

Figure 1: timing-pattern

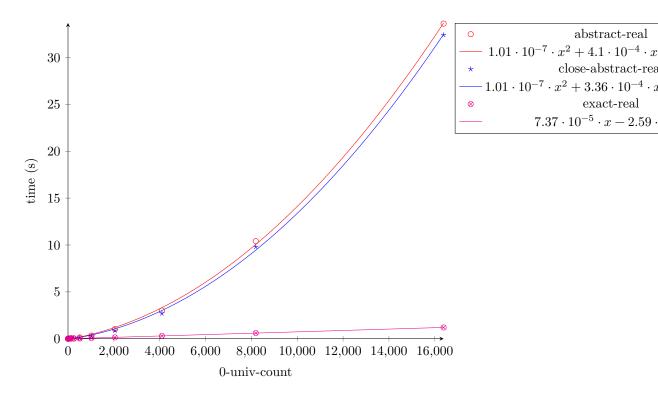


Figure 2: timing-n-polymorphic-universes param-1-n  $\,0\,$ 

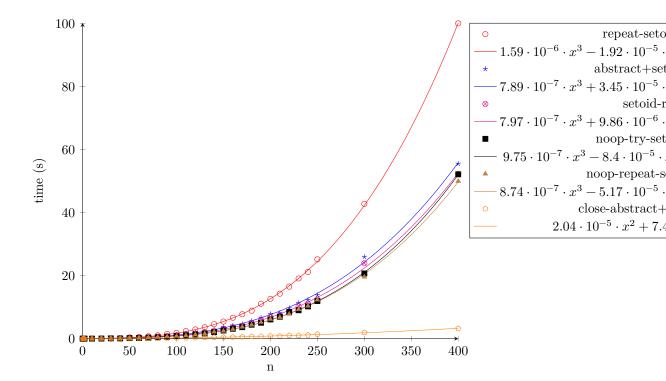


Figure 3: timing-repeat-setoid-rewrite-under-binders

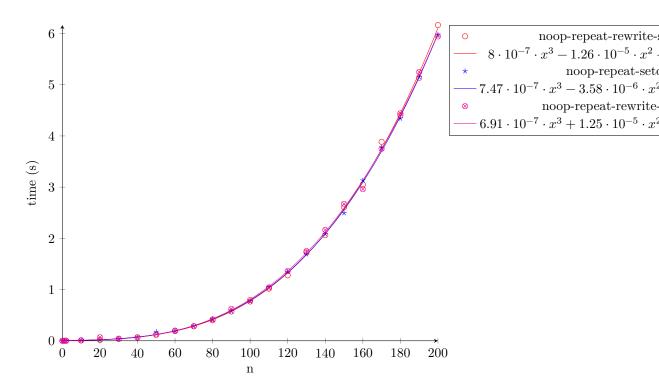
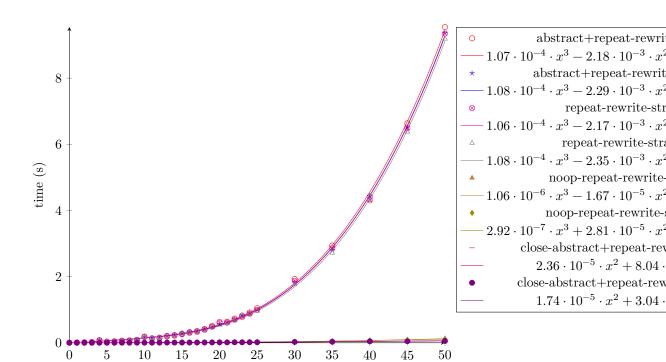
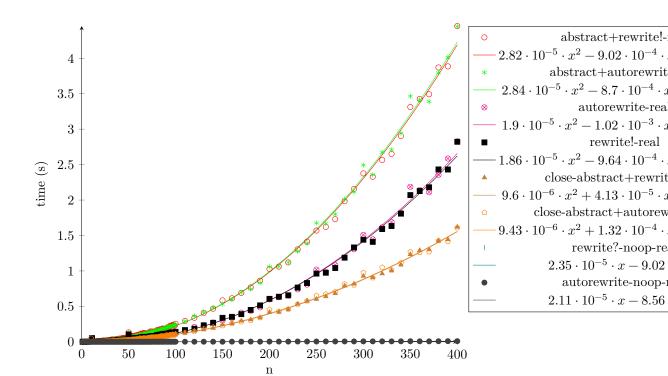


