

Figure 1: timing-pattern

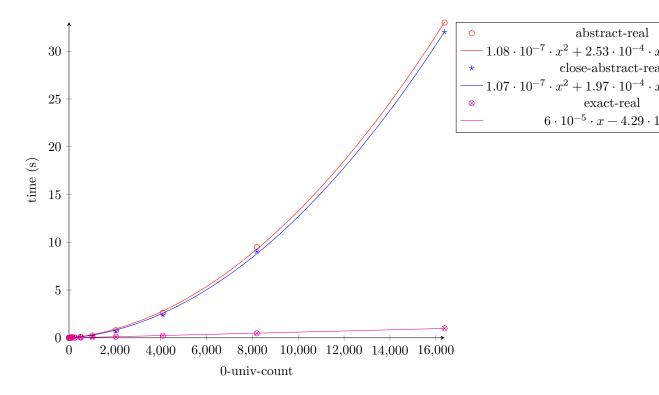
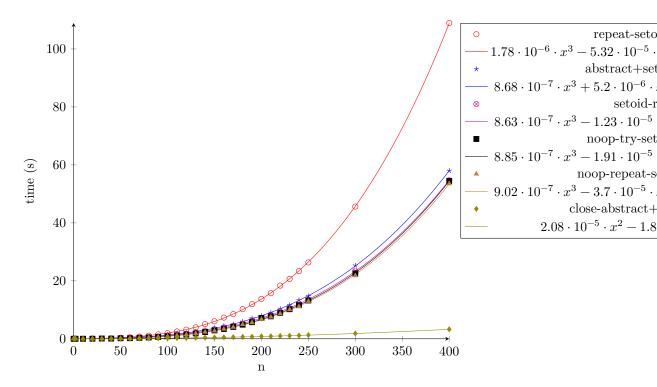
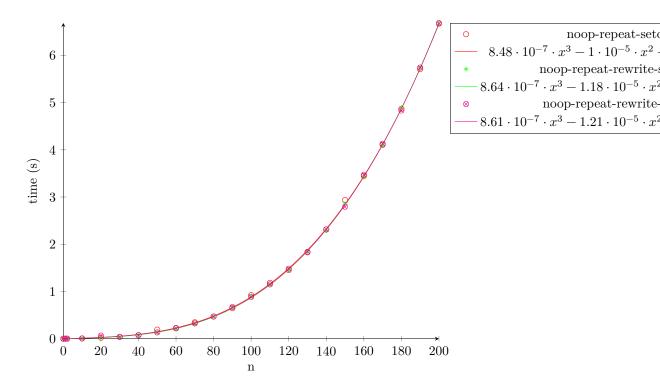


