

Figure 1: timing-pattern

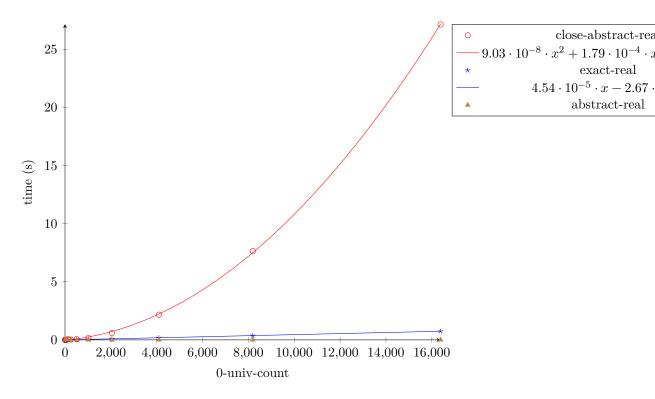
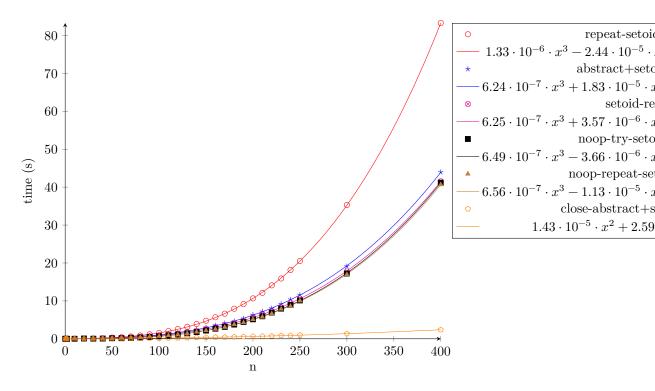


Figure 2: timing-n-polymorphic-universes param-1-n 0



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

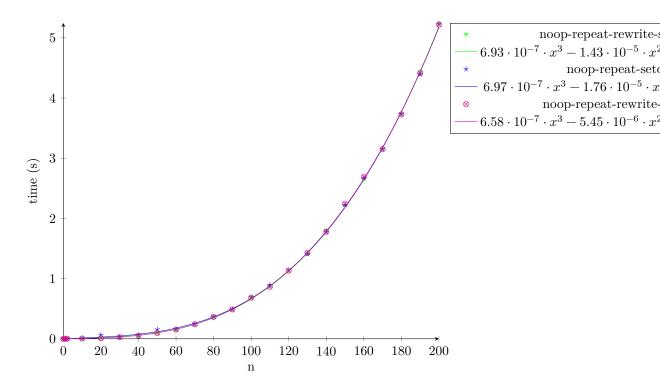
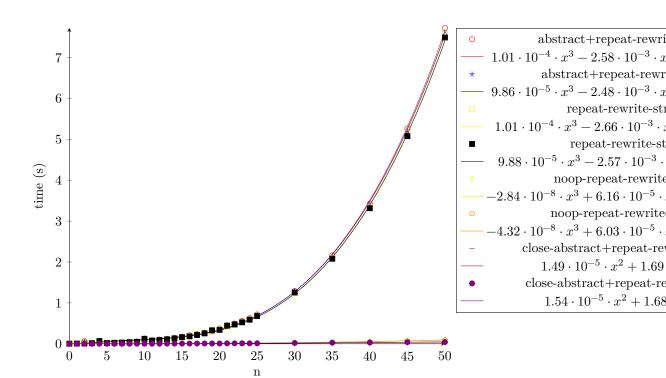
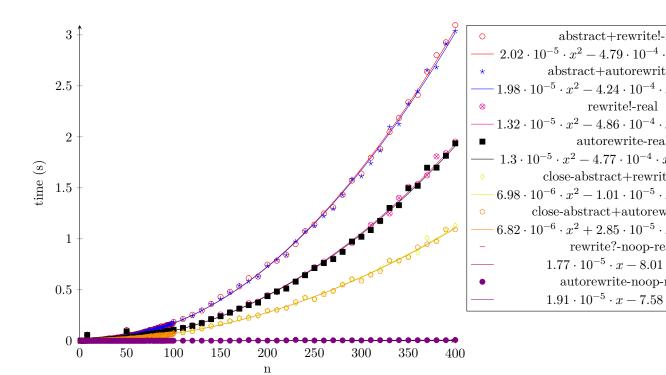


