

Figure 1: timing-pattern

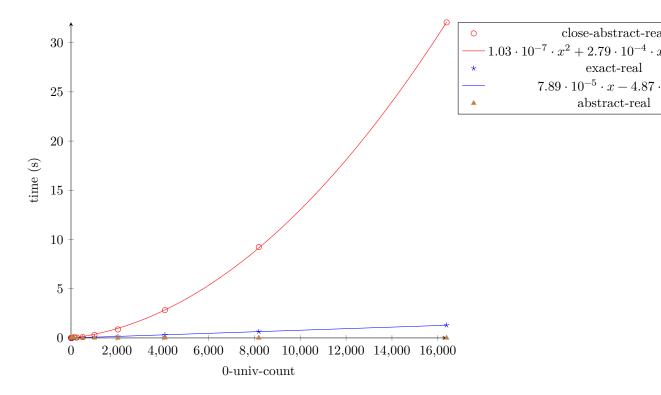
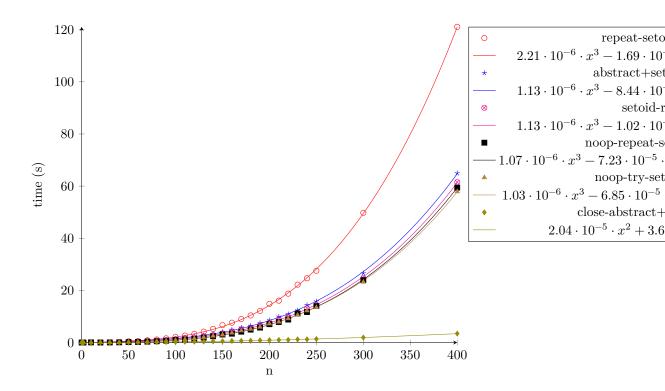


Figure 2: timing-n-polymorphic-universes param-1-n 0



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

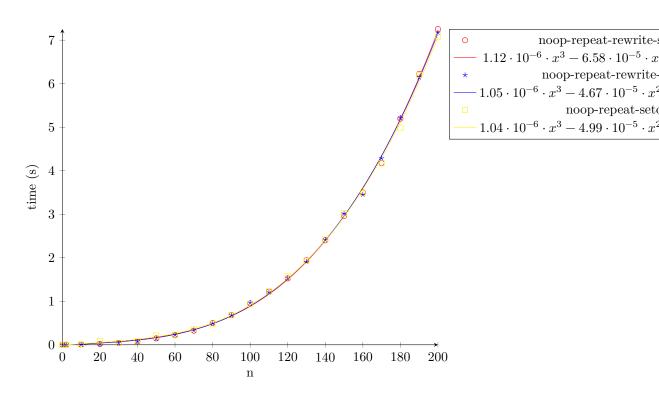
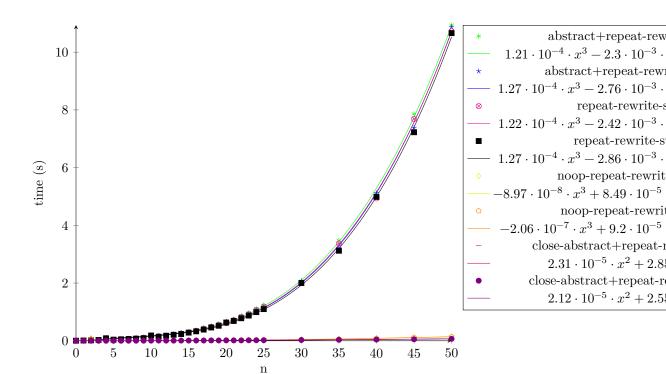
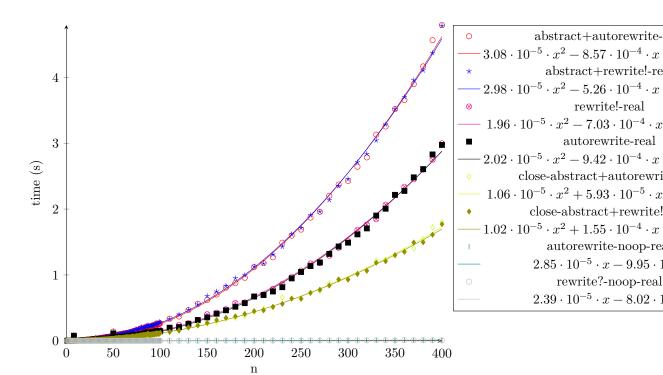


