

Figure 1: timing-pattern

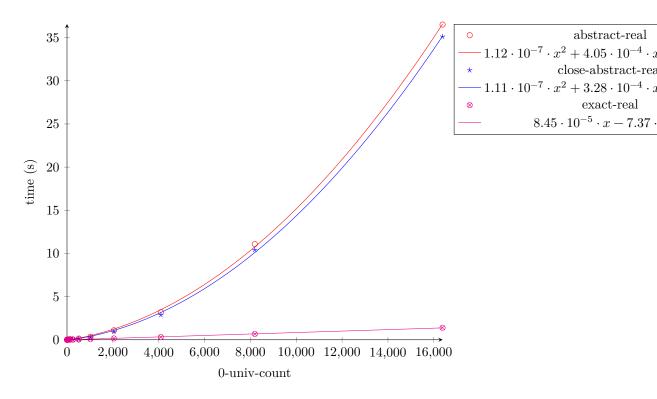
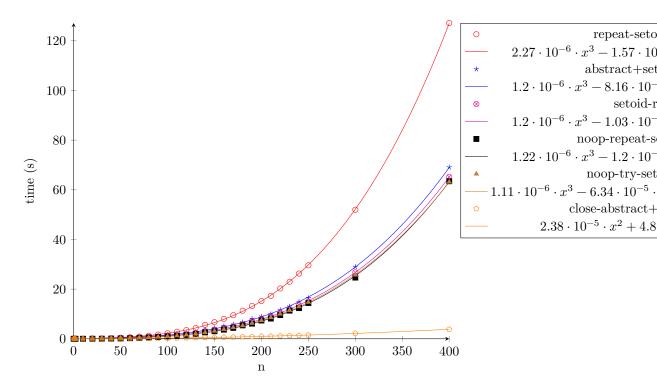


Figure 2: timing-n-polymorphic-universes param-1-n $\,0\,$



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

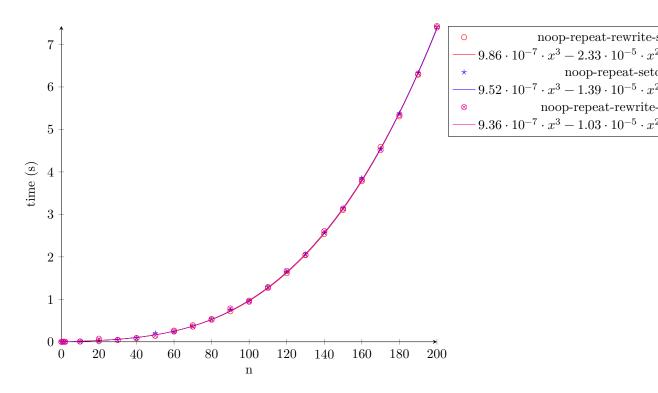
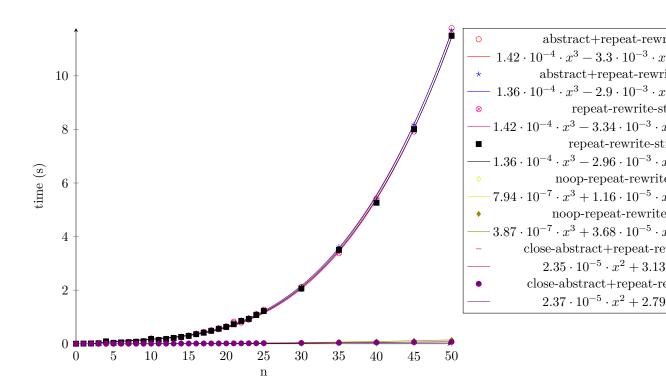
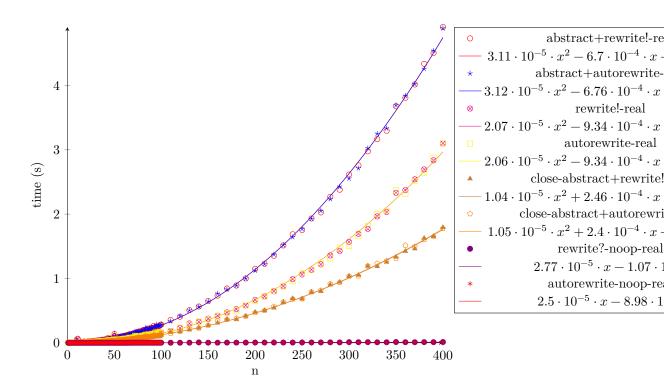


