

Figure 1: timing-pattern

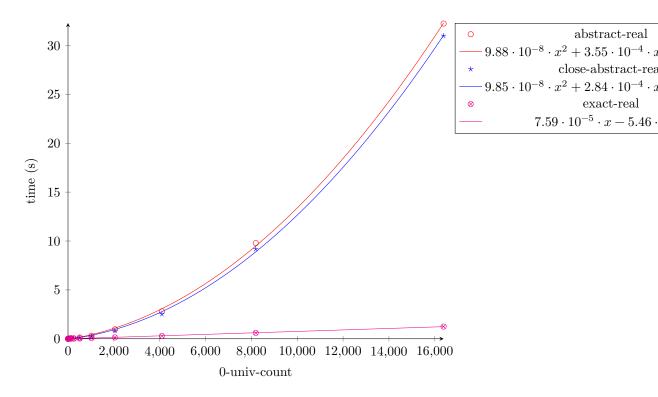


Figure 2: timing-n-polymorphic-universes param-1-n  $\,0\,$ 

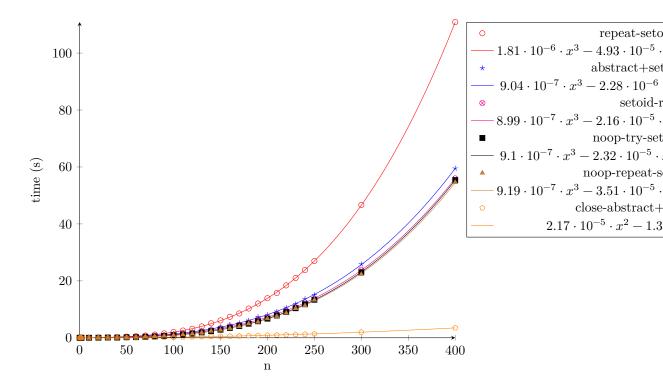
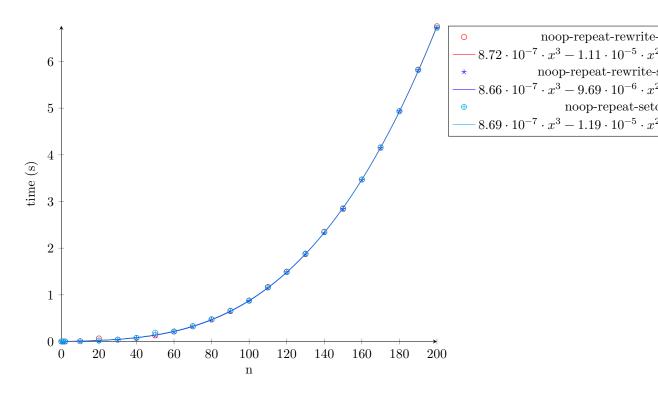
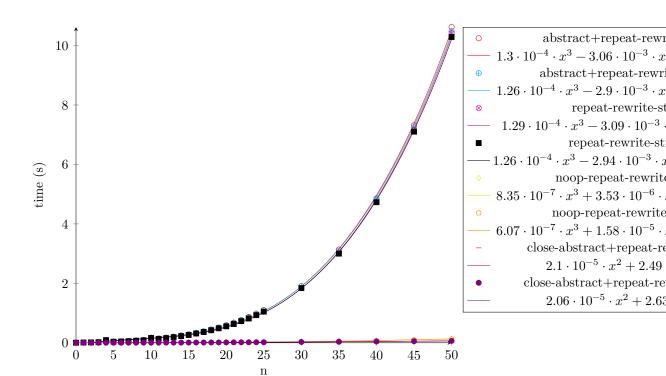


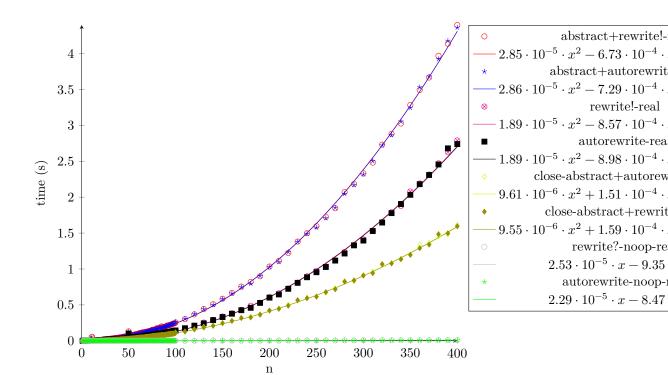
Figure 3: timing-repeat-setoid-rewrite-under-binders