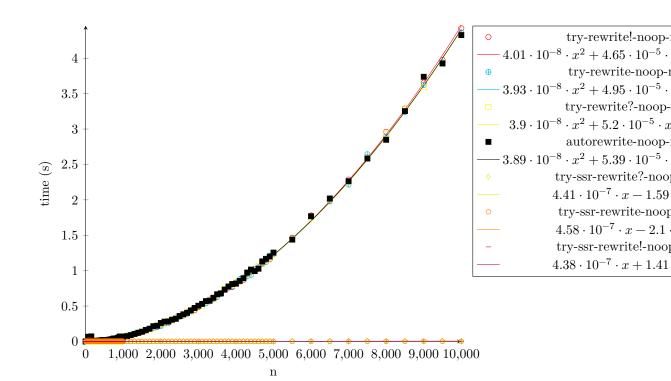
Figure 4: timing-repeat-setoid-rewrite-under-binders-noop



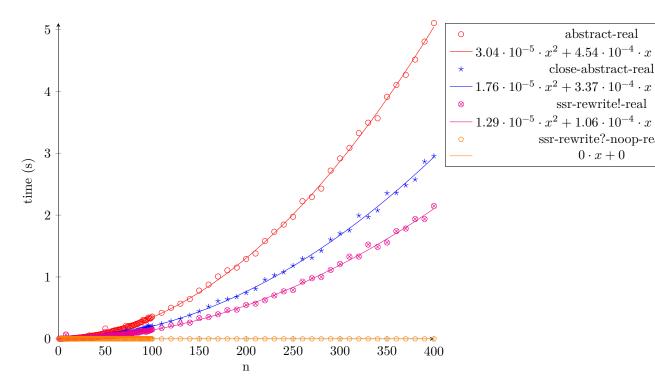
 $Figure\ 5:\ timing-rewrite-strat-under-binders$



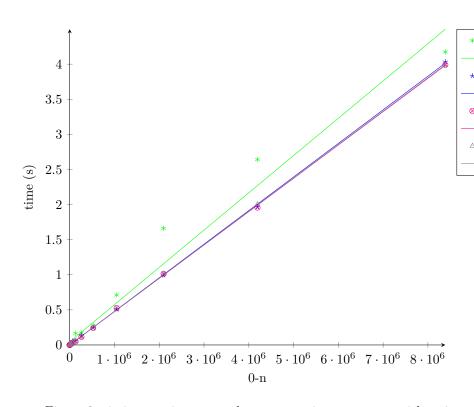
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$



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



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



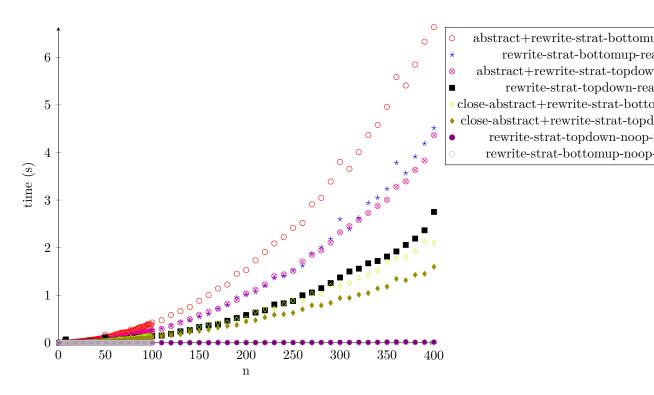
try-ssr-rewrite!-cold-noop-rea $5.31\cdot 10^{-7}\cdot x + 4.31\cdot 10^{-2}$