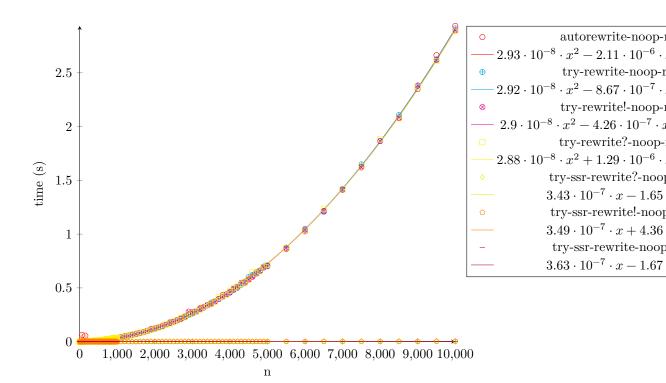
Figure 4: timing-repeat-setoid-rewrite-under-binders-noop



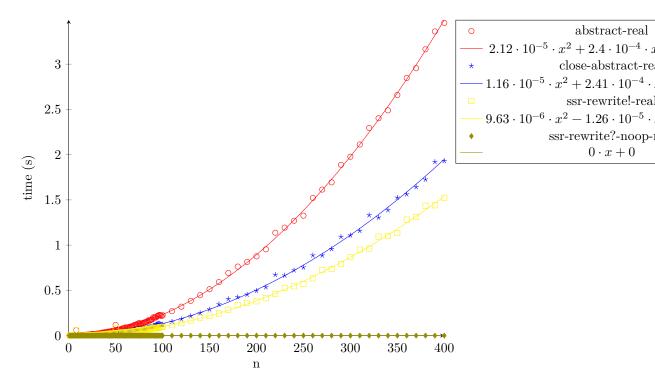
 $Figure\ 5:\ timing-rewrite-strat-under-binders$ 



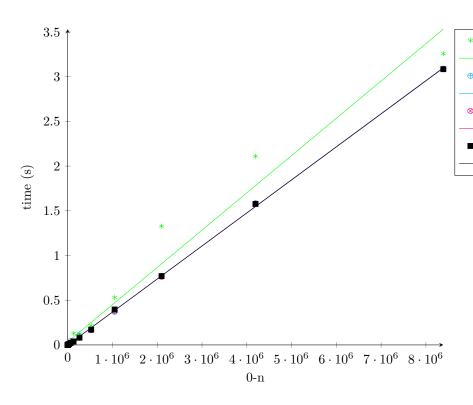
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$ 



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



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

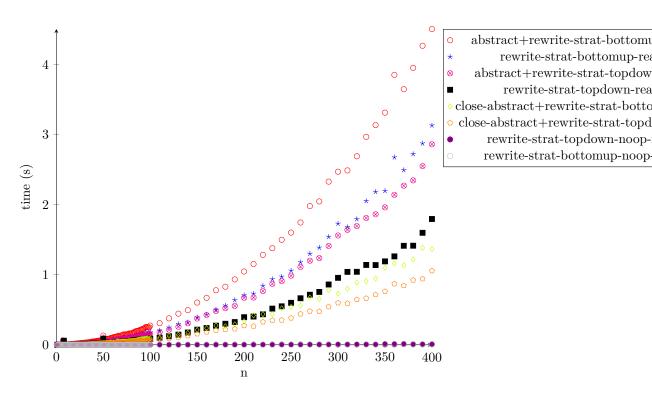


try-ssr-rewrite!-cold-noop-rea  $4.17 \cdot 10^{-7} \cdot x + 3.37 \cdot 10^{-2}$ try-ssr-rewrite!-noop-real

 $3.7\cdot 10^{-7}\cdot x - 8.77\cdot 10^{-4}$  try-ssr-rewrite?-noop-real

 $\begin{aligned} &3.69\cdot 10^{-7}\cdot x - 2.86\cdot 10^{-3}\\ &\text{try-ssr-rewrite-noop-real}\\ &3.69\cdot 10^{-7}\cdot x - 1.68\cdot 10^{-3} \end{aligned}$ 

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-nooprewrite-strat-bottomup-noop-