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

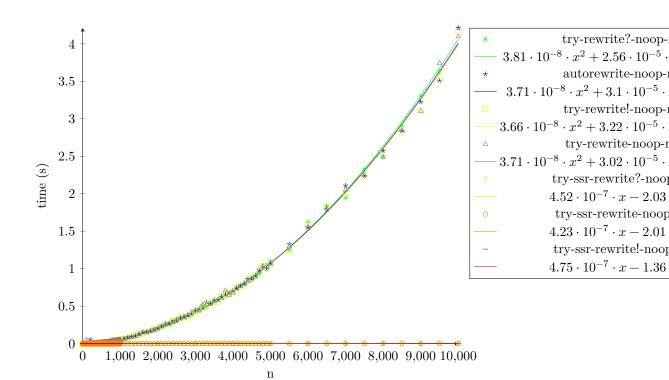


 $Figure\ 5:\ timing-rewrite-strat-under-binders$ 

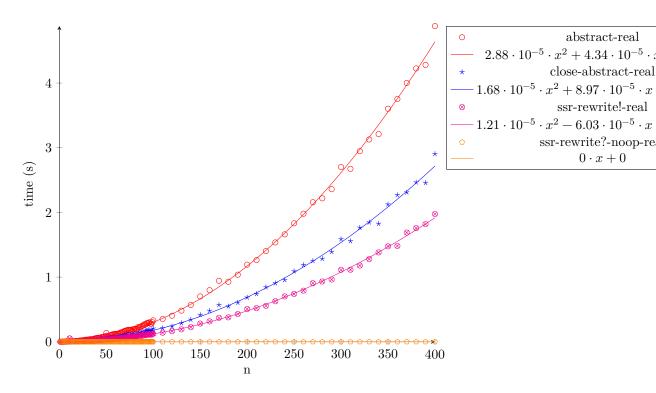
n



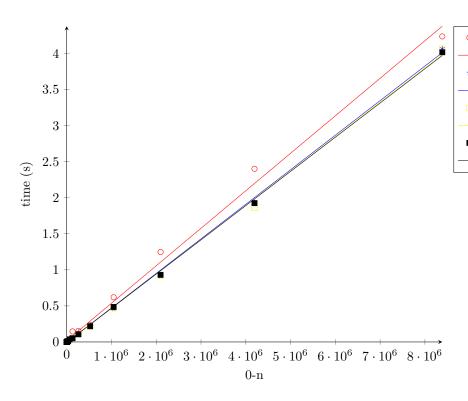
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$ 



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



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



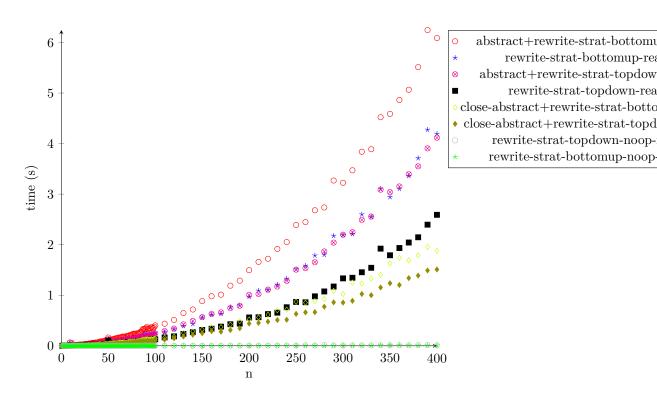
try-ssr-rewrite!-cold-noop-rea  $5.2 \cdot 10^{-7} \cdot x + 1.7 \cdot 10^{-2}$ 

try-ssr-rewrite!-noop-real  $4.79\cdot 10^{-7}\cdot x - 6.85\cdot 10^{-3}$ 

 $\begin{array}{l} \text{try-ssr-rewrite-noop-real} \\ 4.76 \cdot 10^{-7} \cdot x - 1.06 \cdot 10^{-2} \end{array}$ 

try-ssr-rewrite?-noop-real  $4.74\cdot 10^{-7}\cdot x - 7.23\cdot 10^{-3}$ 

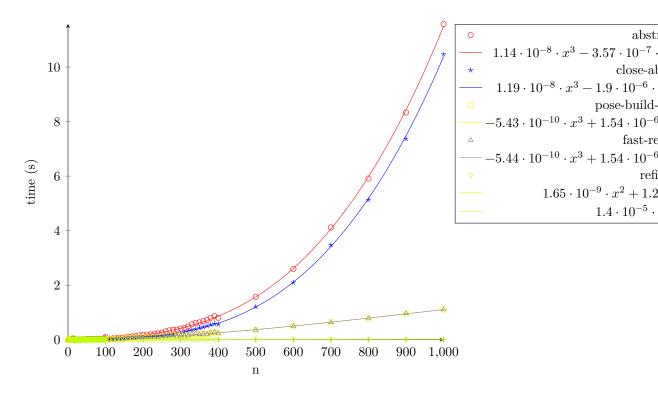
Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn 1



