

Figure 1: timing-pattern

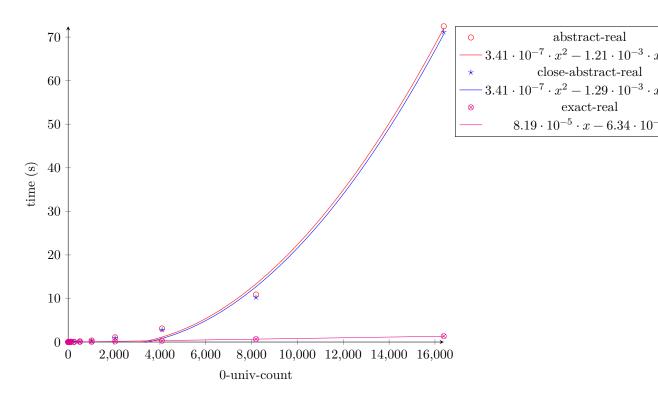


Figure 2: timing-n-polymorphic-universes param-1-n $\,0\,$

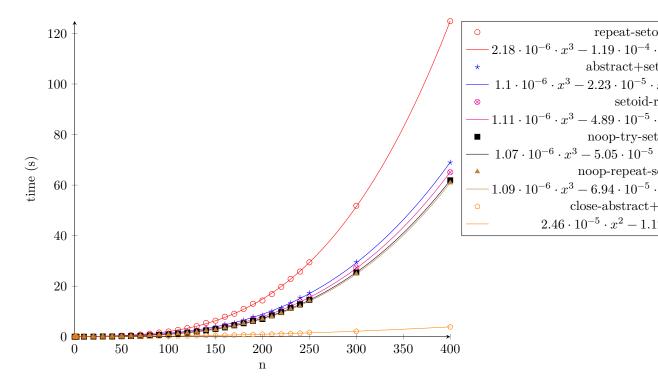
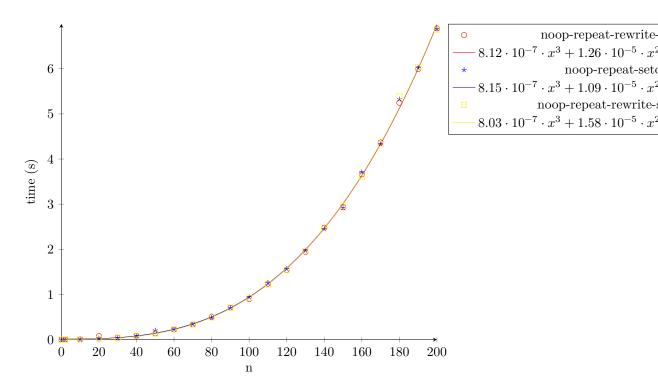
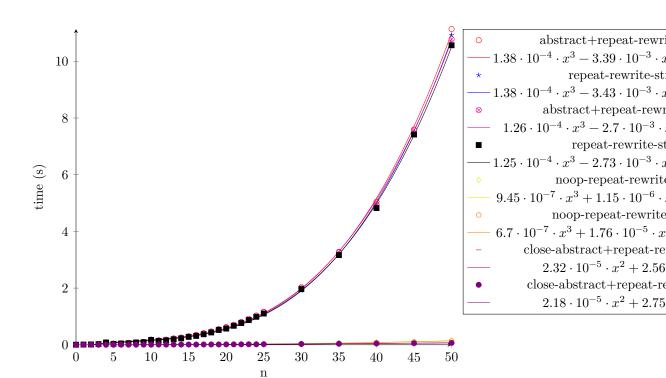


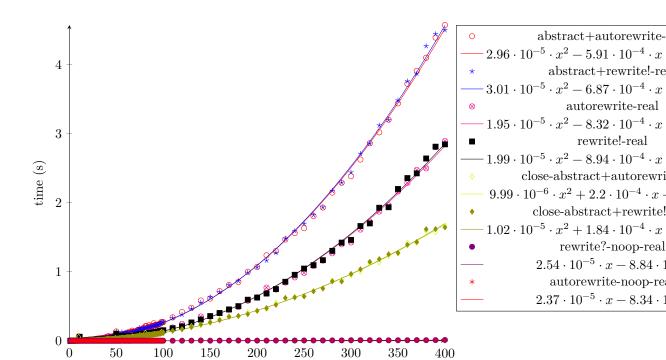
Figure 3: timing-repeat-setoid-rewrite-under-binders



