

Figure 1: timing-pattern

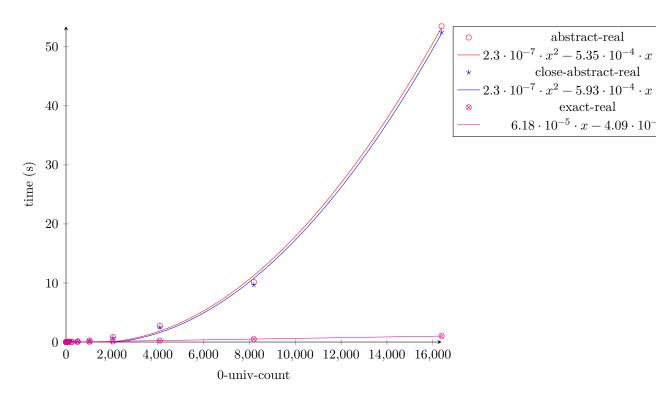
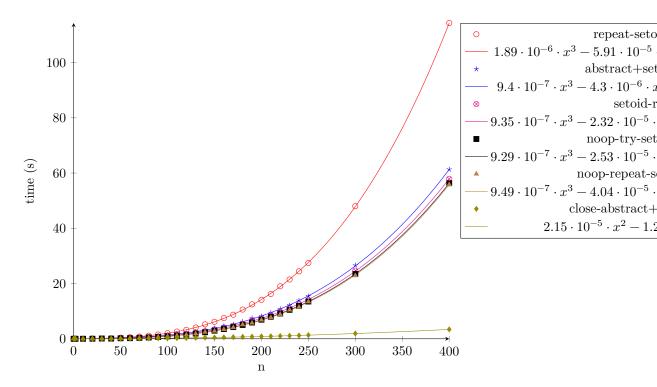
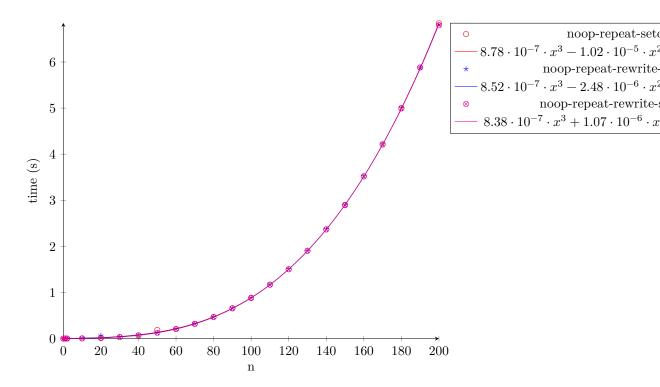


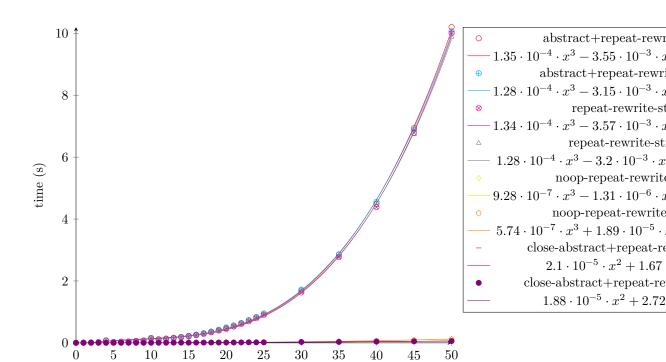
Figure 2: timing-n-polymorphic-universes param-1-n  $\,0\,$ 



