

Figure 1: timing-pattern

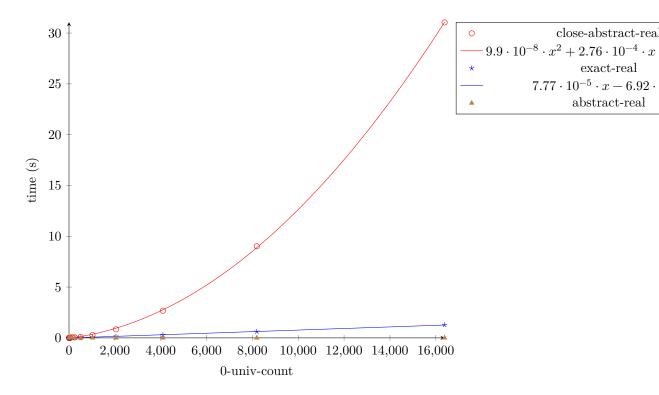
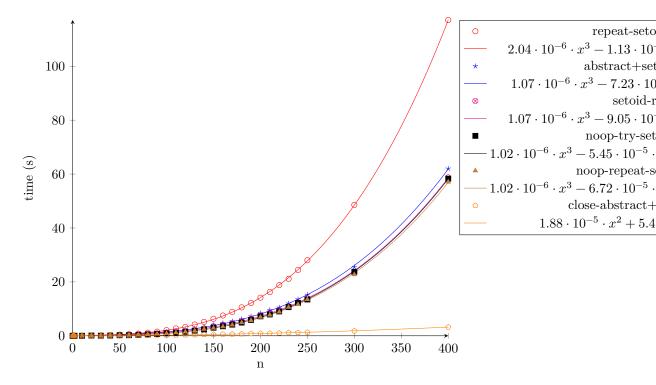


Figure 2: timing-n-polymorphic-universes param-1-n 0



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

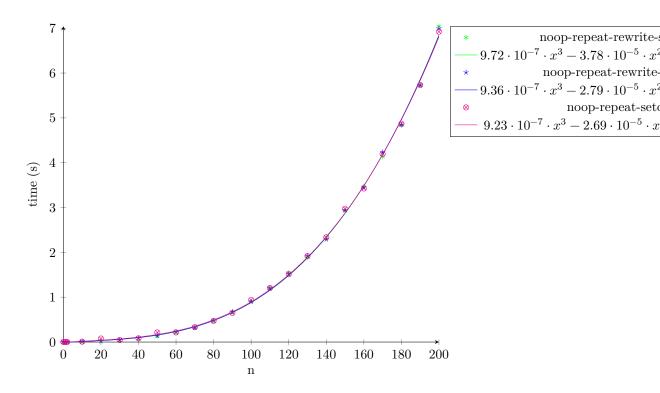
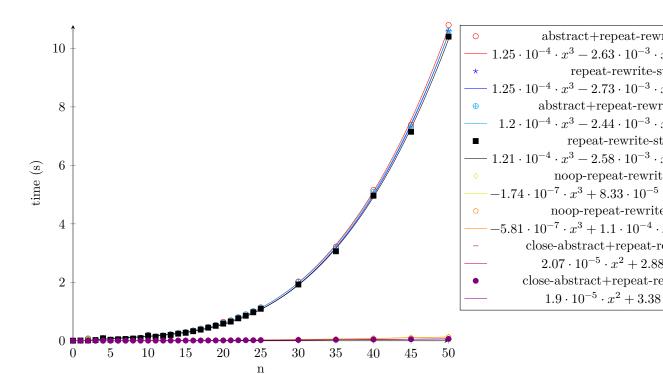
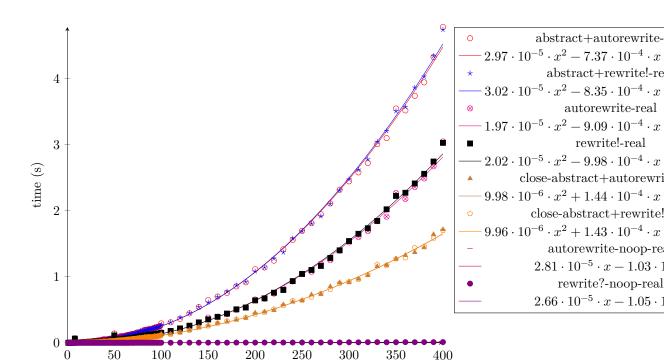


