

Figure 1: timing-pattern

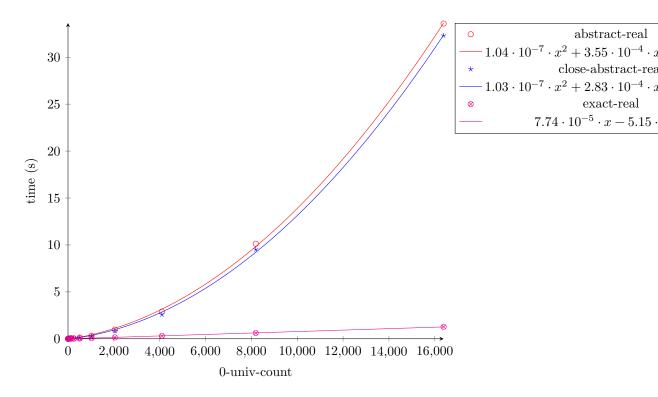
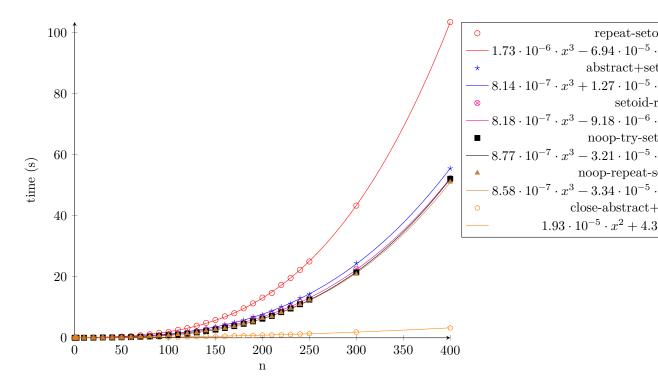


Figure 2: timing-n-polymorphic-universes param-1-n $\,0\,$



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

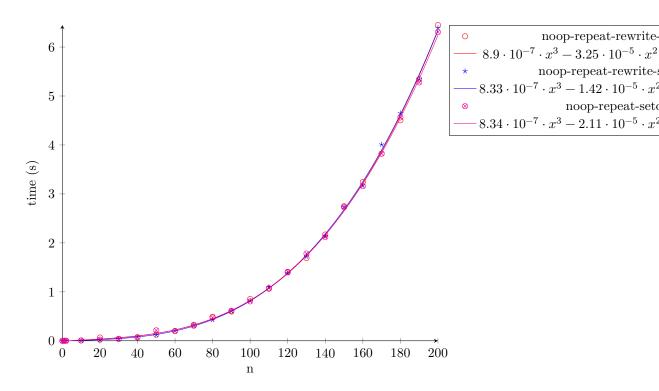


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

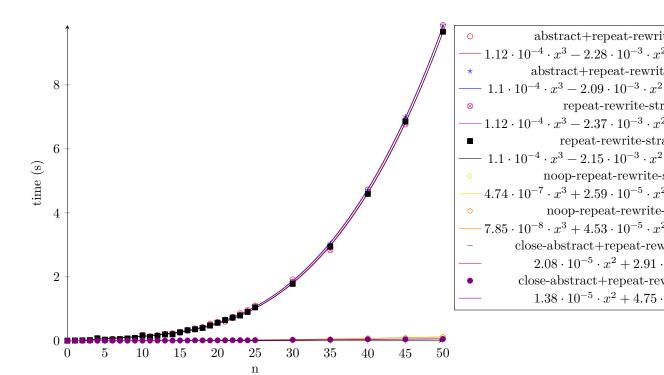
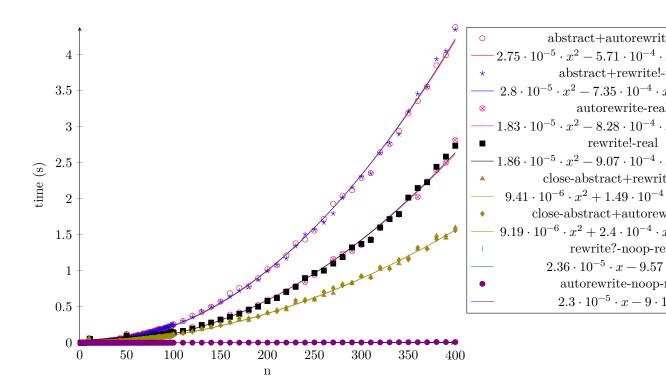
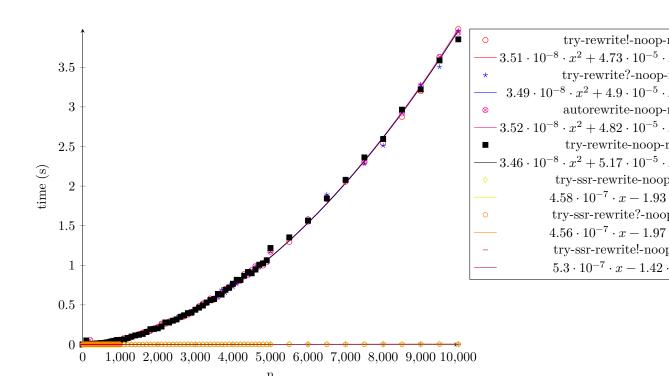