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

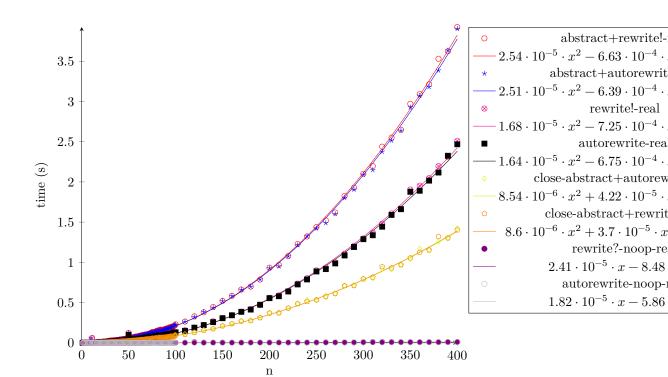


 $Figure\ 4:\ timing-repeat-setoid-rewrite-under-binders-noop$ 

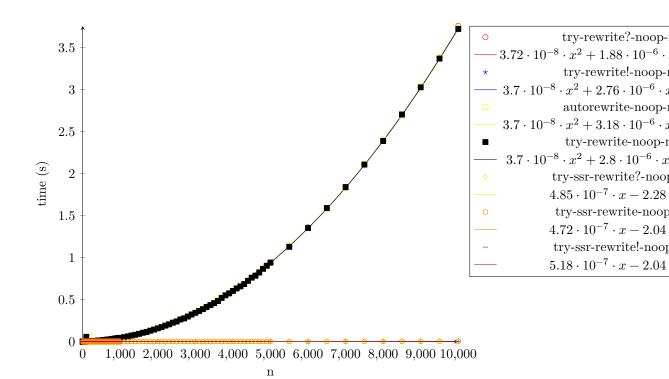


 $Figure\ 5:\ timing-rewrite-strat-under-binders$ 

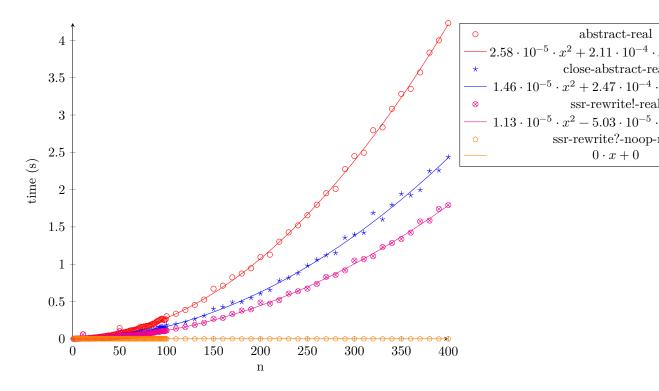
n



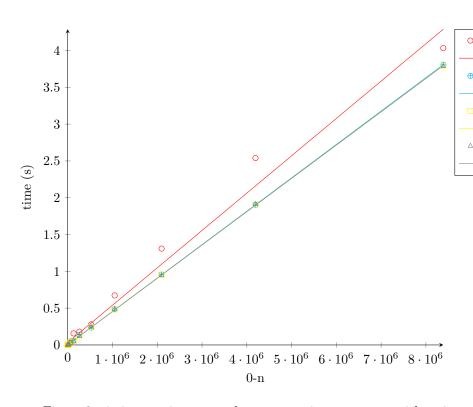
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$ 



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



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



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

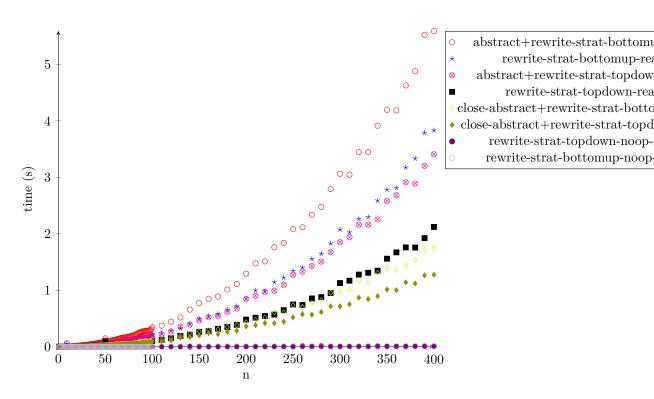
 $5.07 \cdot 10^{-7} \cdot x + 3.23 \cdot 10^{-2}$  try-ssr-rewrite!-noop-real

 $\begin{array}{l} 4.54 \cdot 10^{-7} \cdot x + 2.18 \cdot 10^{-3} \\ \text{try-ssr-rewrite?-noop-real} \end{array}$ 

 $\begin{array}{l} 4.52 \cdot 10^{-7} \cdot x + 7.48 \cdot 10^{-4} \\ \text{try-ssr-rewrite-noop-real} \end{array}$ 