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



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



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

n

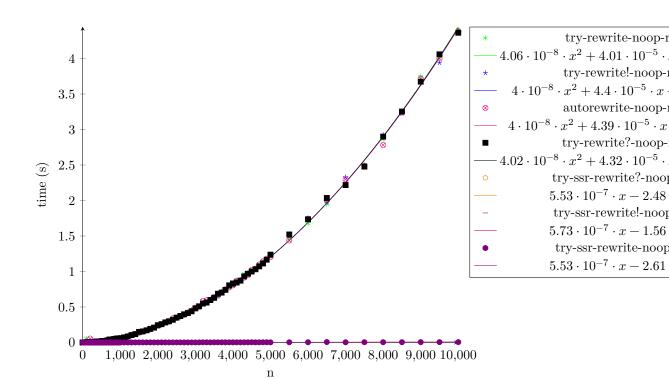
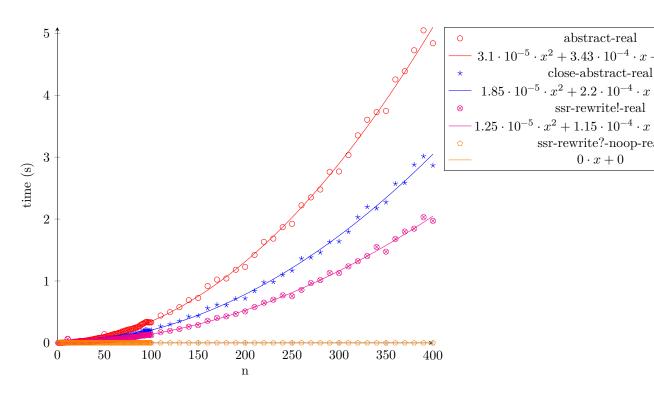


Figure 7: timing-rewrite-repeated-app-autorewrite-noop



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

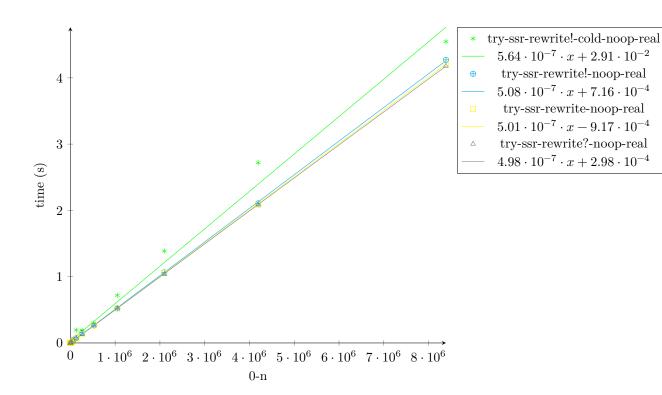
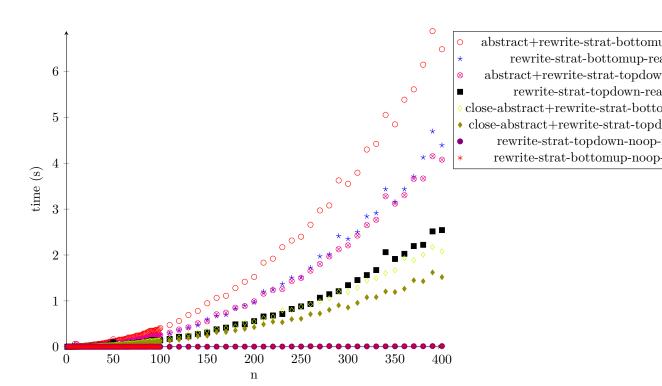
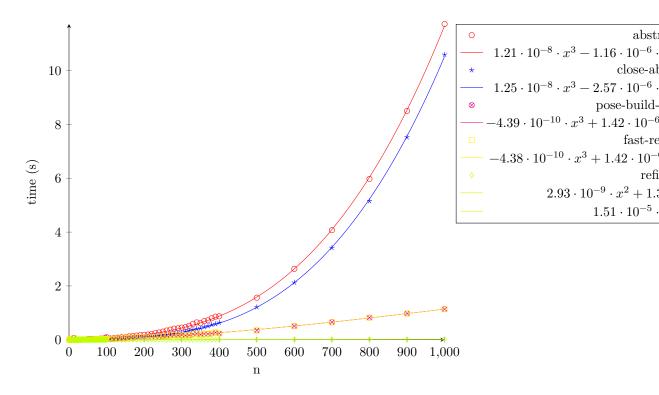