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop



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



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

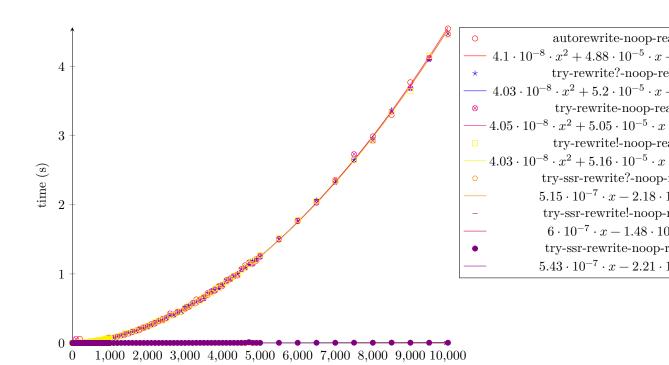
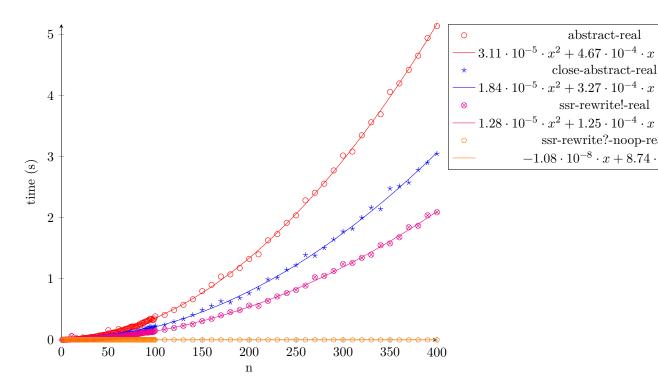


Figure 7: timing-rewrite-repeated-app-autorewrite-noop

n



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

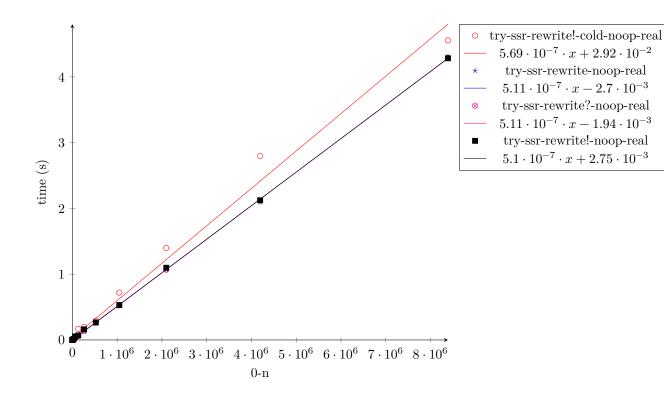
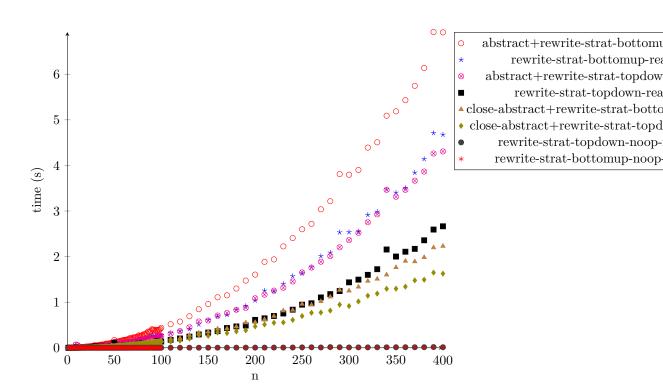
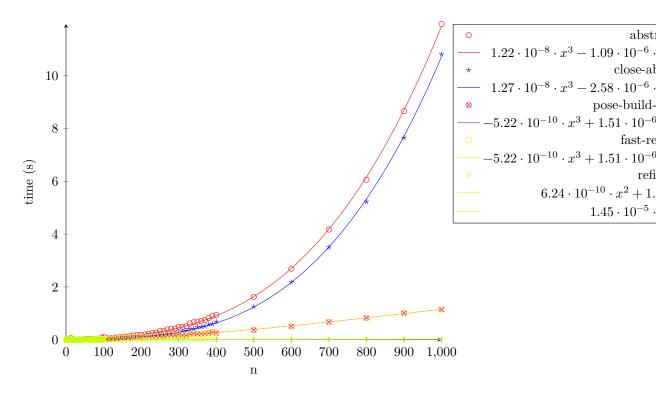