Figure 2: timing-n-polymorphic-universes param-1-n $\,0\,$



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



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

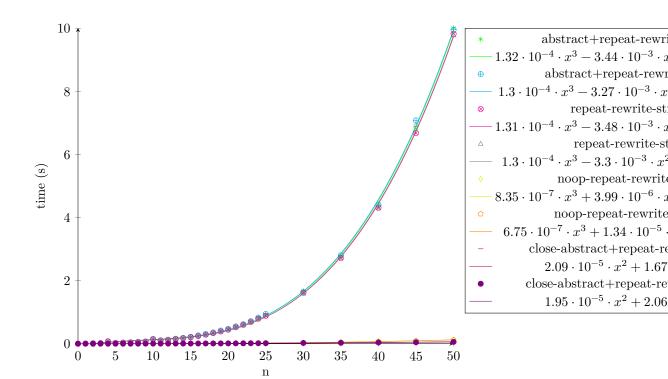


Figure 5: timing-rewrite-strat-under-binders

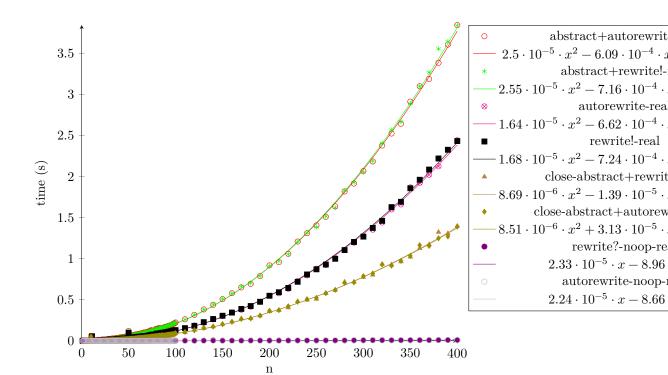
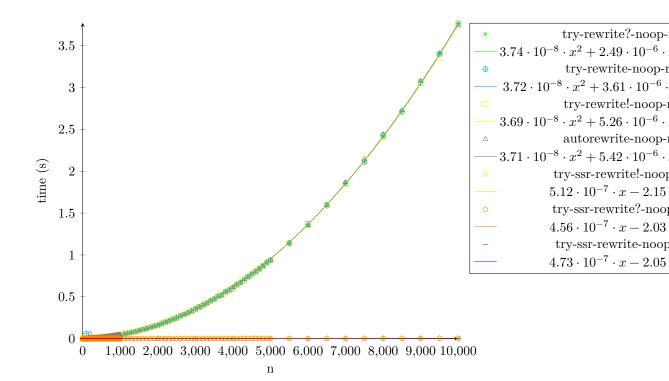
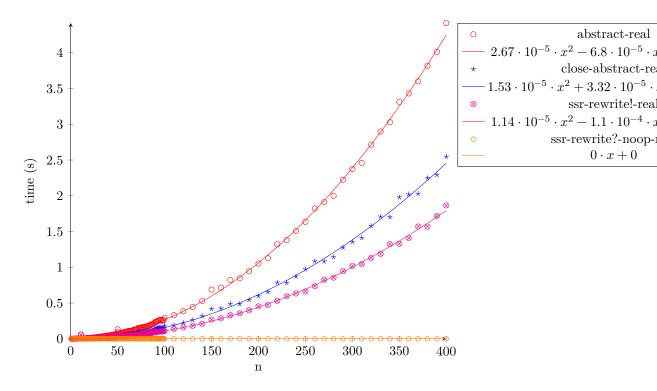


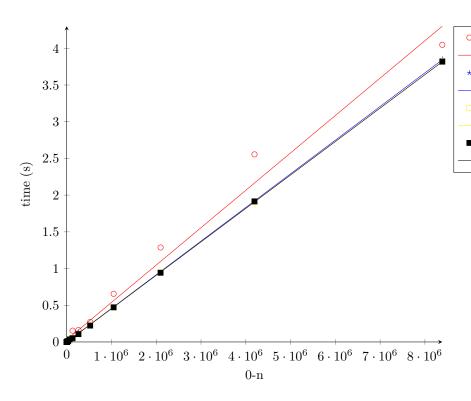
Figure 6: timing-rewrite-repeated-app-autorewrite



