

Figure 1: timing-pattern

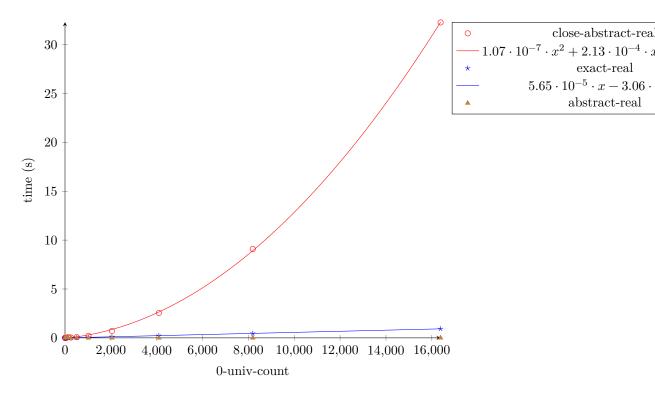
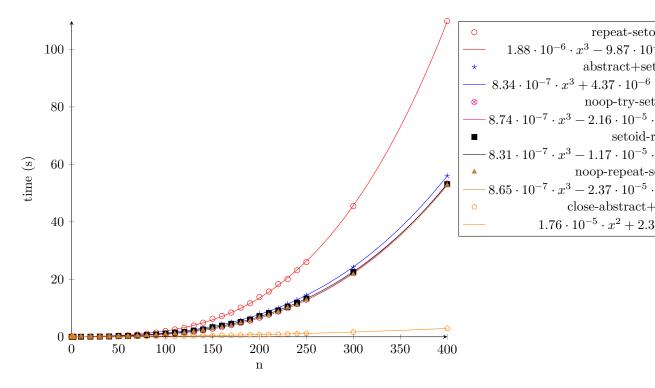
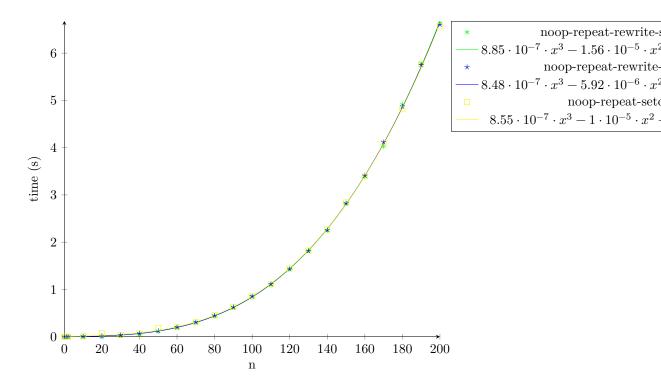


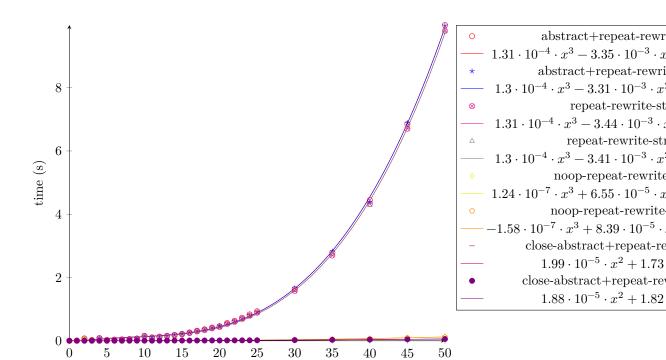
Figure 2: timing-n-polymorphic-universes param-1-n 0