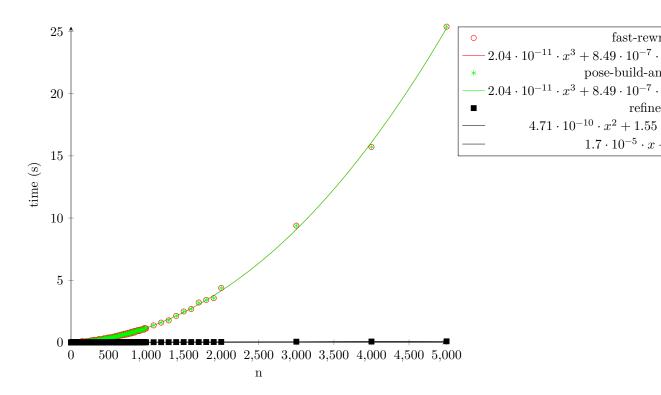
Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn $\ 1$



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



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



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

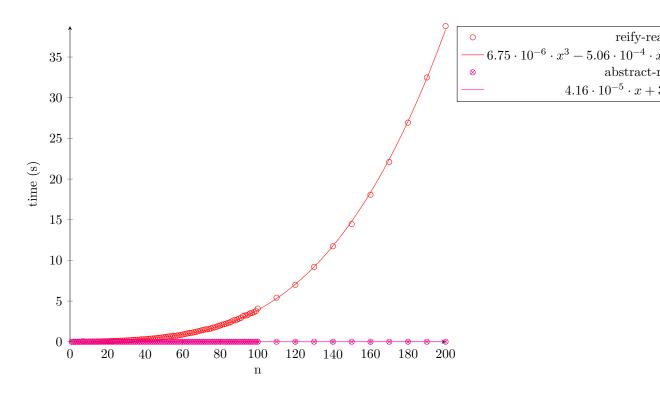
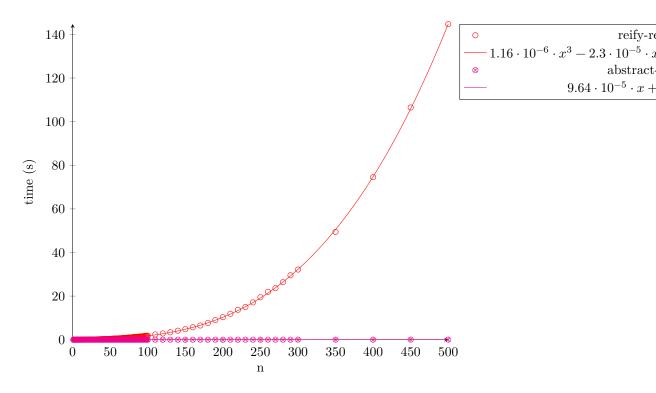
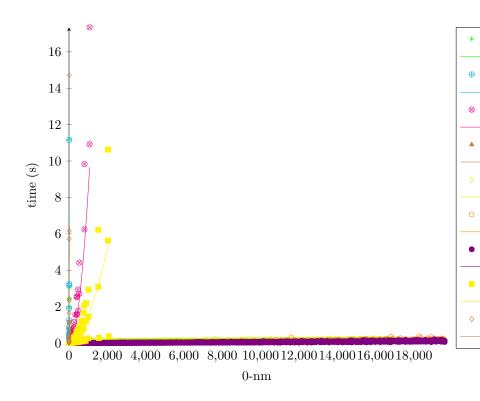


Figure 13: timing-typeclass-reification-let-in-HOAS



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



rewrite-strat(bottomup-bot

 $8.5 \cdot 10^{-6} \cdot x^2 - 1.94 \cdot 10^{-4} \cdot x^2 - 1.94 \cdot 10^{-4} \cdot x^2 + 1.94 \cdot 10^{-4} \cdot x^2$

