

Figure 1: timing-pattern

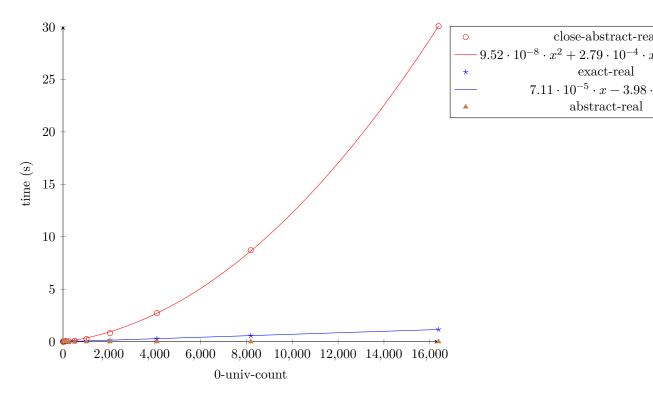


Figure 2: timing-n-polymorphic-universes param-1-n  $\,0\,$ 

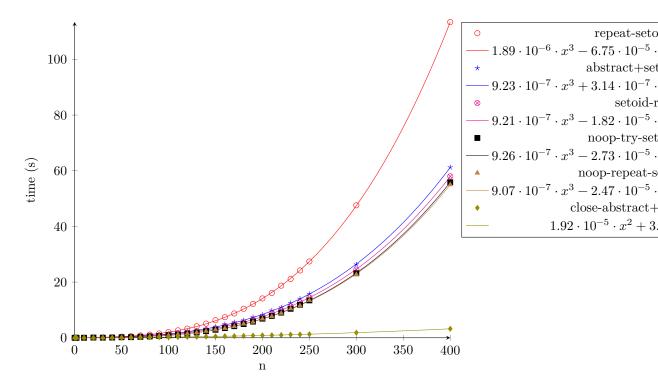
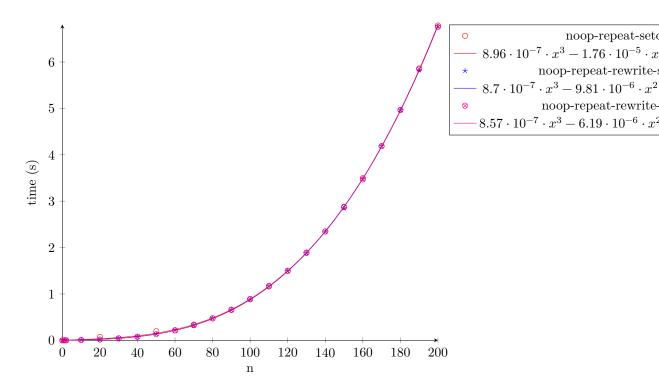
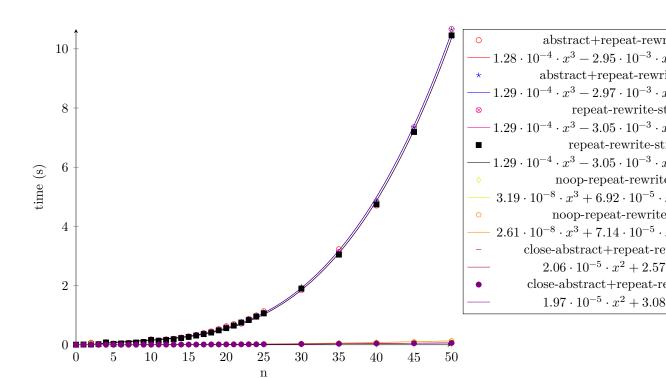


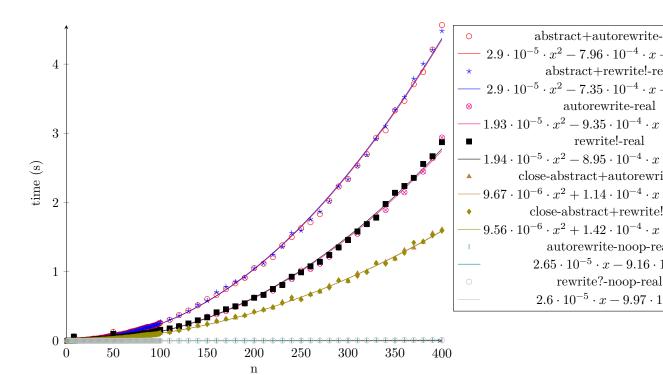
Figure 3: timing-repeat-setoid-rewrite-under-binders