try-ssr-rewrite!-noop-real $4.79\cdot 10^{-7}\cdot x - 7.66\cdot 10^{-5}$

try-ssr-rewrite-noop-real $4.75\cdot 10^{-7}\cdot x - 6.35\cdot 10^{-4}$

try-ssr-rewrite?-noop-real $4.76\cdot 10^{-7}\cdot x - 3.74\cdot 10^{-5}$

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

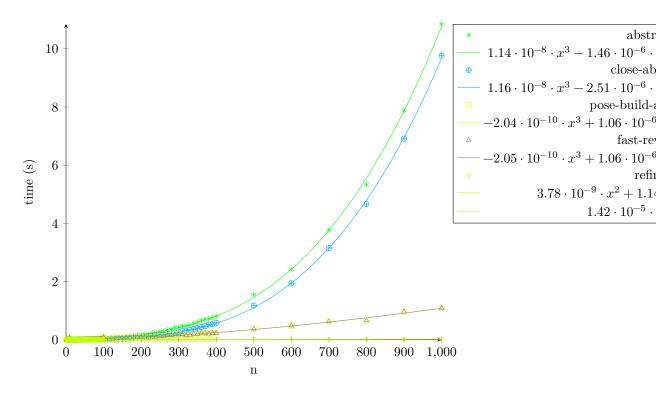


rewrite-strat-bottomup-rea

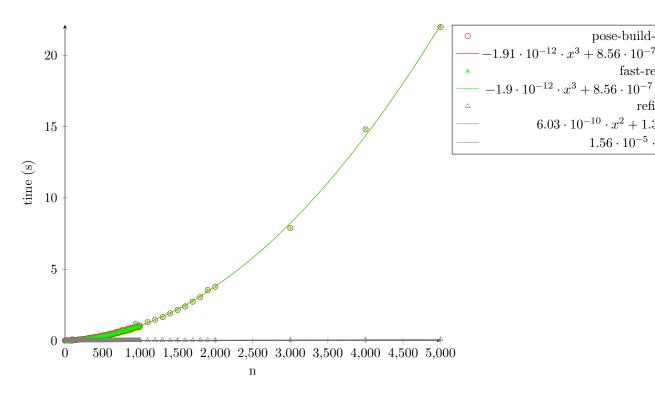
rewrite-strat-topdown-rea

rewrite-strat-topdown-noop-

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



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



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

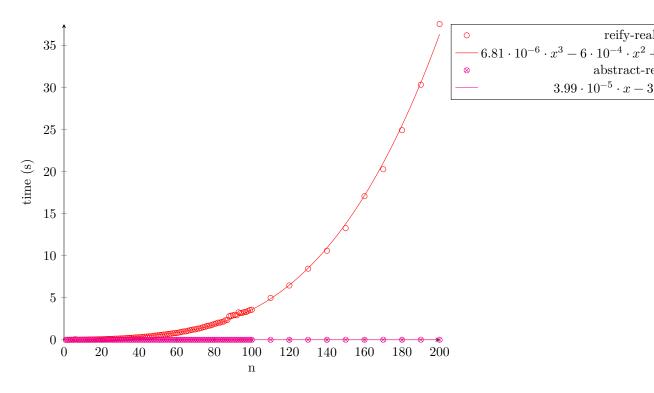


Figure 13: timing-typeclass-reification-let-in-HOAS

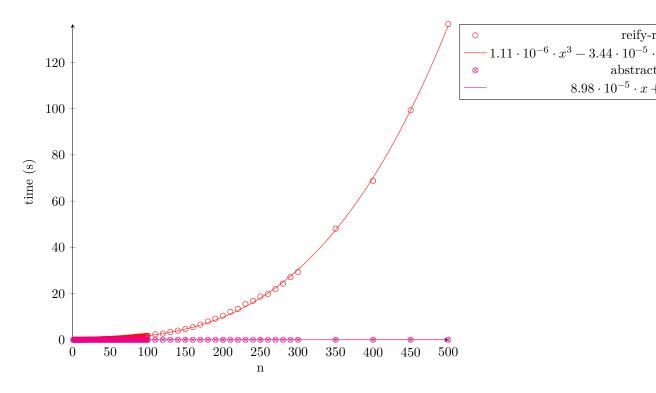
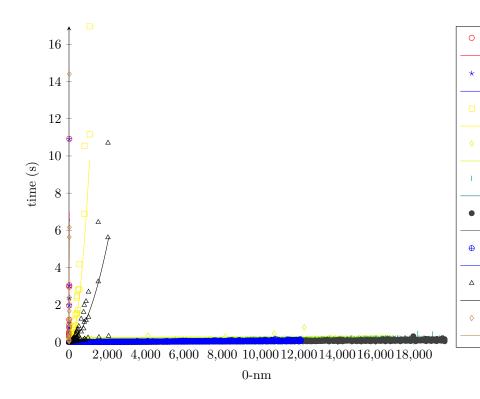