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

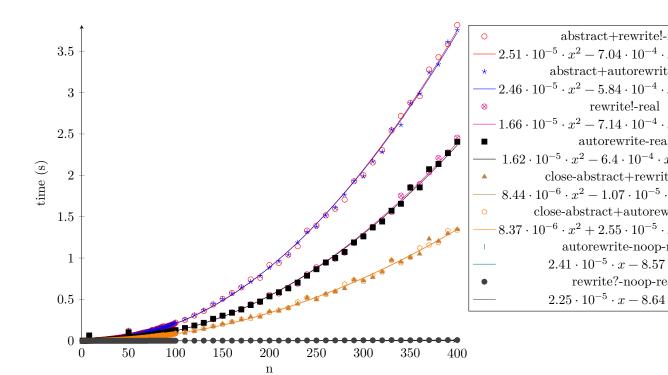


 $Figure \ 4: \ timing-repeat-setoid-rewrite-under-binders-noop \\$



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

n



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

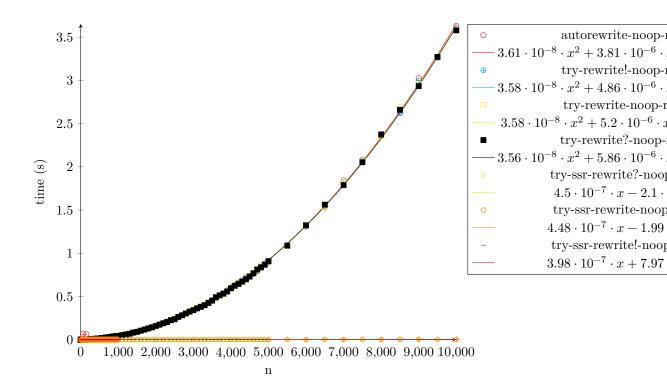


Figure 7: timing-rewrite-repeated-app-autorewrite-noop

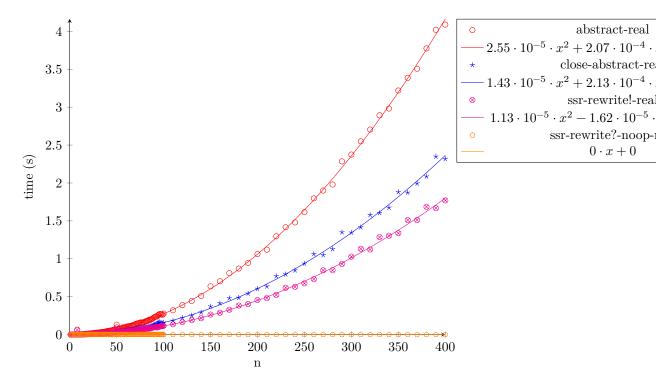
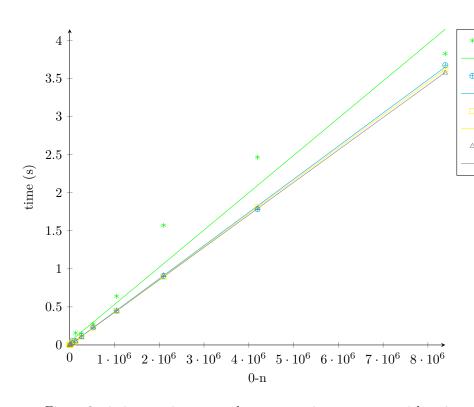


Figure 8: timing-rewrite-repeated-app-ssrrewrite



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

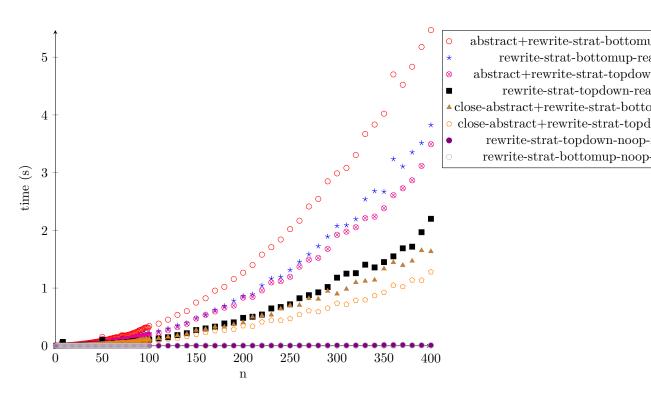
 $4.89 \cdot 10^{-7} \cdot x + 4.21 \cdot 10^{-2}$ try-ssr-rewrite!-noop-real

 $\begin{array}{l} 4.35 \cdot 10^{-7} \cdot x - 3.18 \cdot 10^{-4} \\ \text{try-ssr-rewrite?-noop-real} \end{array}$

 $\begin{array}{l} 4.32\cdot 10^{-7}\cdot x - 1.3\cdot 10^{-3} \\ \text{try-ssr-rewrite-noop-real} \end{array}$

