

Figure 1: timing-pattern

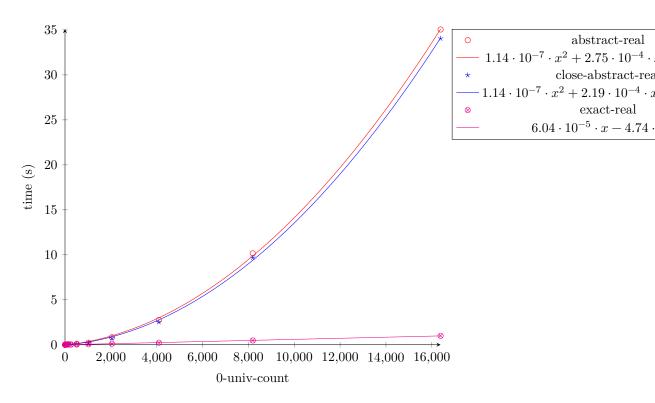
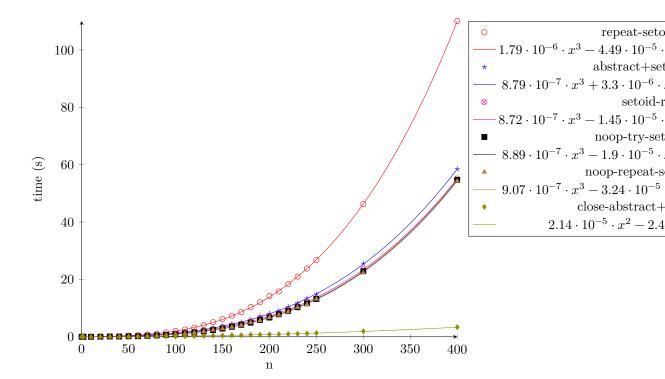


Figure 2: timing-n-polymorphic-universes param-1-n $\,0\,$



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

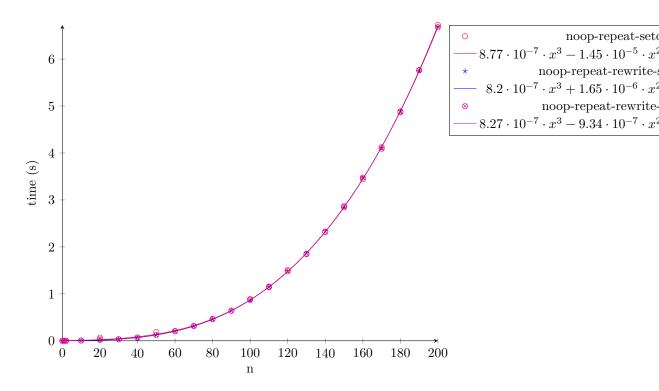


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

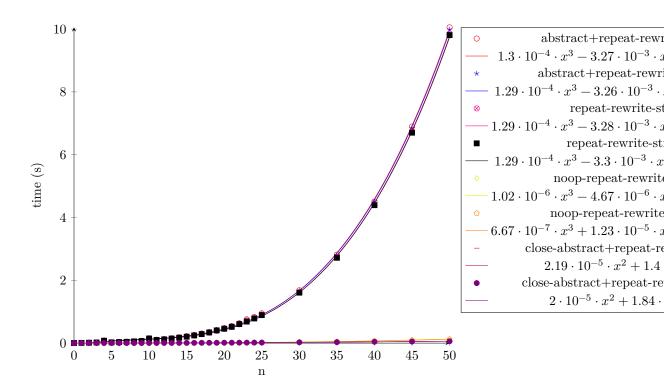
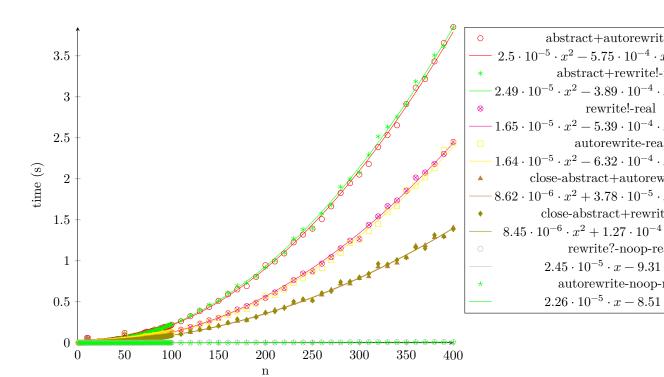