 $4.52 \cdot 10^{-7} \cdot x + 4.53 \cdot 10^{-4}$ 

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

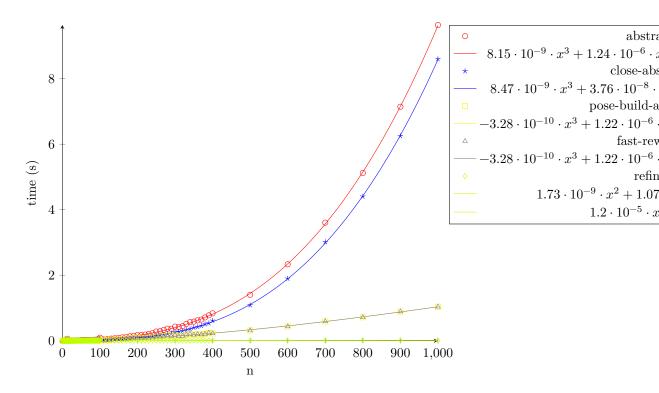


rewrite-strat-bottomup-rea

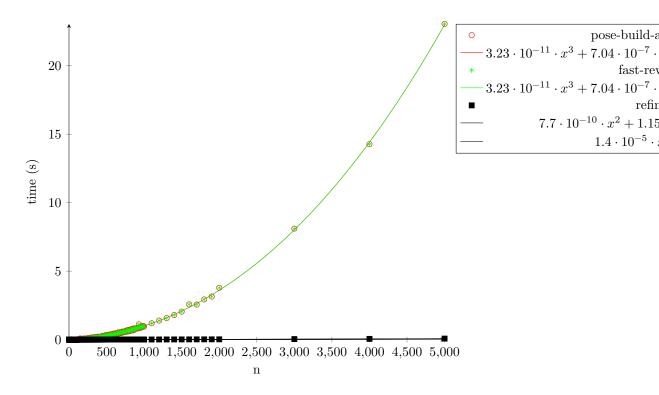
rewrite-strat-topdown-rea

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

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



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



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

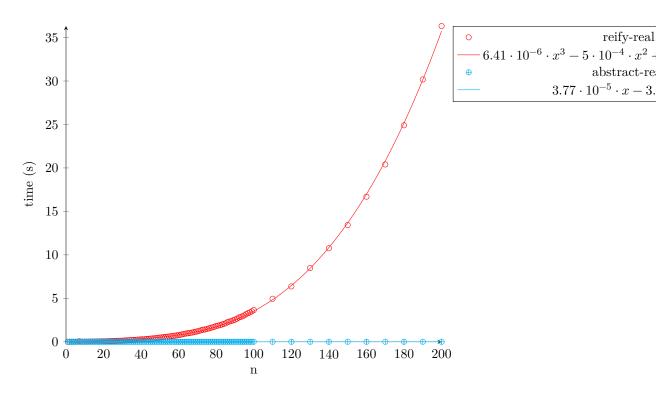


Figure 13: timing-typeclass-reification-let-in-HOAS

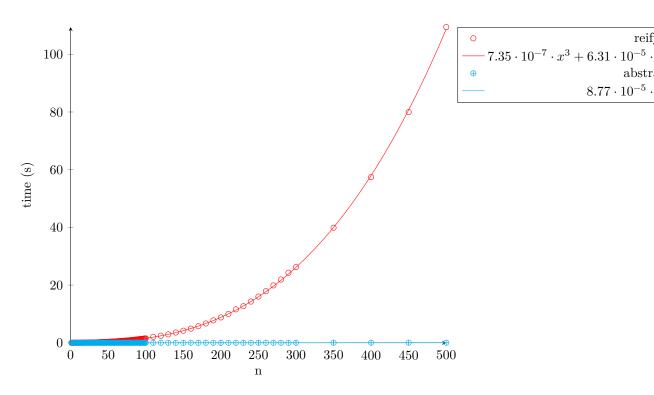
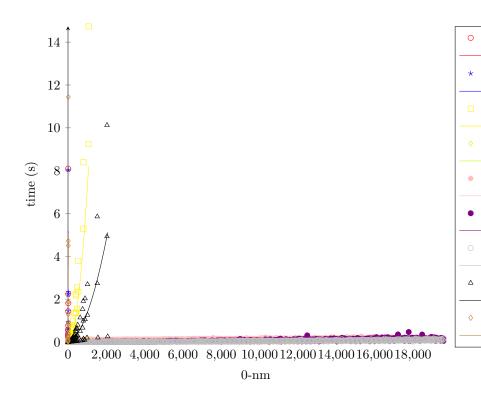