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

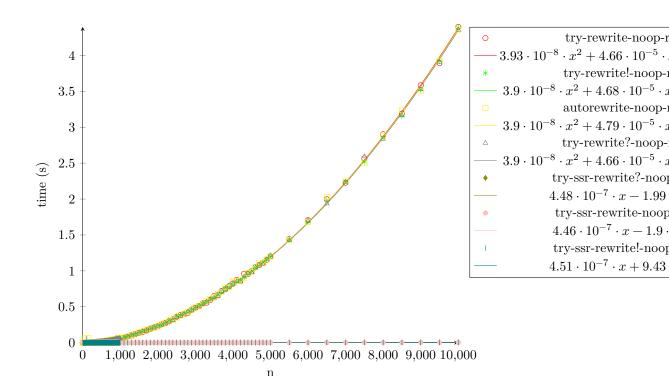


 $Figure\ 5:\ timing-rewrite-strat-under-binders$ 



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

n



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

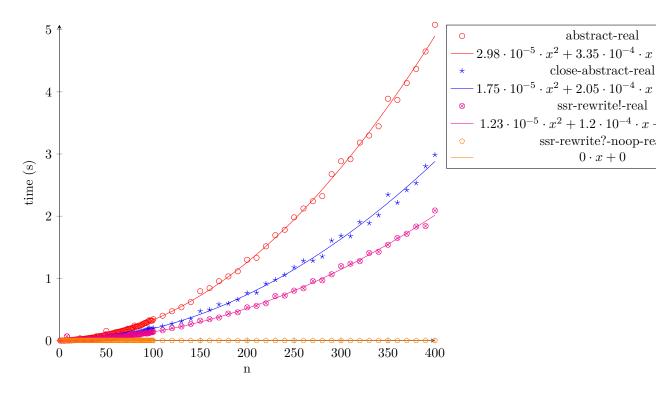
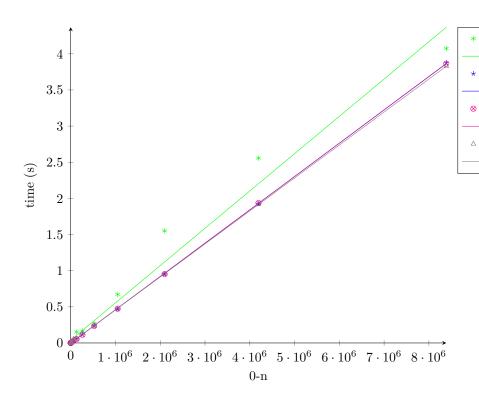


Figure 8: timing-rewrite-repeated-app-ssrrewrite



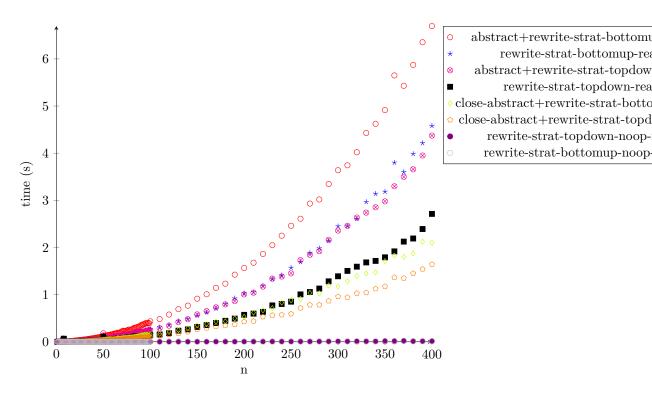
try-ssr-rewrite!-cold-noop-rea $5.16\cdot 10^{-7}\cdot x + 3.8\cdot 10^{-2}$ 