Figure 5: timing-rewrite-strat-under-binders



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

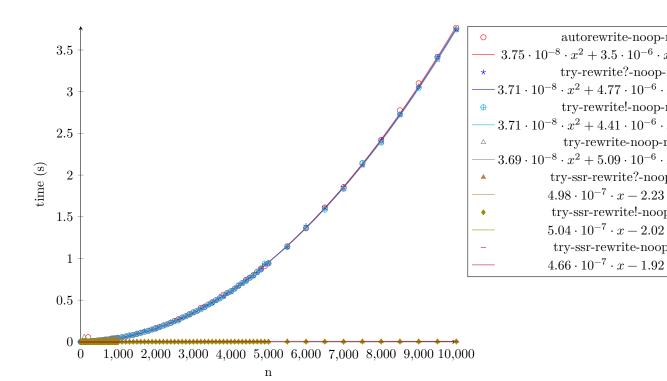


Figure 7: timing-rewrite-repeated-app-autorewrite-noop

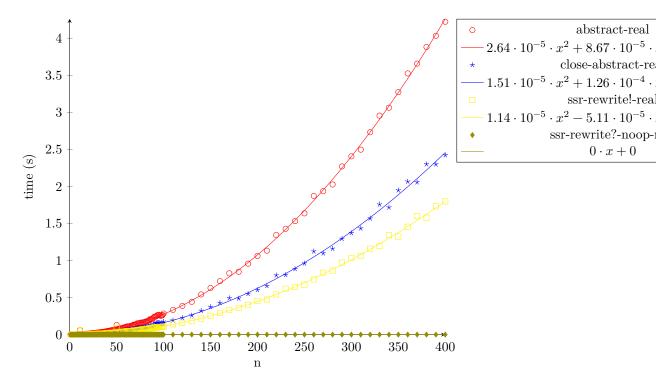
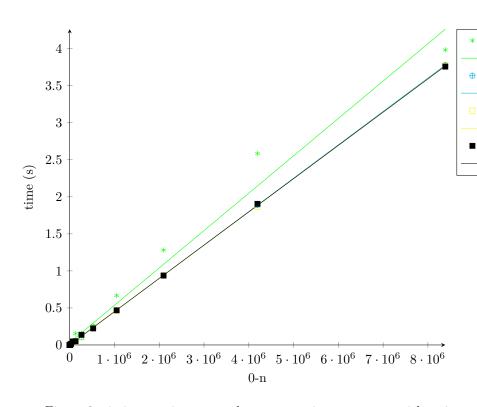


Figure 8: timing-rewrite-repeated-app-ssrrewrite



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

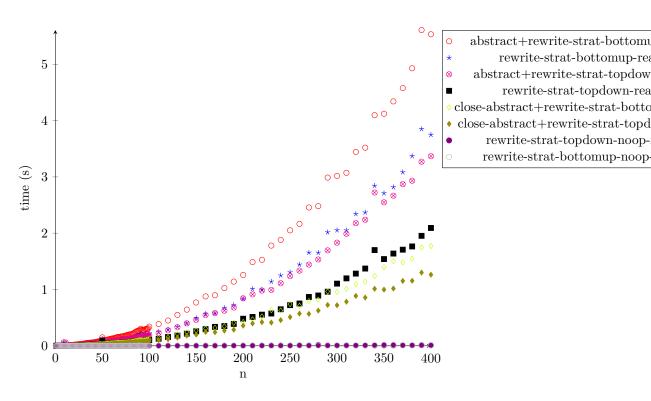
 $5.04 \cdot 10^{-7} \cdot x + 3.11 \cdot 10^{-2}$ try-ssr-rewrite-noop-real

 $\begin{array}{c} 4.51\cdot 10^{-7}\cdot x - 2.86\cdot 10^{-3} \\ \text{try-ssr-rewrite?-noop-real} \end{array}$

 $\begin{array}{l} 4.49 \cdot 10^{-7} \cdot x - 2.56 \cdot 10^{-3} \\ \text{try-ssr-rewrite!-noop-real} \end{array}$