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



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



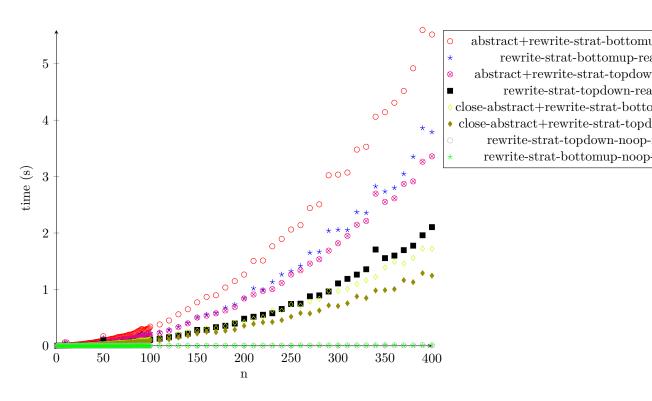
try-ssr-rewrite!-cold-noop-rea

 $5.09 \cdot 10^{-7} \cdot x + 2.91 \cdot 10^{-2}$ try-ssr-rewrite!-noop-real

 $\begin{aligned} &4.58 \cdot 10^{-7} \cdot x - 1.43 \cdot 10^{-3} \\ &\text{try-ssr-rewrite-noop-real} \\ &4.56 \cdot 10^{-7} \cdot x - 2.78 \cdot 10^{-3} \end{aligned}$

try-ssr-rewrite?-noop-real $4.55\cdot 10^{-7}\cdot x - 2.32\cdot 10^{-3}$

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



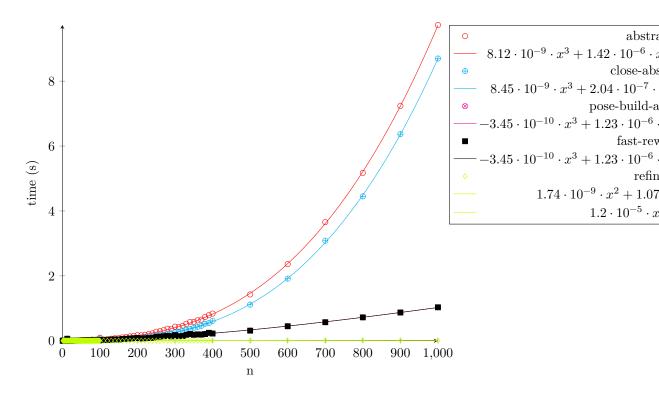
rewrite-strat-bottomup-rea

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

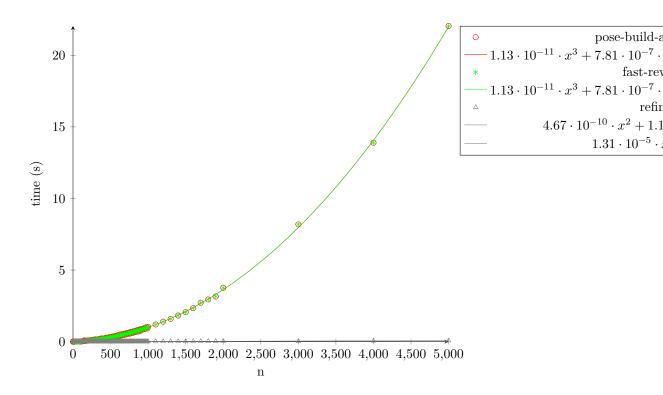
rewrite-strat-topdown-noop-

rewrite-strat-bottomup-noop-

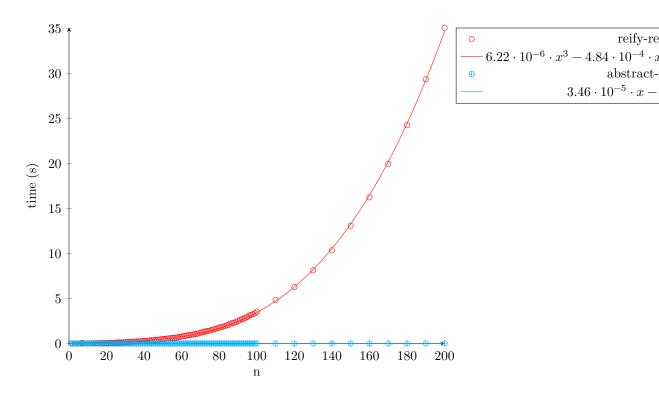
 $Figure~10:~timing\mbox{-rewrite-repeated-app-rewrite-strat}$