 $4.27\cdot 10^{-7}\cdot x + 3.14\cdot 10^{-4}$

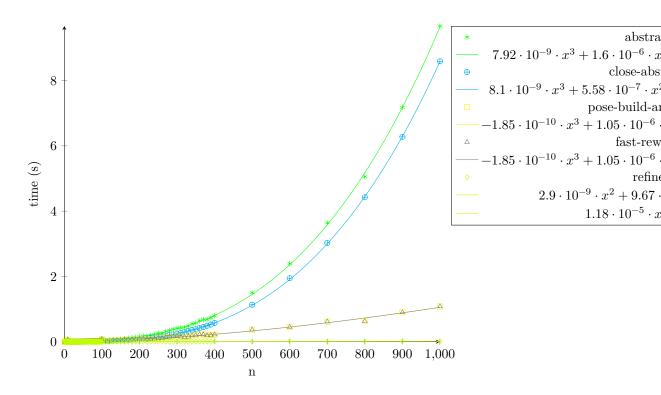
Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn $\ 1$



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

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

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



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

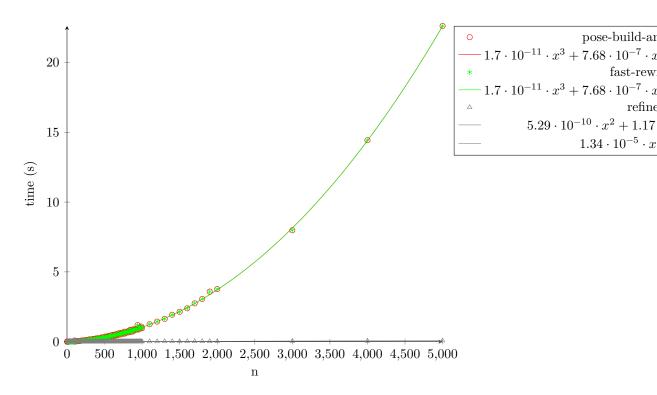


Figure 12: timing-rewrite-repeated-app-fast-rewrite-no-abstract

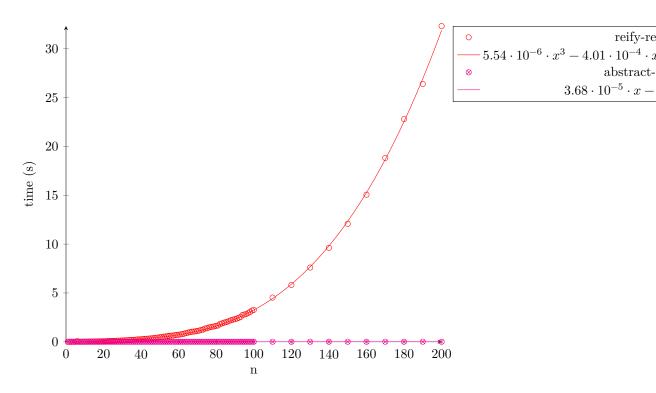
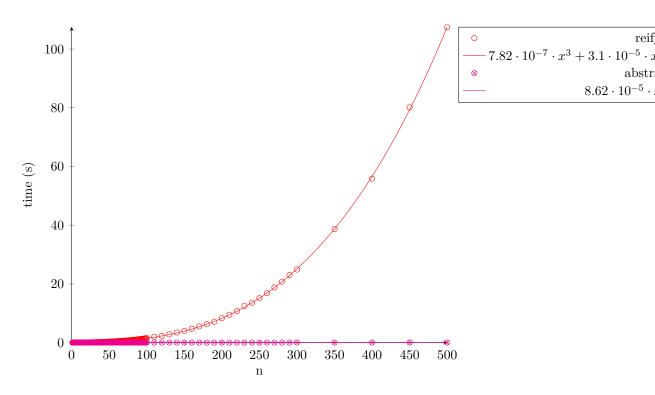
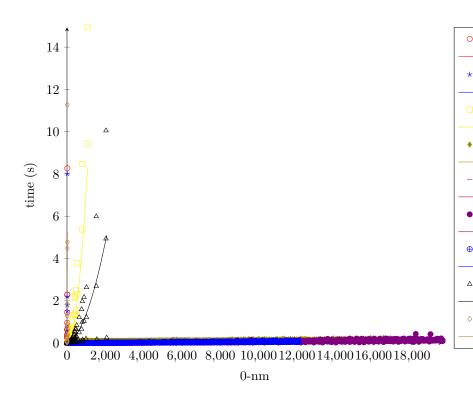