 $1.99 \cdot 10^{-10} \cdot x^2 + 6.42 \cdot 10^{-6} \cdot \\$

 $6.77 \cdot 10^{-11} \cdot x^2 + 6.27 \cdot 10^{-6} \cdot$

 $2.6\cdot 10^{-10}\cdot x^2 + 4.38\cdot 10^{-6}\cdot\\$

 $1.19 \cdot 10^{-10} \cdot x^2 + 3.75 \cdot 10^{-6} \cdot \\$

 $1.1 \cdot 10^{-6} \cdot x^2 + 4.18 \cdot 10^{-4} \cdot x^2$

 $-8.52 \cdot 10^{-3} \cdot x^3 + 0.27 \cdot x^2 -$

 $6.99 \cdot 10^{-3} \exp{(0.46 \cdot ($ rewrite-strat(topdown-bot

 $7.75 \cdot 10^{-3} \exp{(0.46 \cdot ($

cps+vm-compute-

cps+native-compute

cps+cbn-real

cps+lazy-real

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

cps+simpl-real

setoid-rewrite-re

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

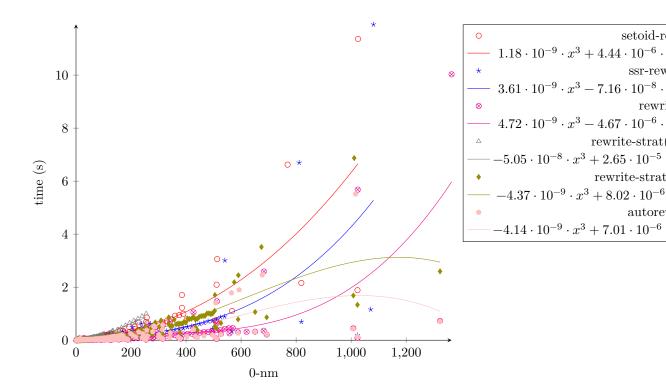
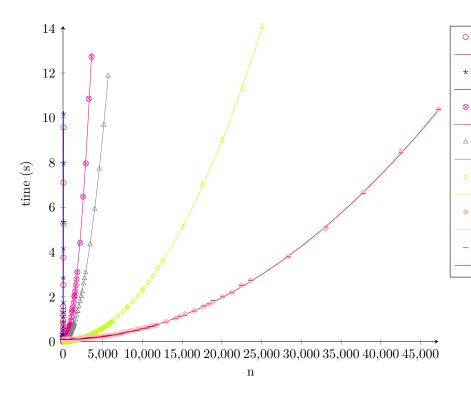


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $2.34 \cdot 10^{-5} \cdot x^3 + 5.51 \cdot 10^{-4} \cdot x^3$

 $2.27 \cdot 10^{-5} \cdot x^3 + 4.86 \cdot 10^{-4} \cdot x^3$

 $1.02 \cdot 10^{-6} \cdot x^2 - 7.81$

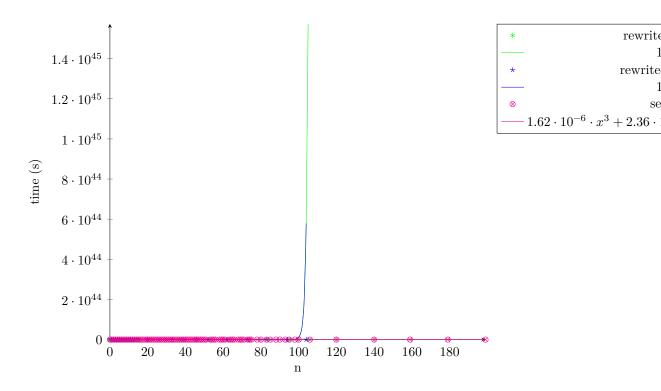
 $3.52 \cdot 10^{-7} \cdot x^2 + 8.75$

 $2.18 \cdot 10^{-8} \cdot x^2 + 1.26$

 $4.53 \cdot 10^{-9} \cdot x^2 + 3.27$

 $4.52 \cdot 10^{-9} \cdot x^2 + 2.92$

 ${\bf Figure~17:~timing\hbox{-}sieve\hbox{-}of\hbox{-}eratosthenes}$



rewrite

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

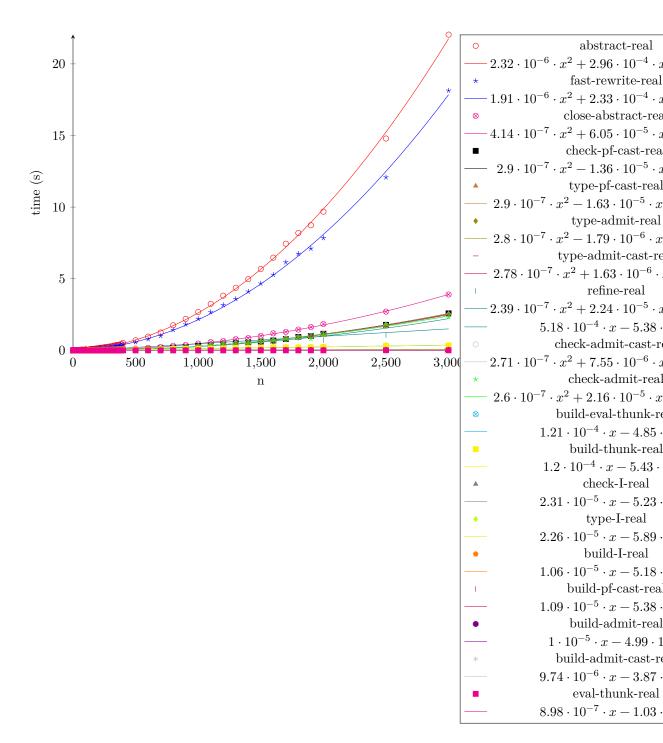


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2