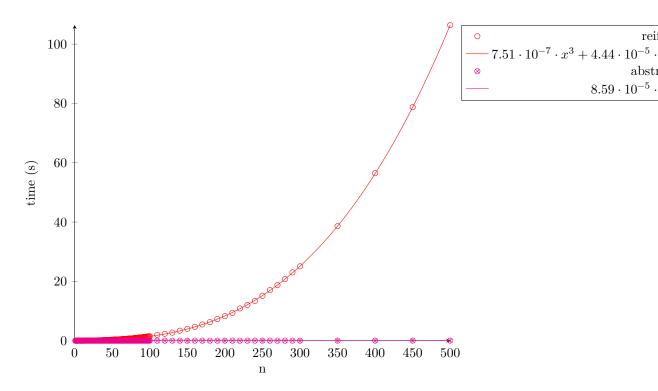
 $Figure~11:~timing\mbox{-rewrite-repeated-app-fast-rewrite}$



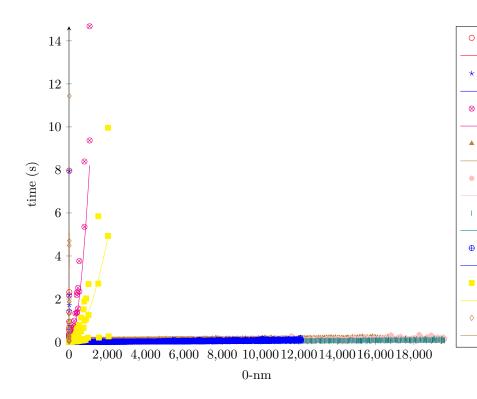
 $Figure~12:~timing\mbox{-rewrite-repeated-app-fast-rewrite-no-abstract}$



 $Figure \ 13: \ timing-type class-reification-let-in-HOAS$



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



rewrite-strat (top down-bot)

 $7.17 \cdot 10^{-6} \cdot x^2 - 8.29 \cdot 10^{-5}$

 $1.07 \cdot 10^{-10} \cdot x^2 + 5.18 \cdot 10^{-6}$

 $2.32 \cdot 10^{-10} \cdot x^2 + 4.01 \cdot 10^{-6} \cdot \\$

 $1.05 \cdot 10^{-10} \cdot x^2 + 3.26 \cdot 10^{-6}$

 $2.22 \cdot 10^{-10} \cdot x^2 + 5.21 \cdot 10^{-6}$

 $1.02 \cdot 10^{-6} \cdot x^2 + 3.51 \cdot 10^{-4} \cdot x^2$

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

 $5.27 \cdot 10^{-3} \exp{(0.46 \cdot ($ rewrite-strat(bottomup-bot

 $5.31 \cdot 10^{-3} exp (0.45 \cdot ($

cps+native-compute

cps+cbn-real

cps+lazy-real

 $\operatorname{cps+cbv-real}$

cps+simpl-real

setoid-rewrite-re

cps+vm-compute-

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

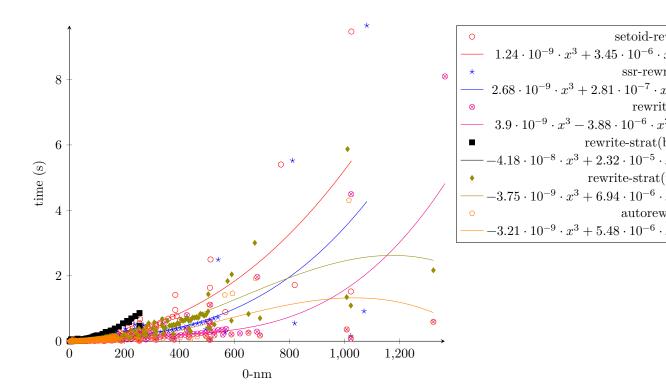
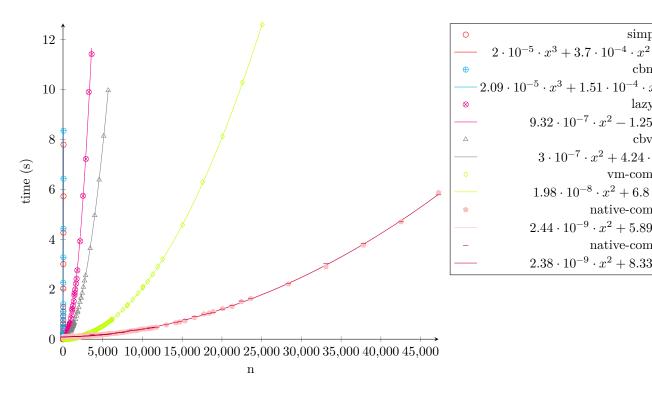