Figure 5: timing-rewrite-strat-under-binders



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



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

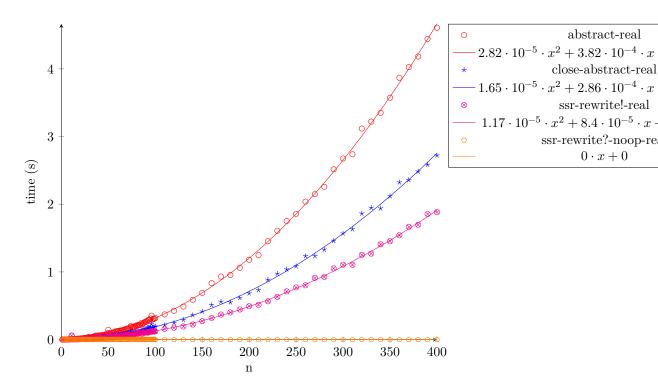
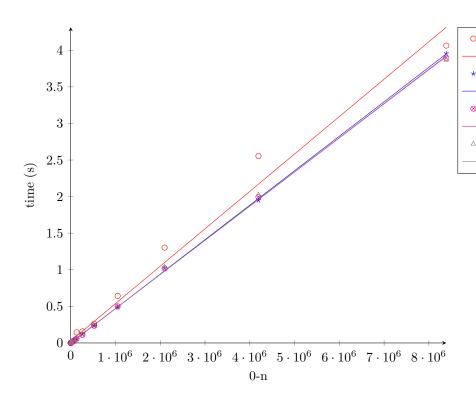


Figure 8: timing-rewrite-repeated-app-ssrrewrite



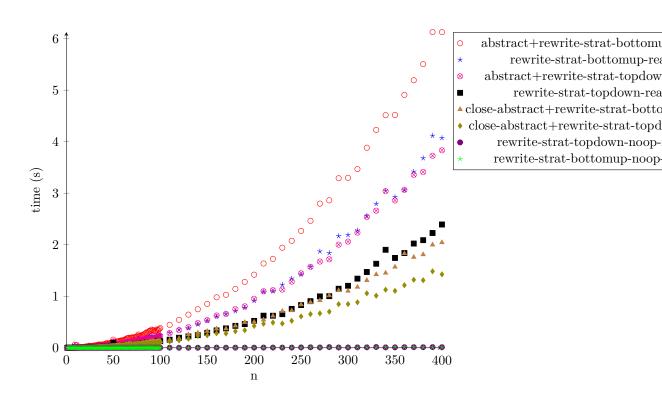
try-ssr-rewrite!-cold-noop-rea

 $\begin{array}{l} 5.11 \cdot 10^{-7} \cdot x + 2.71 \cdot 10^{-2} \\ \text{try-ssr-rewrite-noop-real} \end{array}$

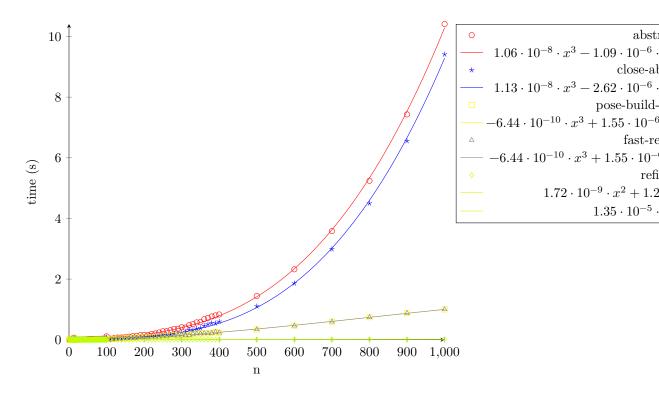
 $\begin{array}{l} 4.71\cdot 10^{-7}\cdot x - 1.74\cdot 10^{-3} \\ \text{try-ssr-rewrite?-noop-real} \end{array}$

 $\begin{aligned} &4.67 \cdot 10^{-7} \cdot x + 1.19 \cdot 10^{-3} \\ &\text{try-ssr-rewrite!-noop-real} \\ &4.66 \cdot 10^{-7} \cdot x + 3.91 \cdot 10^{-3} \end{aligned}$