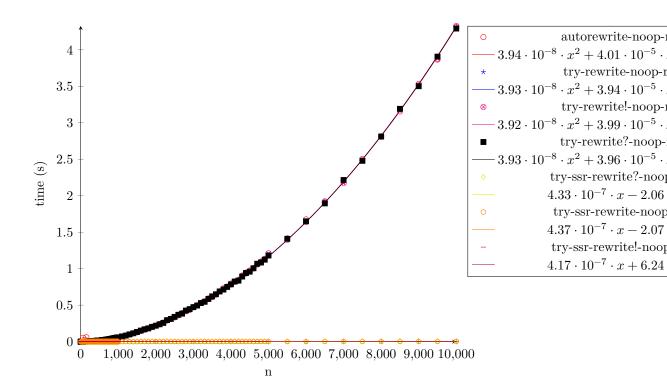
 $Figure \ 4: \ timing-repeat-setoid-rewrite-under-binders-noop \\$ 



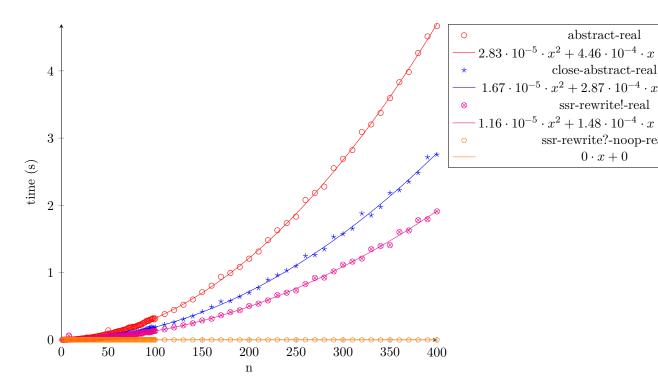
 $Figure\ 5:\ timing-rewrite-strat-under-binders$ 



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



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



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

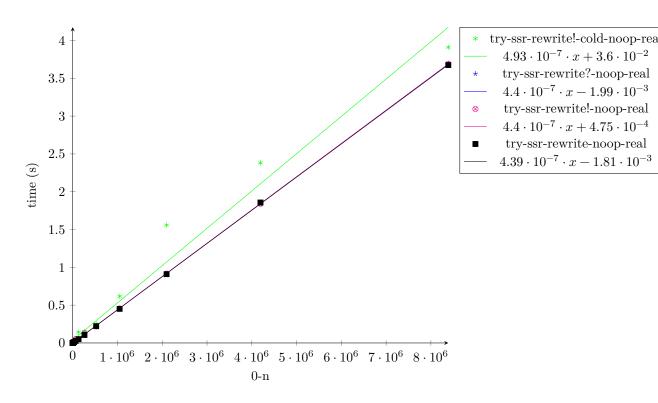
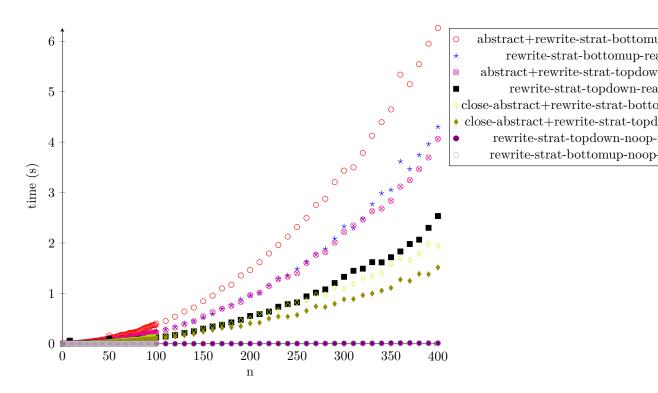