 $4.49 \cdot 10^{-7} \cdot x + 1.04 \cdot 10^{-3}$

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

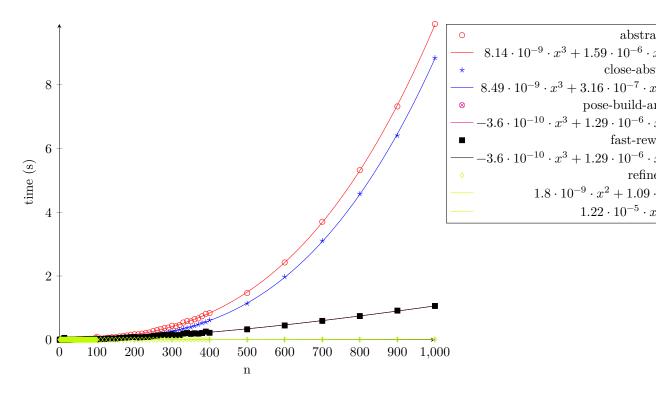


rewrite-strat-bottomup-rea

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

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

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



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

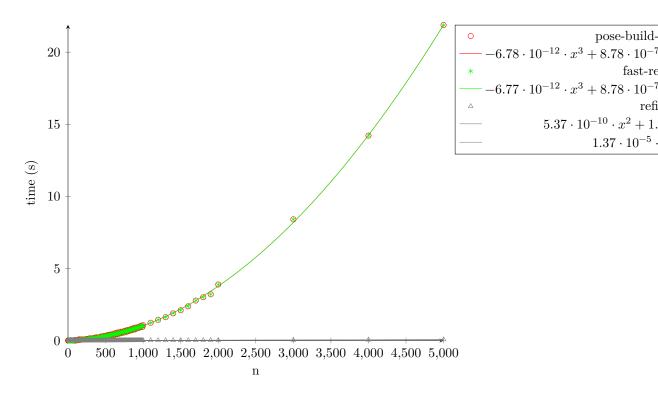
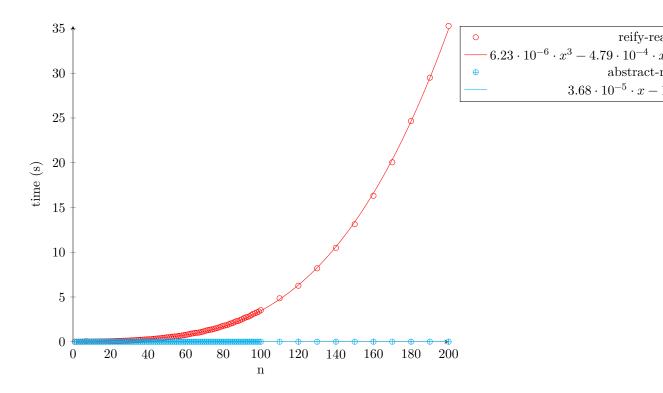
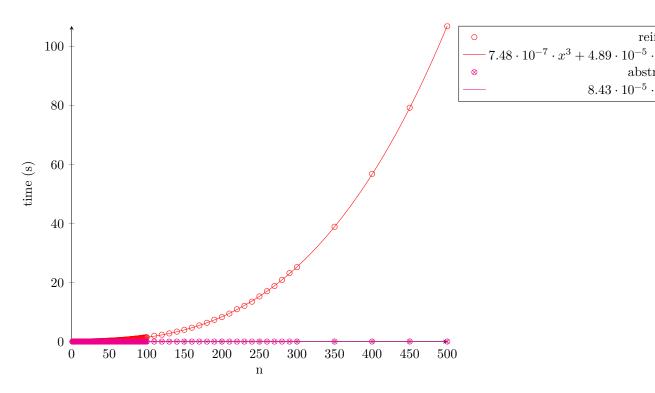


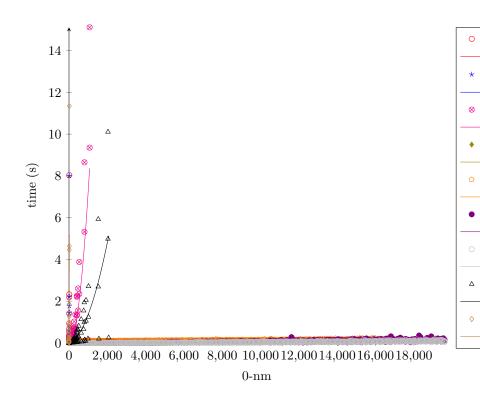
Figure 12: timing-rewrite-repeated-app-fast-rewrite-no-abstract



 ${\bf Figure~13:~timing-type class-reification-let-in-HOAS}$



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



rewrite-strat(topdown-bot

 $7.33\cdot 10^{-6}\cdot x^2 - 1.22\cdot 10^{-4}\cdot .$

 $2.19 \cdot 10^{-10} \cdot x^2 + 5.02 \cdot 10^{-6} \cdot \\$

 $6.5 \cdot 10^{-11} \cdot x^2 + 5.57 \cdot 10^{-6} \cdot x^2$

 $2.37 \cdot 10^{-10} \cdot x^2 + 3.97 \cdot 10^{-6} \cdot$

 $1.02\cdot 10^{-10}\cdot x^2 + 3.39\cdot 10^{-6}\cdot \\$

 $1.03 \cdot 10^{-6} \cdot x^2 + 3.49 \cdot 10^{-4} \cdot x^2$

 $-6.55 \cdot 10^{-3} \cdot x^3 + 0.21 \cdot x^2 - \\$

 $5.23\cdot 10^{-3}\exp{\left(0.46\cdot\right)}$ rewrite-strat (bottomup-bot $5.3\cdot 10^{-3}\exp{\left(0.45\cdot\right)}$