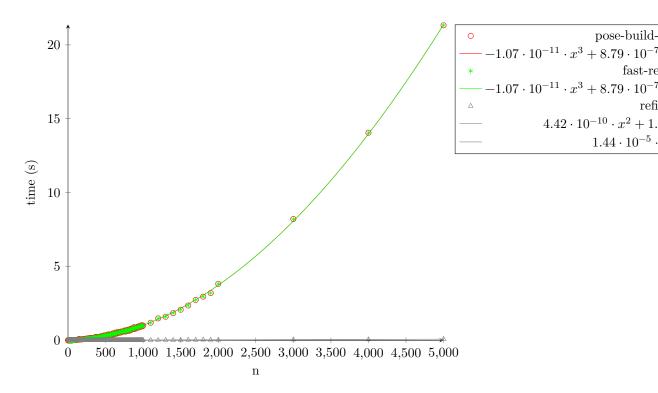
Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn $\ 1$



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



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



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

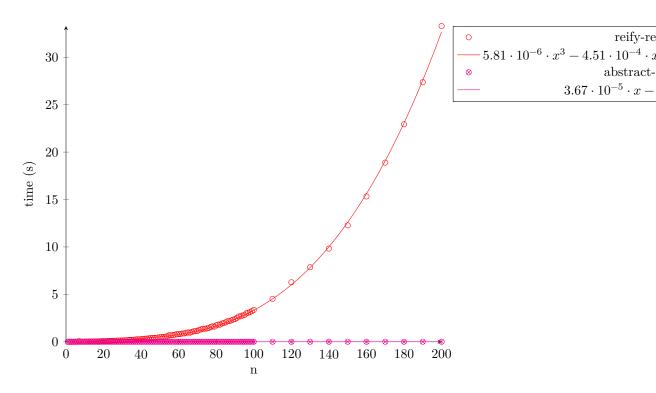


Figure 13: timing-typeclass-reification-let-in-HOAS

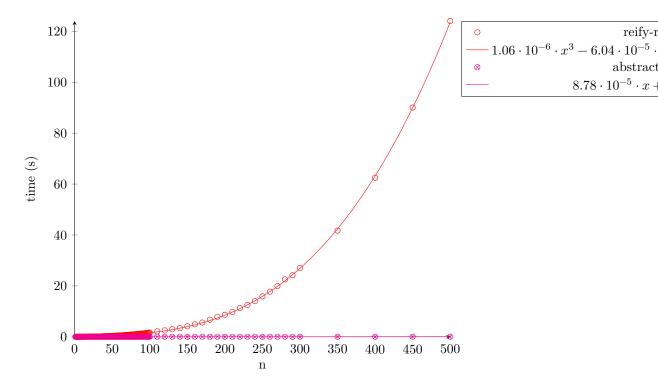
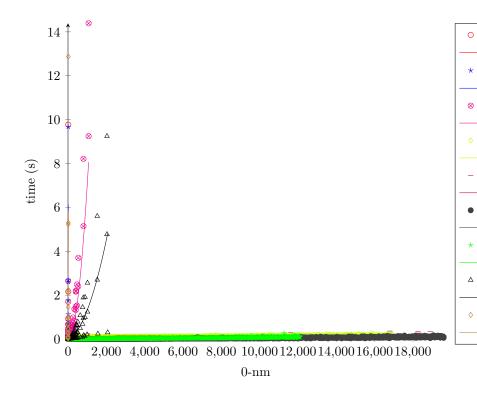


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(bottomup-bot $6 \cdot 10^{-3} \exp{(0.46 \cdot (0.46 \cdot (0.$