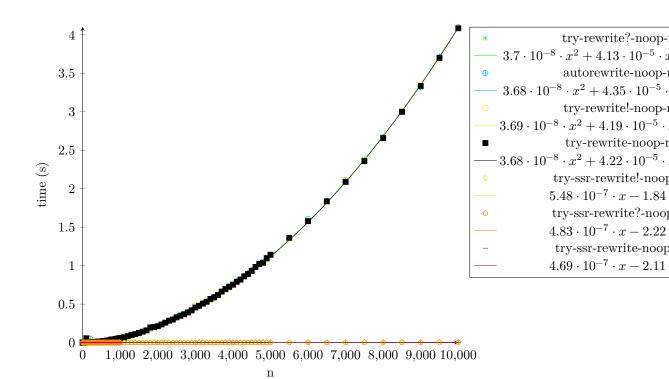
 $Figure\ 4:\ timing-repeat-setoid-rewrite-under-binders-noop$ 



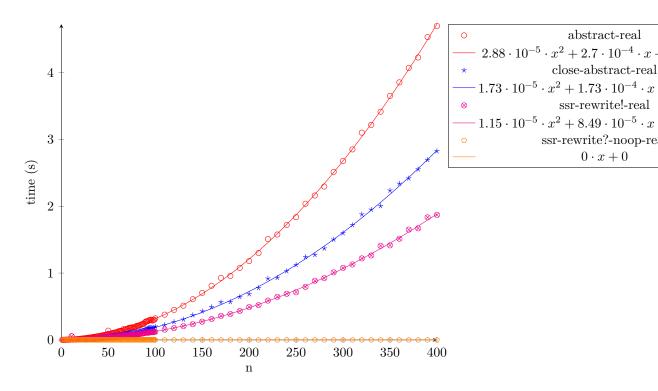
 $Figure\ 5:\ timing-rewrite-strat-under-binders$ 



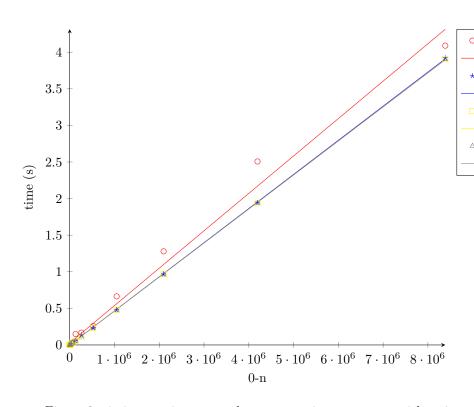
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$ 



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



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



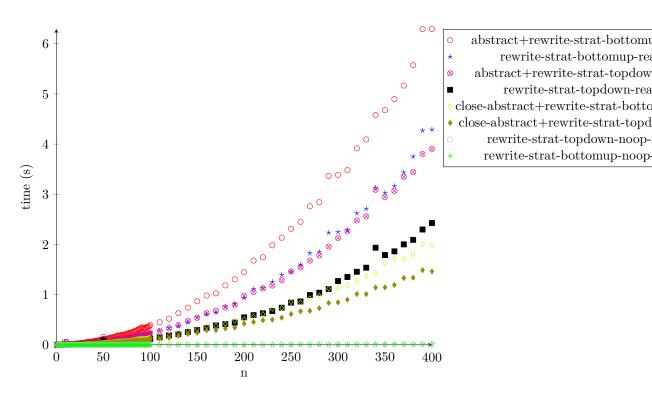
try-ssr-rewrite!-cold-noop-rea

 $5.11 \cdot 10^{-7} \cdot x + 2.69 \cdot 10^{-2}$ try-ssr-rewrite!-noop-real

 $\begin{aligned} &4.66\cdot 10^{-7}\cdot x - 7.93\cdot 10^{-4}\\ &\text{try-ssr-rewrite-noop-real}\\ &4.65\cdot 10^{-7}\cdot x - 2.26\cdot 10^{-3} \end{aligned}$ 

try-ssr-rewrite?-noop-real  $4.65\cdot 10^{-7}\cdot x - 2.07\cdot 10^{-3}$ 

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

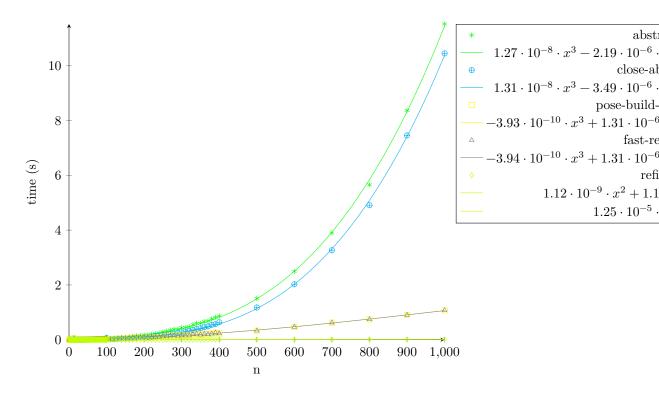


rewrite-strat-bottomup-rea abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