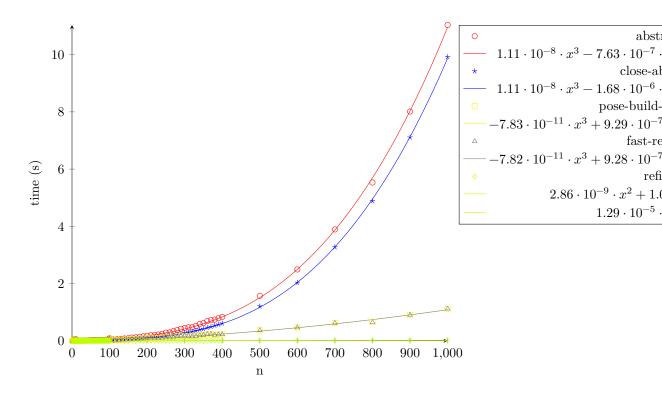
Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn  $\ 1$ 



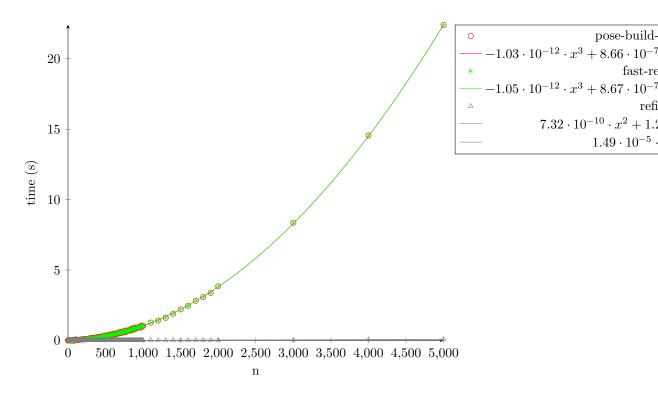
rewrite-strat-bottomup-rea

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

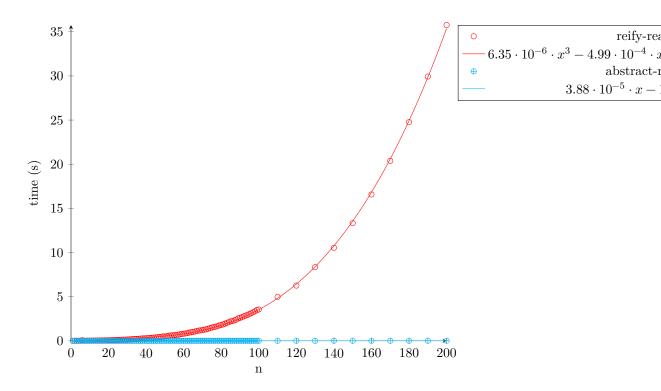


Figure 13: timing-typeclass-reification-let-in-HOAS

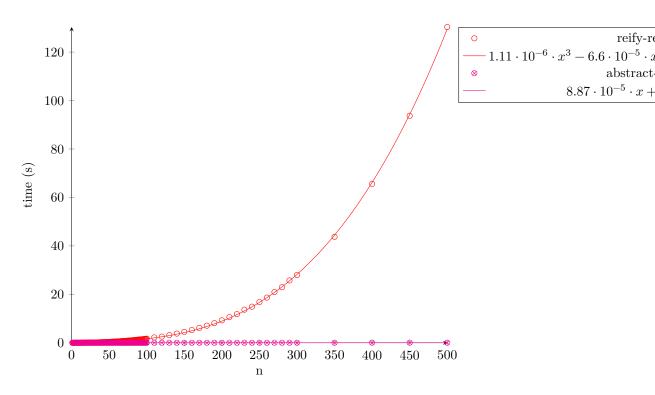
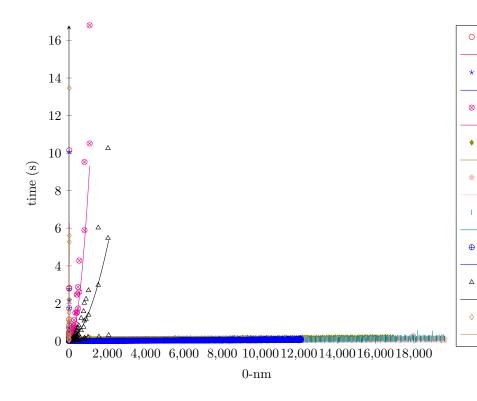