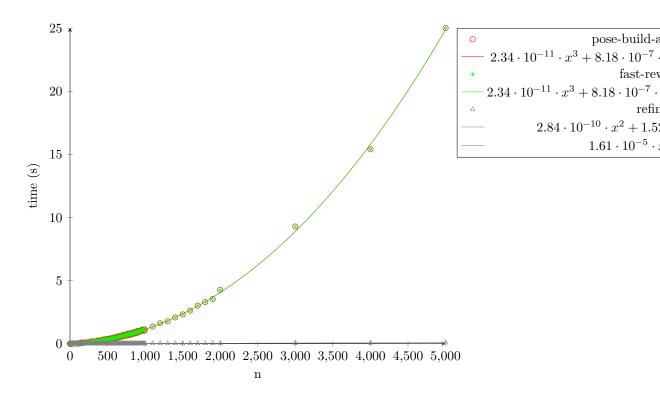
Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn $\ 1$



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



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



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

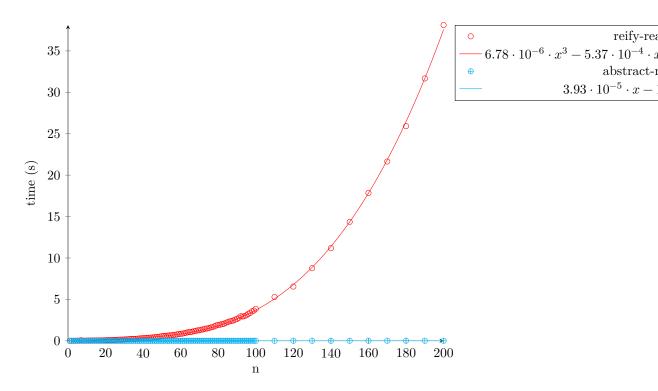


Figure 13: timing-typeclass-reification-let-in-HOAS

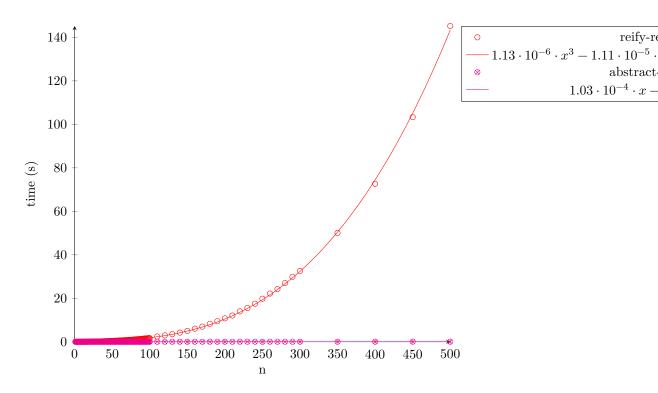
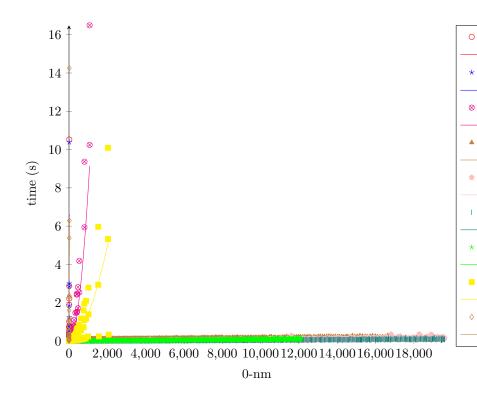


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(bottomup-bot $7.14 \cdot 10^{-3} \exp{(0.45 \cdot ($ rewrite-strat(topdown-bottomup-bottom