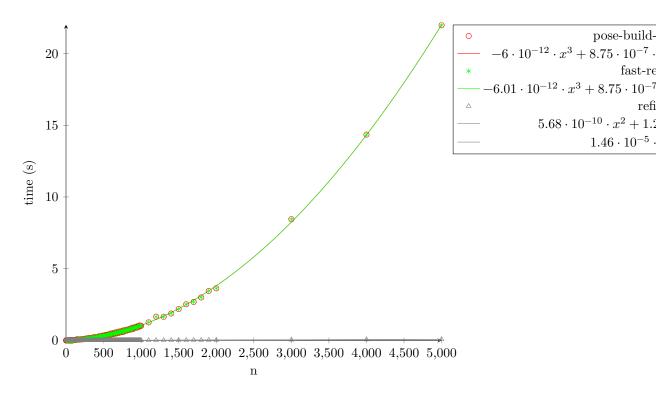
rewrite-strat-topdown-noop-

rewrite-strat-bottomup-noop-

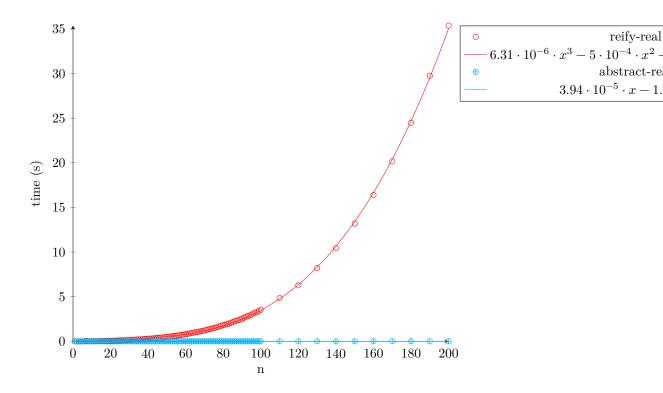
 $Figure~10:~timing\mbox{-rewrite-repeated-app-rewrite-strat}$ 



