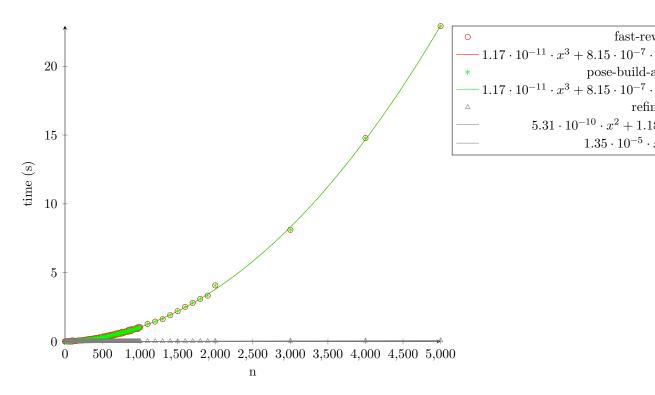
abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

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

 $Figure\ 10:\ timing-rewrite-repeated-app-rewrite-strat$



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



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

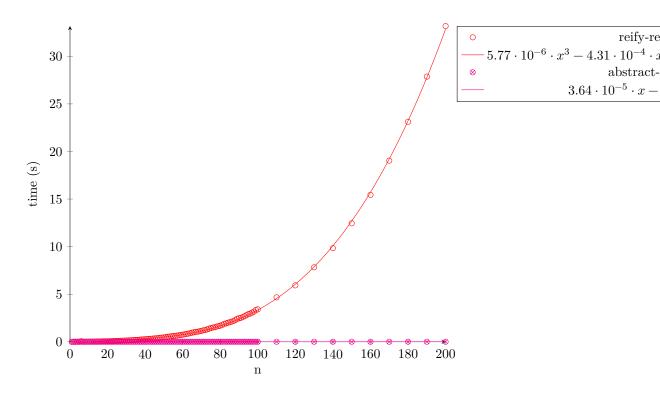
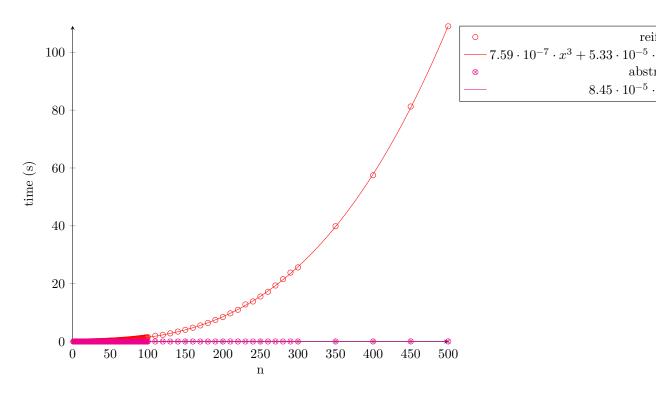
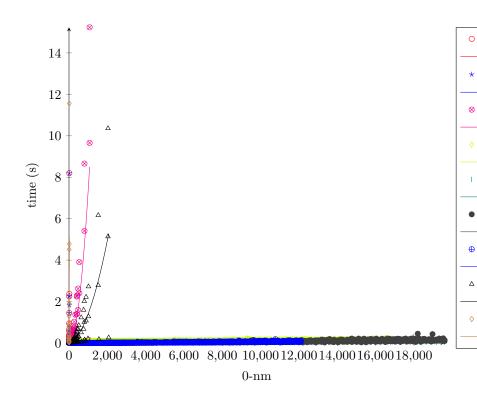