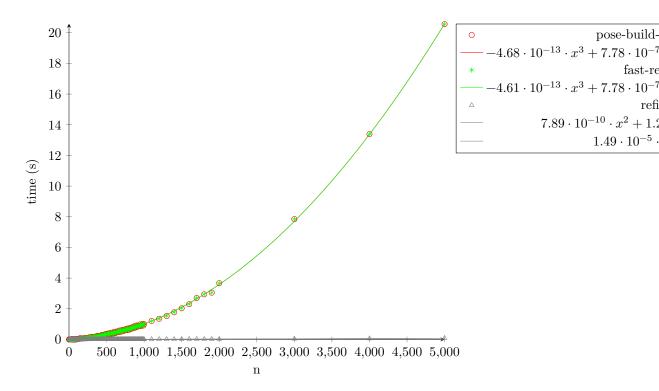
rewrite-strat-bottomup-real

rewrite-strat-topdown-rea

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



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



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

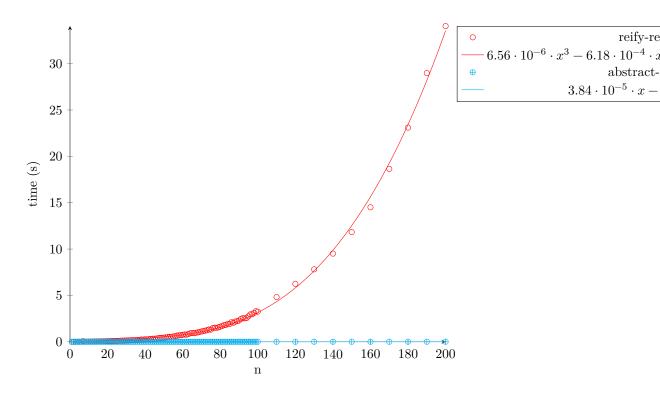


Figure 13: timing-typeclass-reification-let-in-HOAS

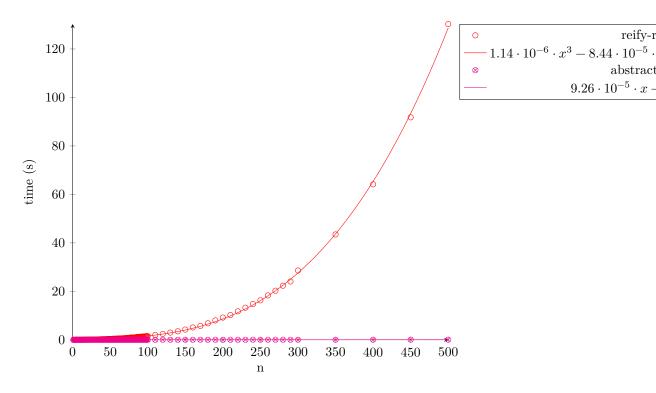
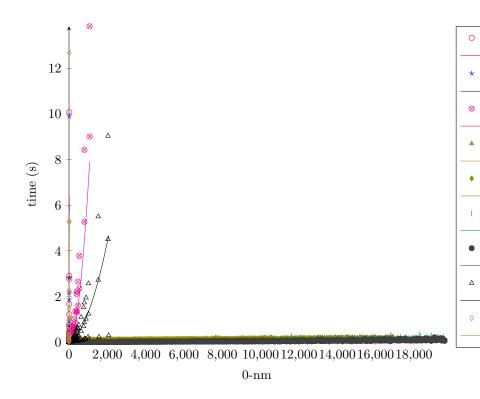


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(topdown-bot  $6.95 \cdot 10^{-3} exp(0.46 \cdot 0.46)$ 