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

 $2 \cdot 10^{-5} \cdot x^3 + 3.7 \cdot 10^{-4} \cdot x^2$

 $9.32 \cdot 10^{-7} \cdot x^2 - 1.25$

 $3 \cdot 10^{-7} \cdot x^2 + 4.24 \cdot$

 $1.98 \cdot 10^{-8} \cdot x^2 + 6.8$

 $2.44 \cdot 10^{-9} \cdot x^2 + 5.89$

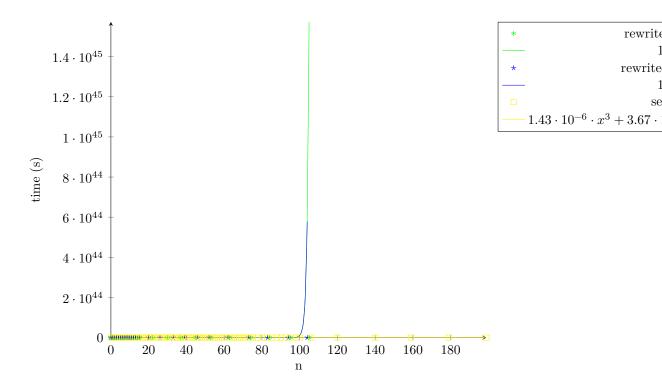
 $2.38 \cdot 10^{-9} \cdot x^2 + 8.33$

vm-com

native-com

native-com

Figure 17: timing-sieve-of-eratosthenes



rewrite

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

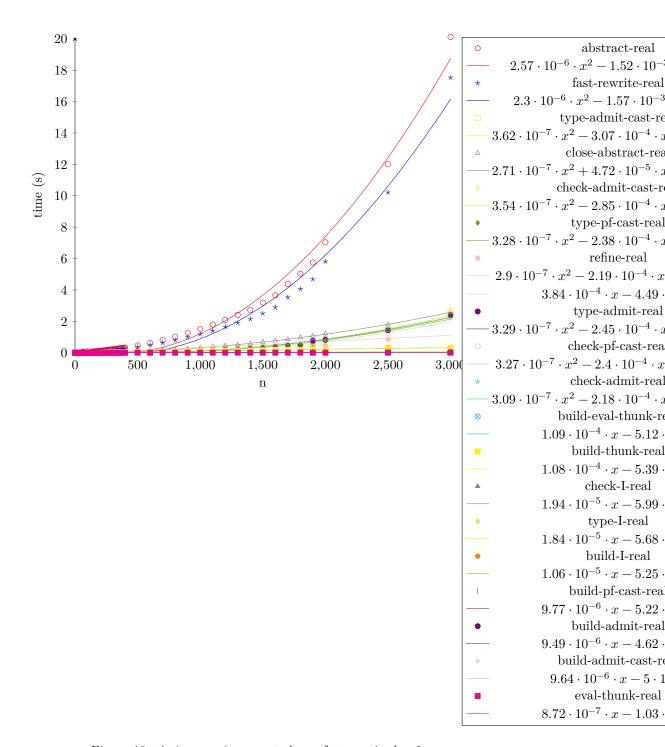


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2