Figure 13: timing-typeclass-reification-let-in-HOAS



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



rewrite-strat (top down-bot)

 $7.38 \cdot 10^{-6} \cdot x^2 - 2.24 \cdot 10^{-4} \cdot x^2 + 2.24 \cdot 10^{-4} \cdot x^2$

 $1.09 \cdot 10^{-10} \cdot x^2 + 4.89 \cdot 10^{-6} \cdot \\$

 $1.04 \cdot 10^{-10} \cdot x^2 + 3.42 \cdot 10^{-6} \cdot$

 $2.03 \cdot 10^{-10} \cdot x^2 + 4.55 \cdot 10^{-6}$

 $8.78 \cdot 10^{-11} \cdot x^2 + 5.48 \cdot 10^{-6} \cdot$

 $1.01 \cdot 10^{-6} \cdot x^2 + 3.75 \cdot 10^{-4} \cdot x^2$

 $-6.6 \cdot 10^{-3} \cdot x^3 + 0.21 \cdot x^2 -$

 $5.7 \cdot 10^{-3} \exp{(0.46 \cdot (0.46 \cdot (0.4$

 $5.54 \cdot 10^{-3} exp (0.45 \cdot ($

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

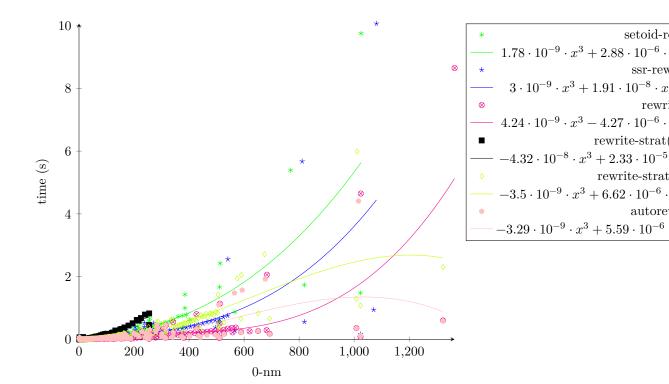
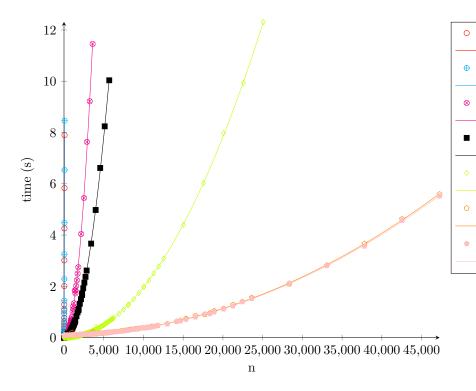


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $2.22 \cdot 10^{-5} \cdot x^3 + 2.04 \cdot 10^{-4} \cdot x^3$

 $2.16 \cdot 10^{-5} \cdot x^3 + 1.33 \cdot 10^{-4} \cdot x^3$

 $9.02 \cdot 10^{-7} \cdot x^2 - 5.82$

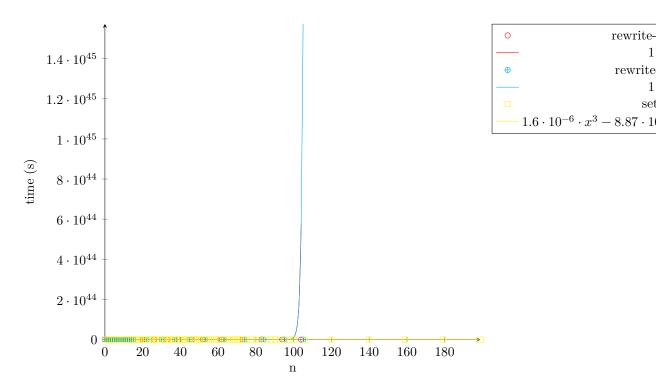
 $3.03 \cdot 10^{-7} \cdot x^2 + 5.19$

 $1.95 \cdot 10^{-8} \cdot x^2 + 6.57$

 $2.37 \cdot 10^{-9} \cdot x^2 + 4.59$

 $2.35 \cdot 10^{-9} \cdot x^2 + 4.25$

Figure 17: timing-sieve-of-eratosthenes



rewrite-

rewrite

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