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(topdown-bot

 $8.22 \cdot 10^{-6} \cdot x^2 - 1.98 \cdot 10^{-4}$ 

 $4.27 \cdot 10^{-11} \cdot x^2 + 5.63 \cdot 10^{-6} \cdot$ 

 $9.61 \cdot 10^{-11} \cdot x^2 + 3.45 \cdot 10^{-6} \cdot$ 

 $2.09 \cdot 10^{-10} \cdot x^2 + 4.38 \cdot 10^{-6} \cdot$ 

 $1.53 \cdot 10^{-10} \cdot x^2 + 4.63 \cdot 10^{-6} \cdot$ 

 $1.07 \cdot 10^{-6} \cdot x^2 + 3.92 \cdot 10^{-4}$ 

 $-7.82 \cdot 10^{-3} \cdot x^3 + 0.25 \cdot x^2 -$ 

 $4.83\cdot 10^{-3}\exp{(0.48\cdot ($  rewrite-strat(bottomup-bot

 $6.27 \cdot 10^{-3} \exp{(0.46 \cdot ($ 

cps+native-compute

cps+cbn-real

cps+cbv-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

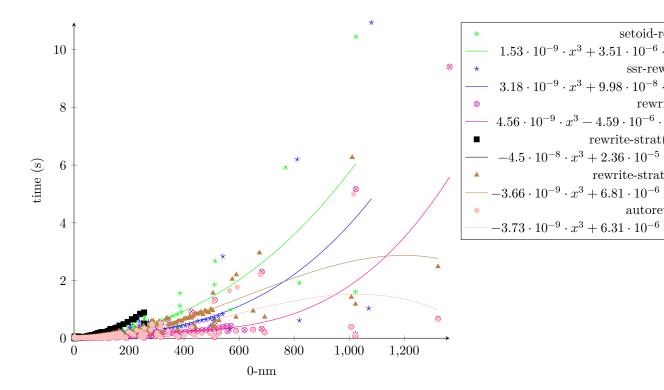
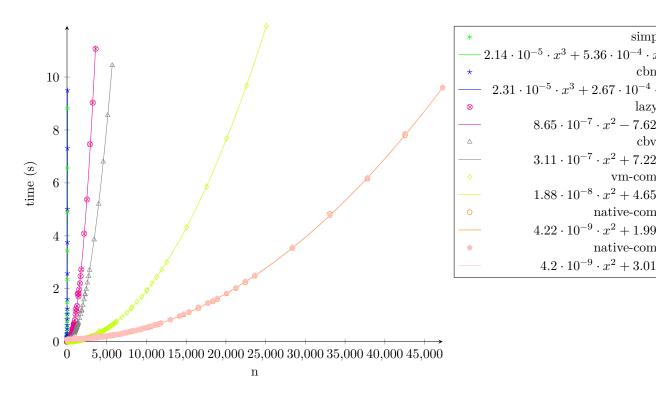


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $8.65 \cdot 10^{-7} \cdot x^2 - 7.62$ 

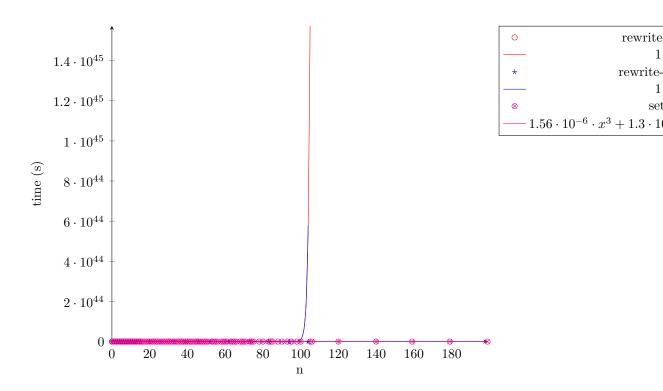
 $3.11 \cdot 10^{-7} \cdot x^2 + 7.22$ 

 $1.88 \cdot 10^{-8} \cdot x^2 + 4.65$ 

 $4.22 \cdot 10^{-9} \cdot x^2 + 1.99$ 

 $4.2 \cdot 10^{-9} \cdot x^2 + 3.01$ 

Figure 17: timing-sieve-of-eratosthenes



rewrite

rewrite-

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