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(topdown-bot

 $8.63 \cdot 10^{-6} \cdot x^2 - 2.08 \cdot 10^{-4} \cdot x^2 = 2.08 \cdot 10^{-4} \cdot x^2$

 $2.27 \cdot 10^{-11} \cdot x^2 + 6.8 \cdot 10^{-6} \cdot x^$

 $2.36 \cdot 10^{-10} \cdot x^2 + 4.72 \cdot 10^{-6} \cdot$

 $1.14 \cdot 10^{-10} \cdot x^2 + 3.69 \cdot 10^{-6} \cdot$

 $1.54 \cdot 10^{-10} \cdot x^2 + 5.25 \cdot 10^{-6} \cdot$

 $1.15 \cdot 10^{-6} \cdot x^2 + 3.42 \cdot 10^{-4} \cdot x^2$

 $-8.37 \cdot 10^{-3} \cdot x^3 + 0.27 \cdot x^2 -$

 $7.36\cdot 10^{-3}\exp{(0.46\cdot ($ rewrite-strat(bottomup-bot

 $7.25 \cdot 10^{-3} \exp{(0.45 \cdot ($

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

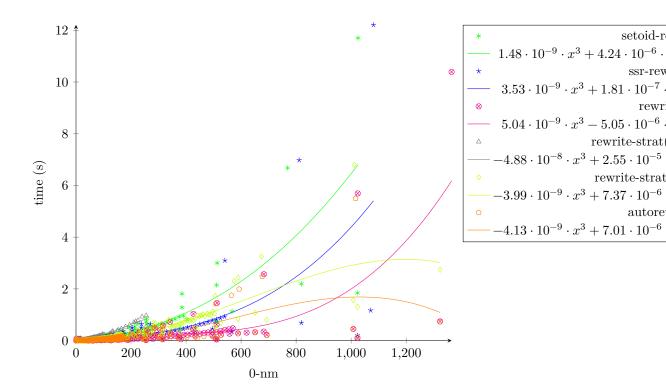
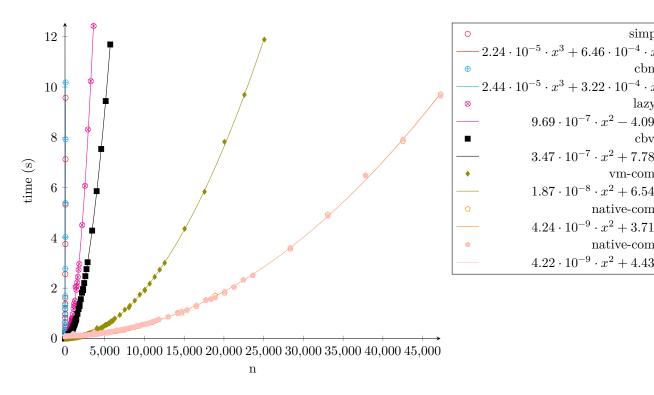


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

lazy

vm-com

native-com

native-com

 $9.69 \cdot 10^{-7} \cdot x^2 - 4.09$

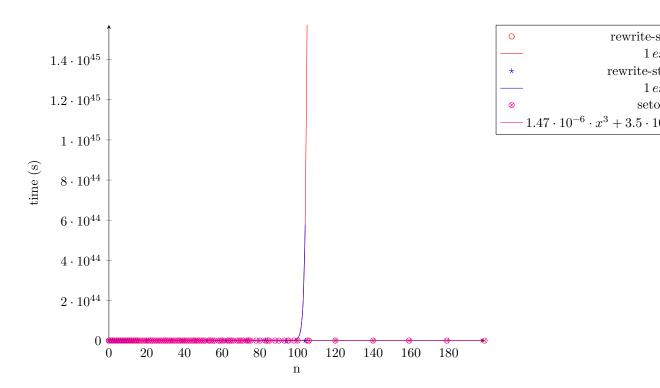
 $3.47 \cdot 10^{-7} \cdot x^2 + 7.78$

 $1.87 \cdot 10^{-8} \cdot x^2 + 6.54$

 $4.24 \cdot 10^{-9} \cdot x^2 + 3.71$

 $4.22 \cdot 10^{-9} \cdot x^2 + 4.43$

Figure 17: timing-sieve-of-eratosthenes



rewrite-s

rewrite-st

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