Figure 13: timing-typeclass-reification-let-in-HOAS



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



rewrite-strat(topdown-bot

 $7.46\cdot 10^{-6}\cdot x^2 - 1.54\cdot 10^{-4}\cdot .$

 $4.25\cdot 10^{-11}\cdot x^2 + 5.95\cdot 10^{-6}\cdot \\$

 $1.02 \cdot 10^{-10} \cdot x^2 + 3.57 \cdot 10^{-6} \cdot$

 $2.21 \cdot 10^{-10} \cdot x^2 + 4.48 \cdot 10^{-6} \cdot$

 $1.28\cdot 10^{-10}\cdot x^2 + 5.15\cdot 10^{-6}\cdot$

 $1.06 \cdot 10^{-6} \cdot x^2 + 3.69 \cdot 10^{-4} \cdot x^2$

 $-6.71 \cdot 10^{-3} \cdot x^3 + 0.21 \cdot x^2 -$

 $3.1\cdot 10^{-3}\exp{(0.49\cdot(0$

cps+native-compute

cps+cbn-real

cps+cbv-real

cps+lazy-real

cps+simpl-real

setoid-rewrite-re

cps+vm-compute-

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

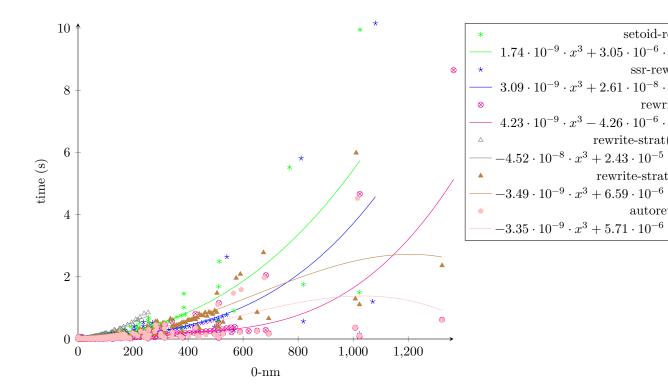
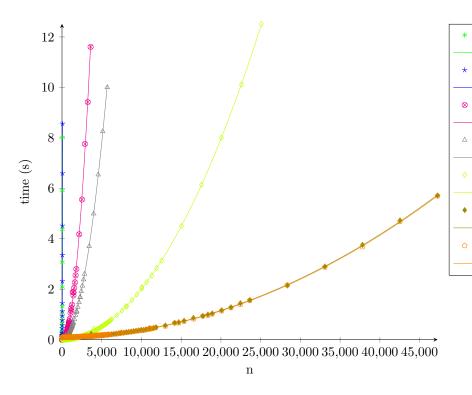


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $2.16 \cdot 10^{-5} \cdot x^3 + 2.99 \cdot 10^{-4} \cdot x^3$

 $2.14 \cdot 10^{-5} \cdot x^3 + 1.77 \cdot 10^{-4} \cdot x^3$

 $9.14 \cdot 10^{-7} \cdot x^2 - 4.78$

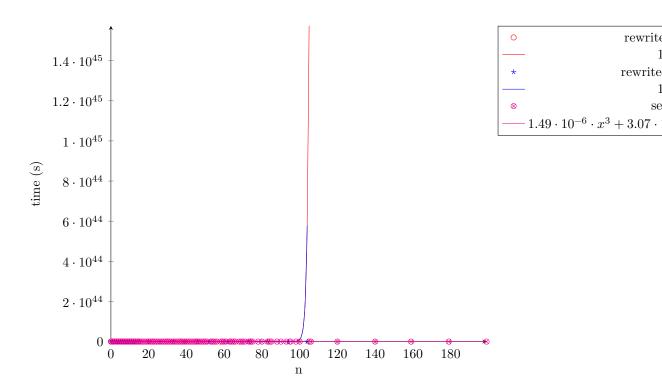
 $3.01 \cdot 10^{-7} \cdot x^2 + 5.52$

 $1.97 \cdot 10^{-8} \cdot x^2 + 4.38$

 $2.43 \cdot 10^{-9} \cdot x^2 + 4.84$

 $2.43 \cdot 10^{-9} \cdot x^2 + 3.73$

Figure 17: timing-sieve-of-eratosthenes



rewrite

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