 $6.98 \cdot 10^{-6} \cdot x^2 - 2.42 \cdot 10^{-5} \cdot x^2$

 $1.3 \cdot 10^{-10} \cdot x^2 + 4.53 \cdot 10^{-6} \cdot x^2$

 $2.45 \cdot 10^{-10} \cdot x^2 + 3.93 \cdot 10^{-6} \cdot$

 $1.03 \cdot 10^{-10} \cdot x^2 + 3.34 \cdot 10^{-6}$

 $2.88\cdot 10^{-10}\cdot x^2 + 4.57\cdot 10^{-6}\cdot \\$

 $9.39 \cdot 10^{-7} \cdot x^2 + 3.9 \cdot 10^{-4} \cdot x^2$

 $-7.6 \cdot 10^{-3} \cdot x^3 + 0.24 \cdot x^2 -$

 $7.14 \cdot 10^{-3} exp (0.45 \cdot ($

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

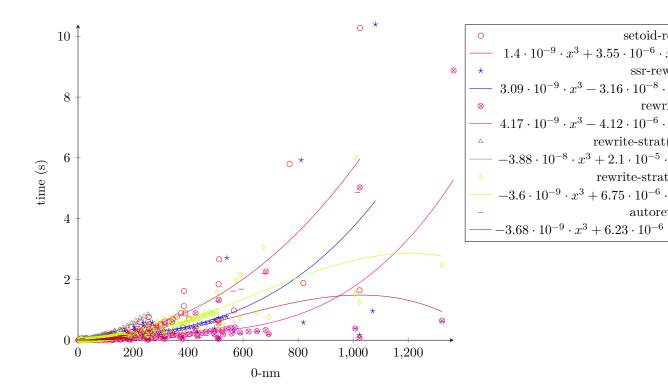
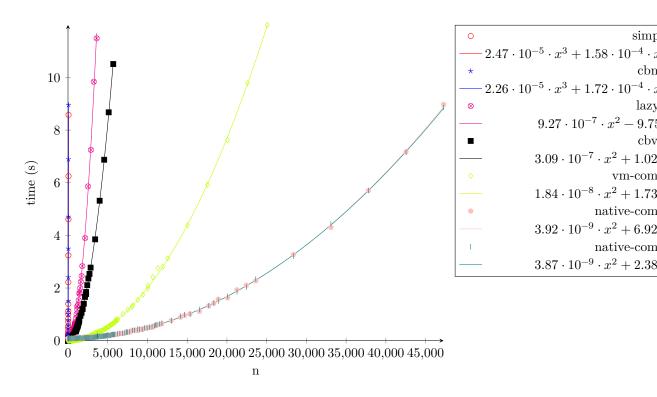


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $9.27 \cdot 10^{-7} \cdot x^2 - 9.75$

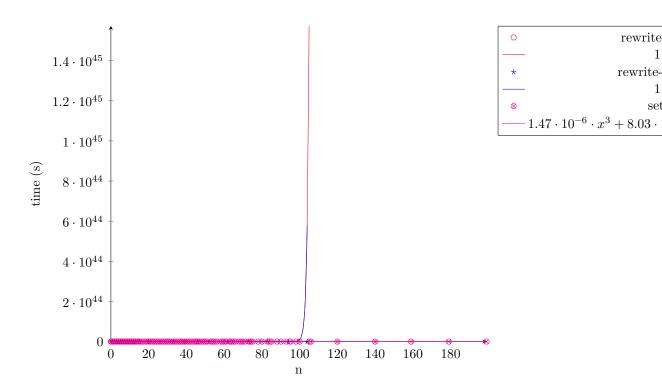
 $3.09 \cdot 10^{-7} \cdot x^2 + 1.02$

 $1.84 \cdot 10^{-8} \cdot x^2 + 1.73$

 $3.92 \cdot 10^{-9} \cdot x^2 + 6.92$

 $3.87 \cdot 10^{-9} \cdot x^2 + 2.38$

Figure 17: timing-sieve-of-eratosthenes



rewrite

rewrite-

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

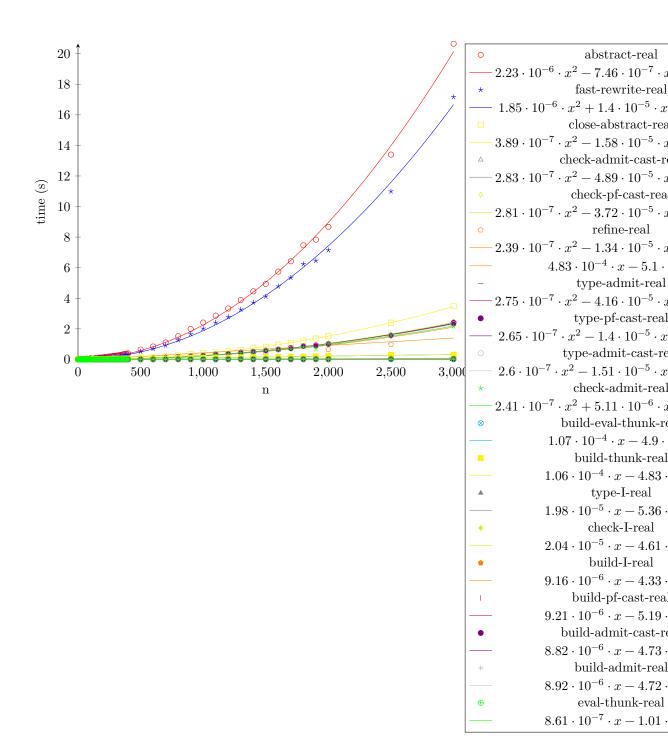


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2