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



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



 ${\bf Figure~13:~timing-type class-reification-let-in-HOAS}$ 

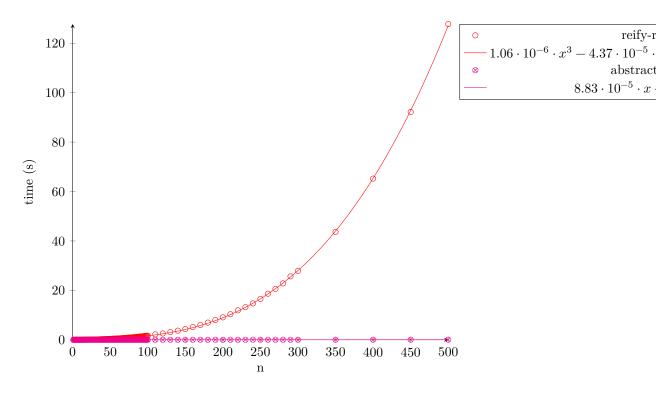


Figure 14: timing-typeclass-reification-let-in-PHOAS

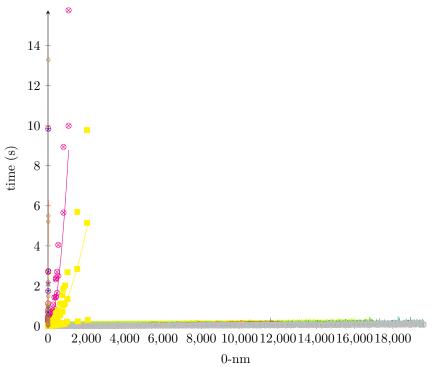


Figure 15: timing-rewrite-lift-lets-map param-1-n 1, param-2-m 1

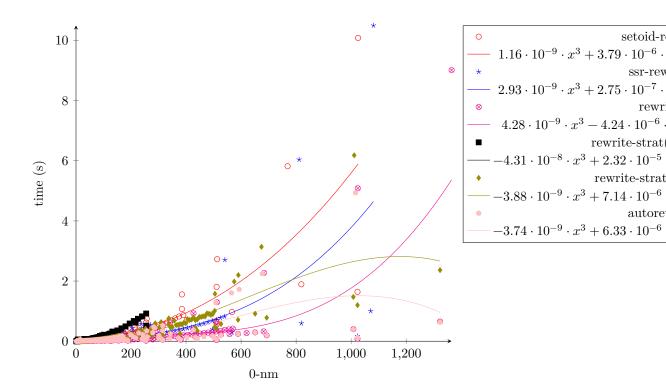
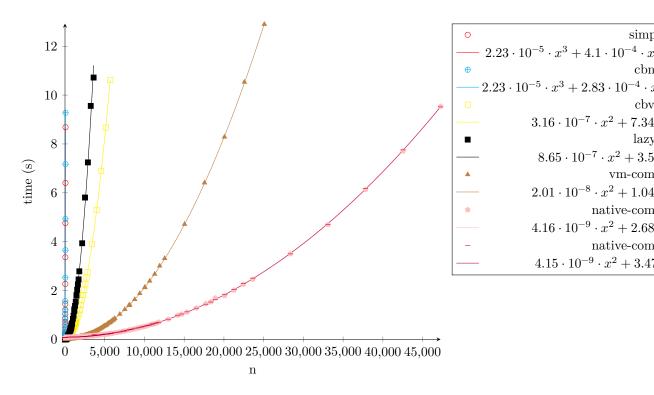


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $3.16 \cdot 10^{-7} \cdot x^2 + 7.34$ 

 $8.65 \cdot 10^{-7} \cdot x^2 + 3.5$ 

 $2.01 \cdot 10^{-8} \cdot x^2 + 1.04$ 

 $4.16 \cdot 10^{-9} \cdot x^2 + 2.68$ 

 $4.15 \cdot 10^{-9} \cdot x^2 + 3.47$ 

Figure 17: timing-sieve-of-eratosthenes

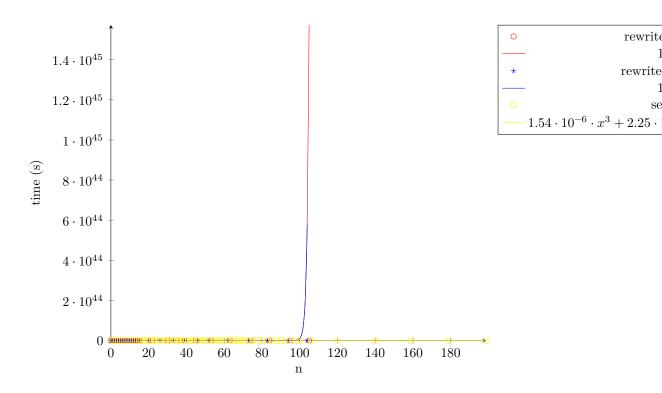


Figure 18: timing-rewrite-under-lets-plus-0  $\,$ 

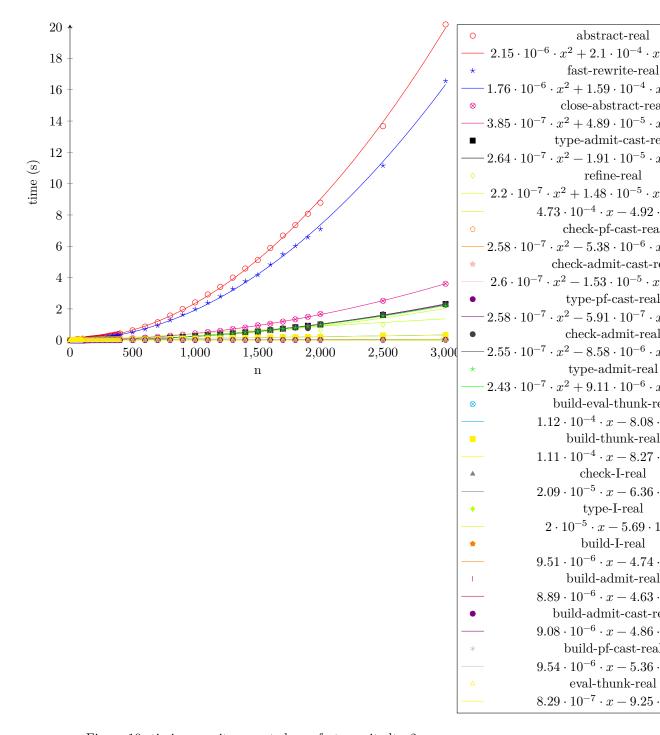


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2