 $8.01\cdot 10^{-6}\cdot x^2 - 1.39\cdot 10^{-4}\cdot x^2 + 1.000\cdot x^2 +$

 $6.68 \cdot 10^{-12} \cdot x^2 + 7.7 \cdot 10^{-6} \cdot x^$

 $2.41 \cdot 10^{-10} \cdot x^2 + 4.26 \cdot 10^{-6} \cdot$

 $8.83 \cdot 10^{-11} \cdot x^2 + 4.11 \cdot 10^{-6} \cdot$

 $2.15\cdot 10^{-10}\cdot x^2 + 6.39\cdot 10^{-6}\cdot \\$

 $1.04 \cdot 10^{-6} \cdot x^2 + 4.1 \cdot 10^{-4} \cdot x^2$

 $-8.24 \cdot 10^{-3} \cdot x^3 + 0.26 \cdot x^2 -$

 $8.09 \cdot 10^{-3} \exp{(0.45 \cdot ($

cps+native-compute

cps+cbn-real

cps+lazy-real

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

cps+simpl-real

setoid-rewrite-re

cps+vm-compute-

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

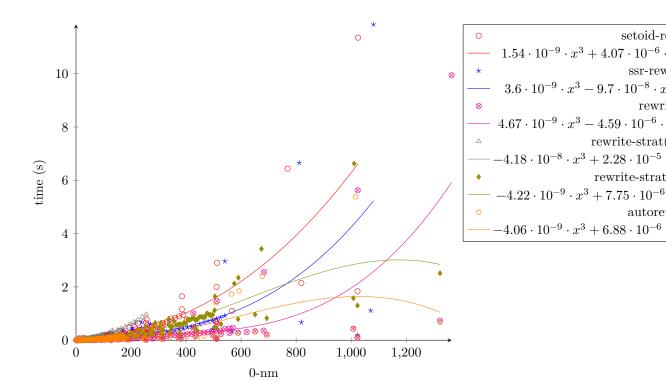
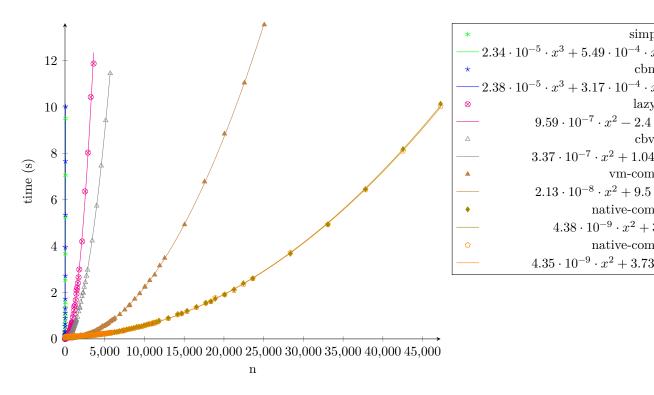


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com $4.38 \cdot 10^{-9} \cdot x^2 + 3$

native-com

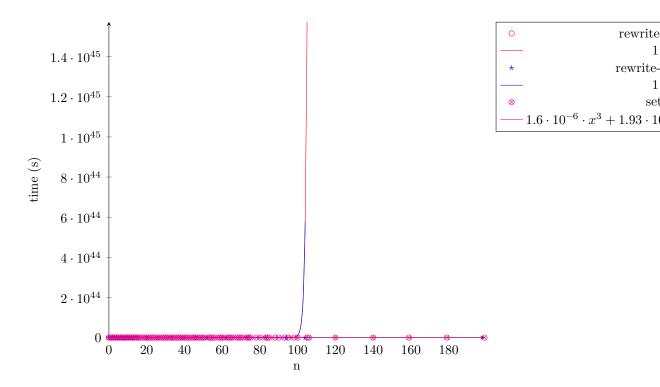
 $9.59 \cdot 10^{-7} \cdot x^2 - 2.4$

 $3.37 \cdot 10^{-7} \cdot x^2 + 1.04$

 $2.13 \cdot 10^{-8} \cdot x^2 + 9.5$

 $4.35 \cdot 10^{-9} \cdot x^2 + 3.73$

Figure 17: timing-sieve-of-eratosthenes



rewrite

rewrite-

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

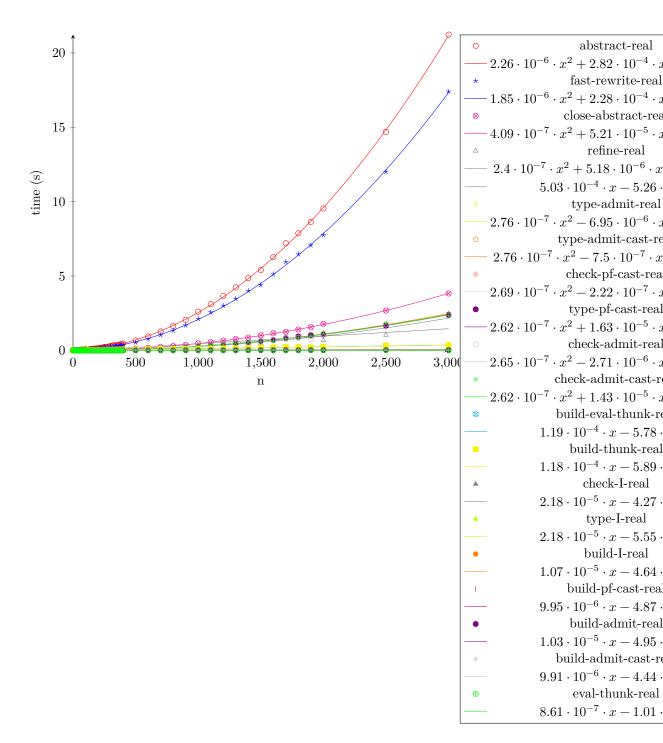


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2