try-ssr-rewrite-noop-real  $4.61\cdot 10^{-7}\cdot x - 2.58\cdot 10^{-3}$ 

try-ssr-rewrite?-noop-real  $4.61\cdot 10^{-7}\cdot x - 1.86\cdot 10^{-3}$ 

try-ssr-rewrite!-noop-real  $4.56\cdot 10^{-7}\cdot x + 1\cdot 10^{-3}$ 

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

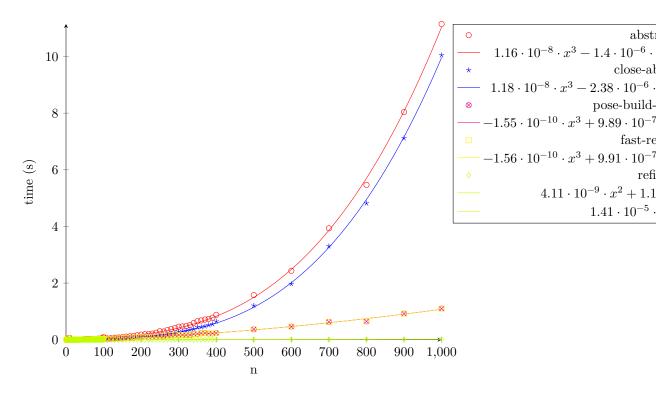


 $abstract + rewrite - strat - bottom \\ u$ rewrite-strat-bottomup-rea

abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

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

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



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

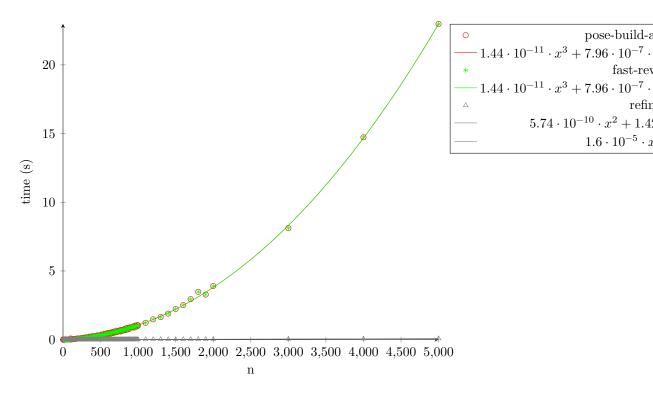


Figure 12: timing-rewrite-repeated-app-fast-rewrite-no-abstract

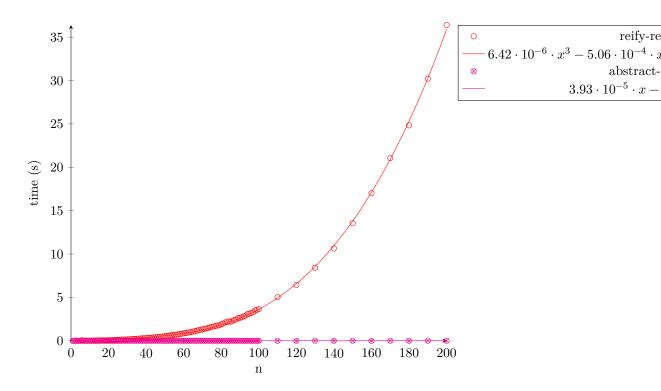


Figure 13: timing-typeclass-reification-let-in-HOAS

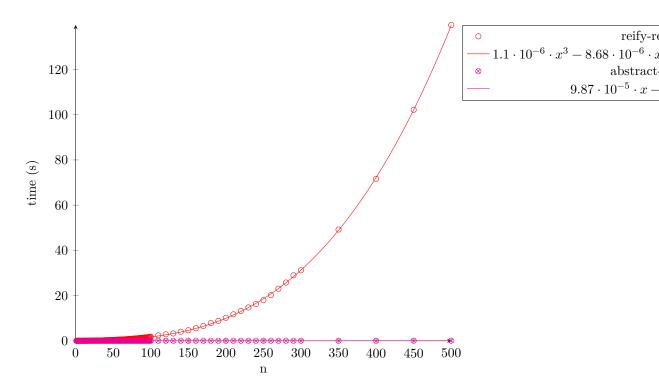
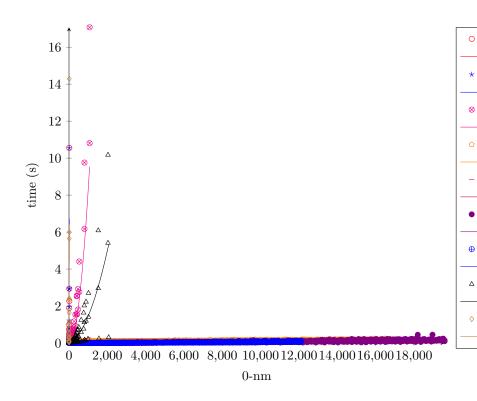