rewrite-strat(bottomup-bot  $7.15 \cdot 10^{-3} exp(0.45 \cdot 0.45)$ 

 $6.59 \cdot 10^{-6} \cdot x^2 + 2.35 \cdot 10^{-4} \cdot \\$ 

 $1.13 \cdot 10^{-10} \cdot x^2 + 6.02 \cdot 10^{-6} \cdot$ 

 $-3.2 \cdot 10^{-11} \cdot x^2 + 6.76 \cdot 10^{-6}$ 

 $2.32 \cdot 10^{-10} \cdot x^2 + 4.39 \cdot 10^{-6}$ 

 $1.46\cdot 10^{-10}\cdot x^2 + 2.59\cdot 10^{-6}\cdot$ 

 $8.93 \cdot 10^{-7} \cdot x^2 + 4.19 \cdot 10^{-4} \cdot$ 

 $-7.55 \cdot 10^{-3} \cdot x^3 + 0.24 \cdot x^2 -$ 

cps+cbn-real

cps+lazy-real

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

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

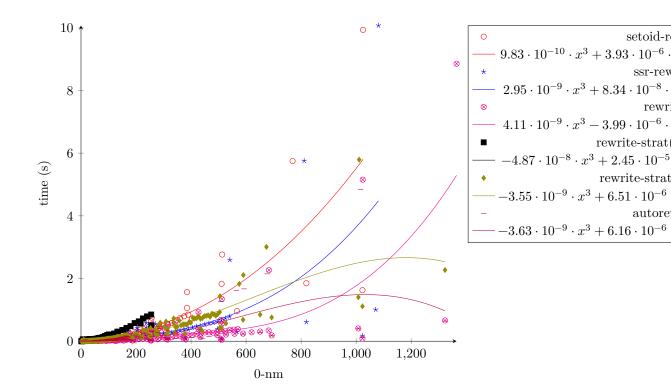
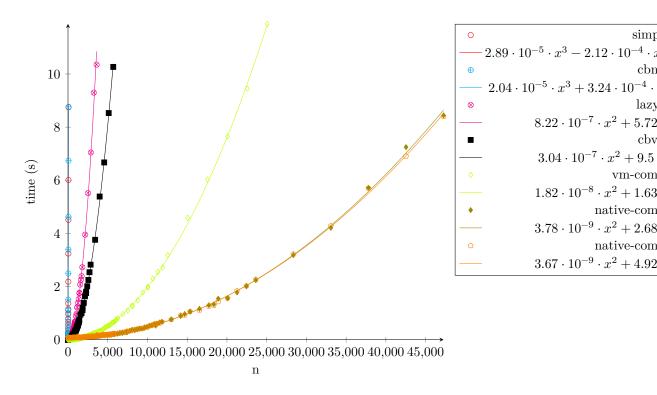


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $8.22 \cdot 10^{-7} \cdot x^2 + 5.72$ 

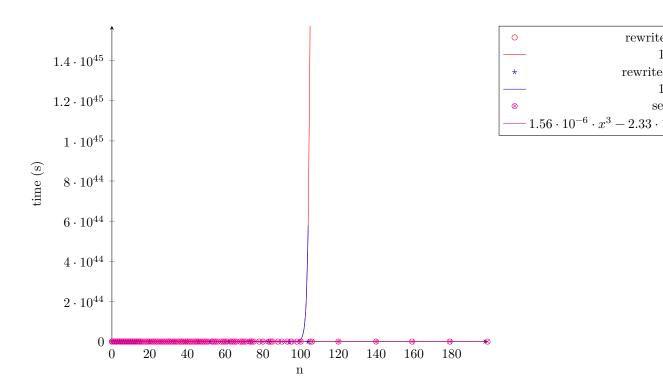
 $3.04 \cdot 10^{-7} \cdot x^2 + 9.5$ 

 $1.82 \cdot 10^{-8} \cdot x^2 + 1.63$ 

 $3.78 \cdot 10^{-9} \cdot x^2 + 2.68$ 

 $3.67 \cdot 10^{-9} \cdot x^2 + 4.92$ 

Figure 17: timing-sieve-of-eratosthenes



rewrite

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

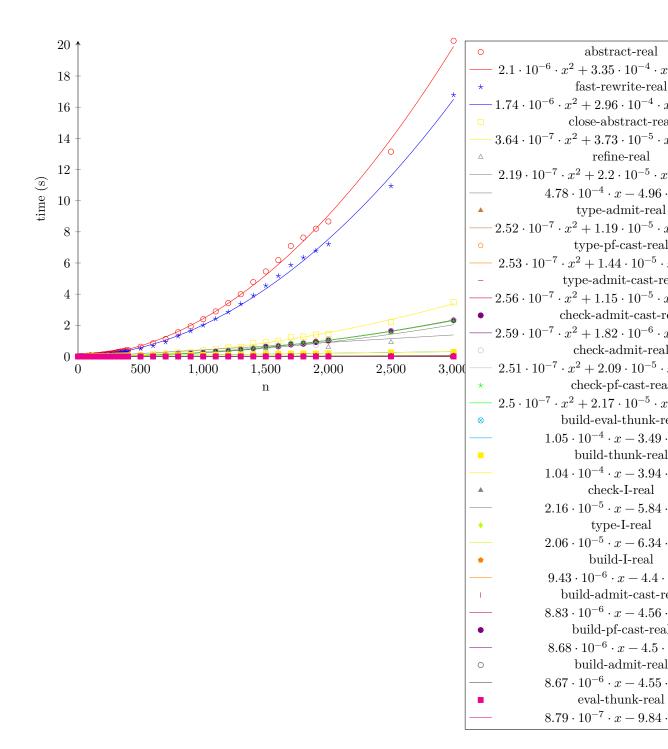


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac 2