cps+cbn-real

cps+lazy-real

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

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

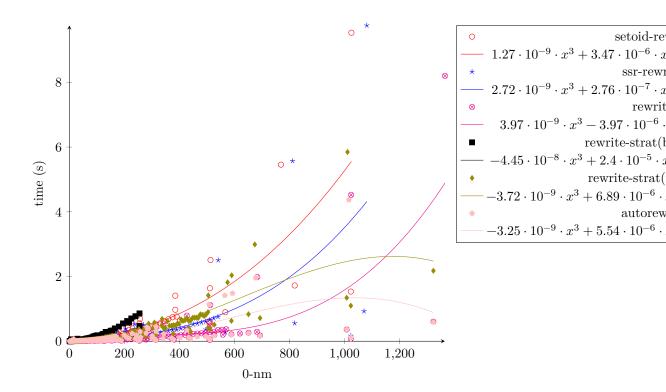
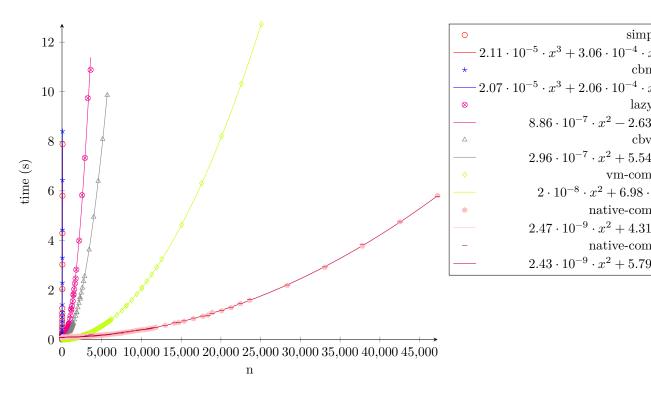


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



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native-com

native-com

 $8.86 \cdot 10^{-7} \cdot x^2 - 2.63$

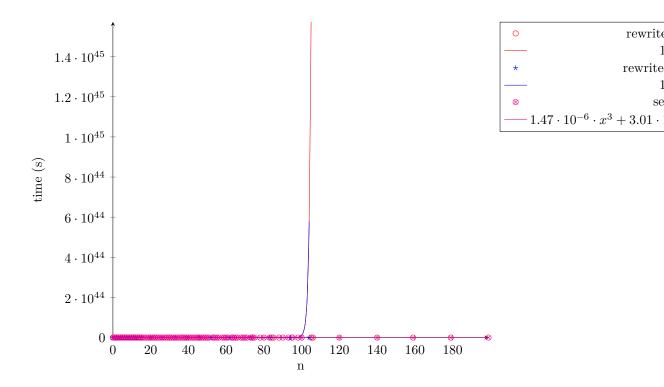
 $2.96 \cdot 10^{-7} \cdot x^2 + 5.54$

 $2 \cdot 10^{-8} \cdot x^2 + 6.98 \cdot$

 $2.47 \cdot 10^{-9} \cdot x^2 + 4.31$

 $2.43 \cdot 10^{-9} \cdot x^2 + 5.79$

Figure 17: timing-sieve-of-eratosthenes



rewrite

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

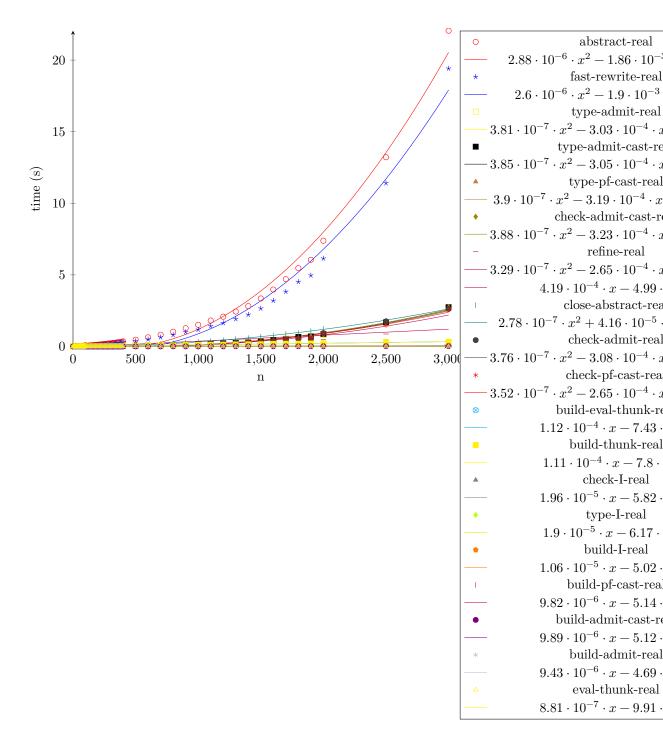


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2