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(bottomup-bot

 $8.33\cdot 10^{-6}\cdot x^2 - 1.18\cdot 10^{-4}\cdot x^2 + 1.00$ 

 $8.5 \cdot 10^{-11} \cdot x^2 + 5.57 \cdot 10^{-6} \cdot x^2$ 

 $1.09 \cdot 10^{-10} \cdot x^2 + 3.78 \cdot 10^{-6} \cdot$ 

 $2.28 \cdot 10^{-10} \cdot x^2 + 4.69 \cdot 10^{-6} \cdot$ 

 $1.24 \cdot 10^{-10} \cdot x^2 + 5.5 \cdot 10^{-6} \cdot x^$ 

 $1.03 \cdot 10^{-6} \cdot x^2 + 4.38 \cdot 10^{-4} \cdot x^2$ 

 $-8.33 \cdot 10^{-3} \cdot x^3 + 0.27 \cdot x^2 -$ 

 $5.18\cdot 10^{-3} \exp{(0.47\cdot ($ rewrite-strat(topdown-both

 $7.73 \cdot 10^{-3} \exp{(0.45 \cdot ($ 

cps+native-compute

cps+cbn-real

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

cps+lazy-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

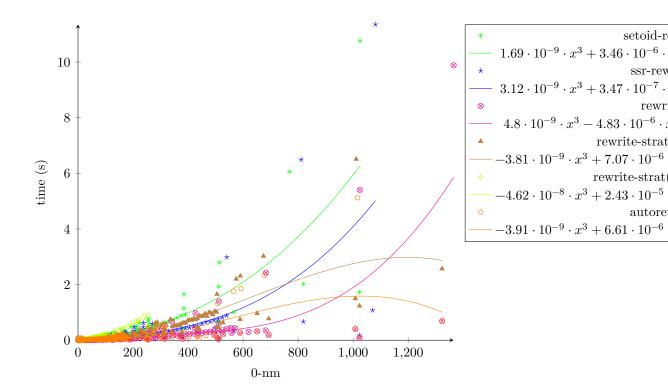
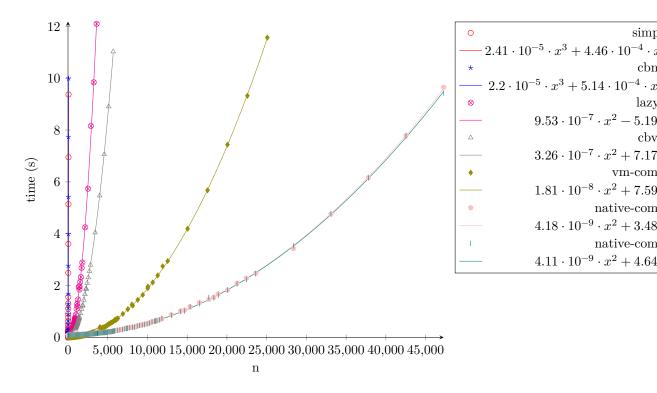


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $9.53 \cdot 10^{-7} \cdot x^2 - 5.19$ 

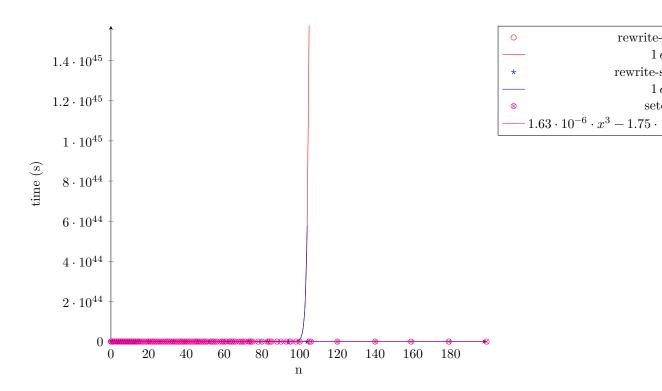
cbv  $3.26 \cdot 10^{-7} \cdot x^2 + 7.17$ 

 $1.81 \cdot 10^{-8} \cdot x^2 + 7.59$ 

 $4.18 \cdot 10^{-9} \cdot x^2 + 3.48$ 

 $4.11\cdot 10^{-9}\cdot x^2 + 4.64$ 

Figure 17: timing-sieve-of-eratosthenes



rewrite-

rewrite-s

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