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(bottomup-bot

 $7.14 \cdot 10^{-6} \cdot x^2 - 7.3 \cdot 10^{-5} \cdot x^2$ 

 $1.74 \cdot 10^{-10} \cdot x^2 + 5.65 \cdot 10^{-6} \cdot$ 

 $7 \cdot 10^{-11} \cdot x^2 + 5.69 \cdot 10^{-6} \cdot x^2$ 

 $2.11\cdot 10^{-10}\cdot x^2 + 4.61\cdot 10^{-6}\cdot \\$ 

 $1.15 \cdot 10^{-10} \cdot x^2 + 3.35 \cdot 10^{-6} \cdot$ 

 $1.03 \cdot 10^{-6} \cdot x^2 + 3.4 \cdot 10^{-4} \cdot x^2$ 

 $-6.62 \cdot 10^{-3} \cdot x^3 + 0.21 \cdot x^2 -$ 

 $5.26\cdot 10^{-3} \exp{(0.46\cdot ($ rewrite-strat(topdown-both

 $5.53 \cdot 10^{-3} \exp{(0.46 \cdot ($ 

cps+cbn-real

cps+lazy-real

cps+cbv-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

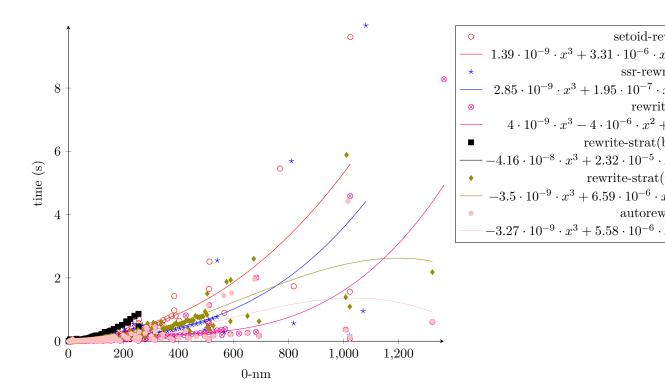
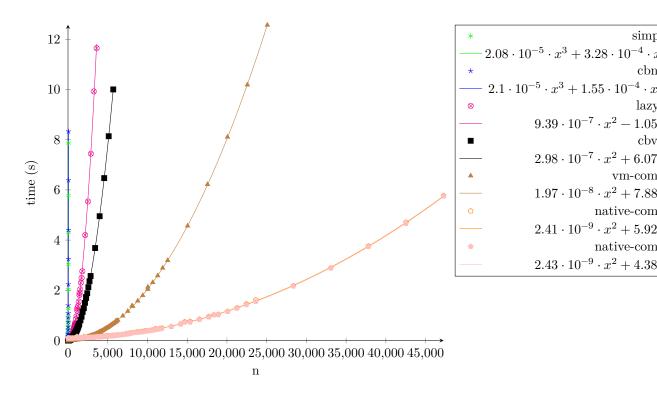


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

lazy

vm-com

native-com

native-com

 $9.39 \cdot 10^{-7} \cdot x^2 - 1.05$ 

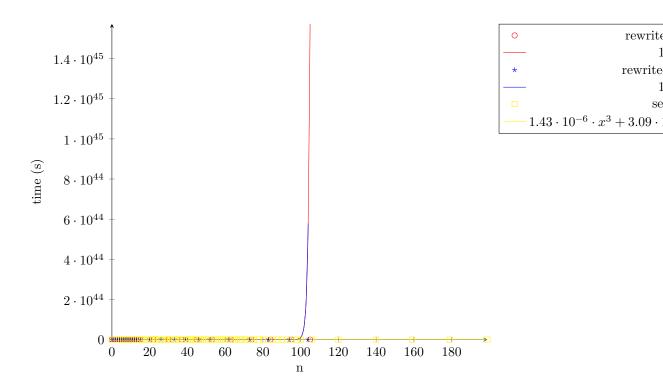
 $2.98 \cdot 10^{-7} \cdot x^2 + 6.07$ 

 $1.97 \cdot 10^{-8} \cdot x^2 + 7.88$ 

 $2.41 \cdot 10^{-9} \cdot x^2 + 5.92$ 

 $2.43 \cdot 10^{-9} \cdot x^2 + 4.38$ 

Figure 17: timing-sieve-of-eratosthenes



rewrite

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

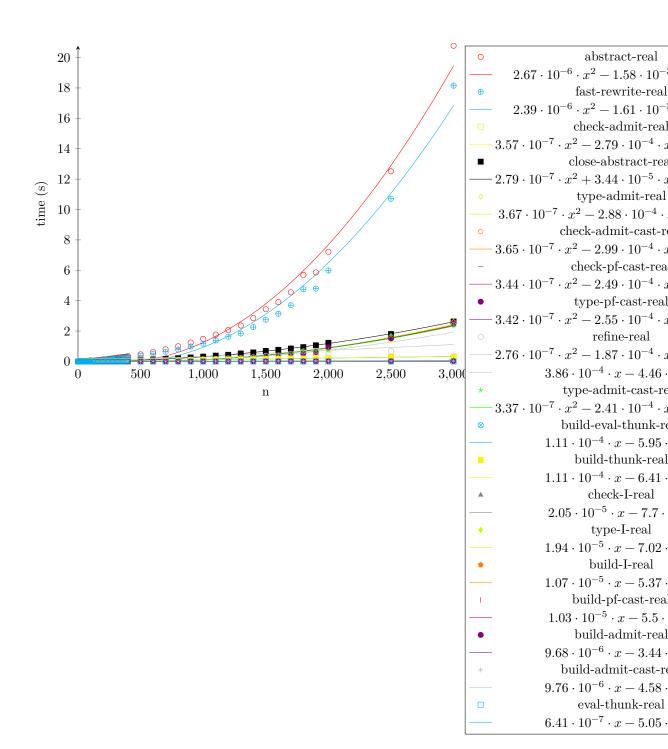


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2