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

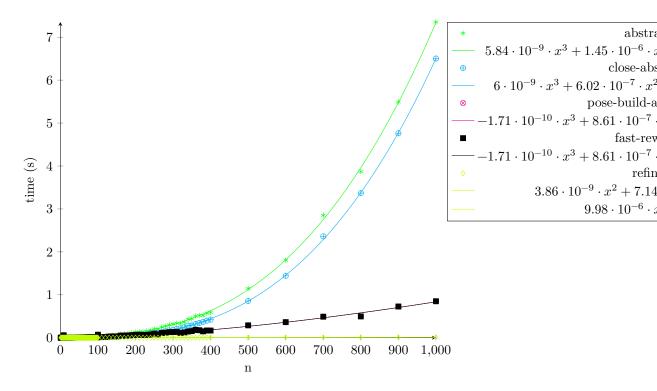
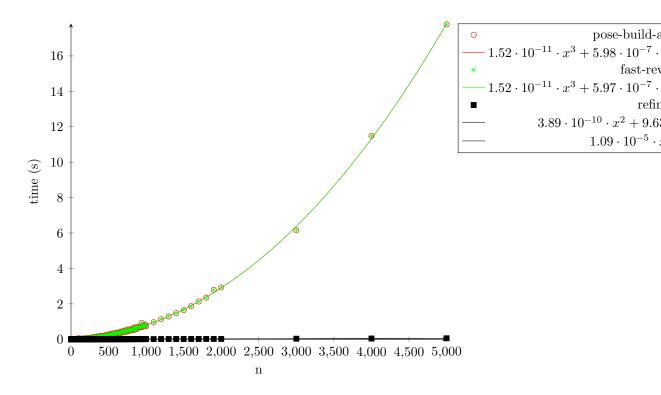


Figure 11: timing-rewrite-repeated-app-fast-rewrite



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

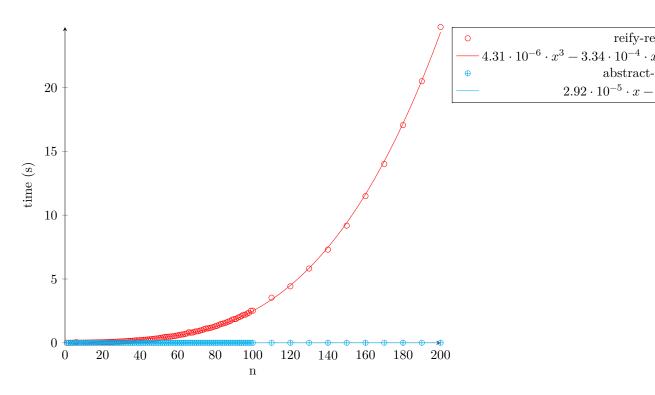


Figure 13: timing-typeclass-reification-let-in-HOAS

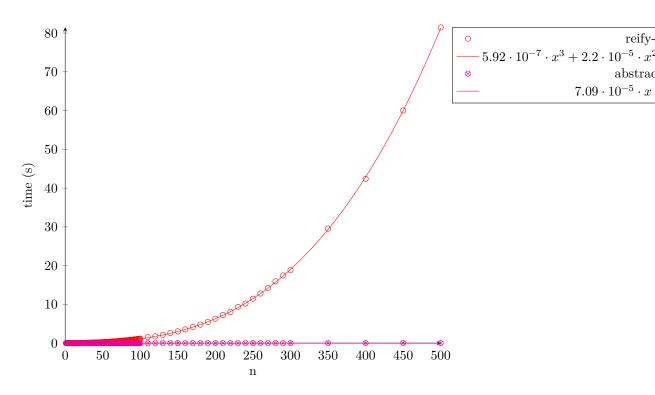
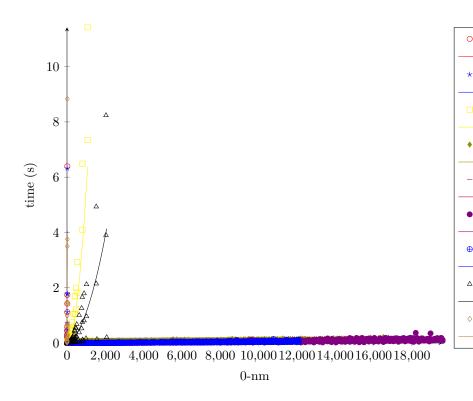


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(bottomup-bot  $3.93 \cdot 10^{-3} exp(0.46 \cdot ($ 

 $5.63 \cdot 10^{-6} \cdot x^2 - 1.2 \cdot 10^{-4} \cdot x^2$ 

 $3.62\cdot 10^{-11}\cdot x^2 + 5.01\cdot 10^{-6}\cdot \\$ 

 $8.37 \cdot 10^{-11} \cdot x^2 + 2.97 \cdot 10^{-6}$ 

 $1.88 \cdot 10^{-10} \cdot x^2 + 3.71 \cdot 10^{-6} \cdot$ 

 $1.1 \cdot 10^{-10} \cdot x^2 + 3.96 \cdot 10^{-6} \cdot x^2$ 

 $8.28 \cdot 10^{-7} \cdot x^2 + 2.92 \cdot 10^{-4}$ 

 $-5.18 \cdot 10^{-3} \cdot x^3 + 0.17 \cdot x^2 -$ 

cps+cbn-real

cps+cbv-real

cps+lazy-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

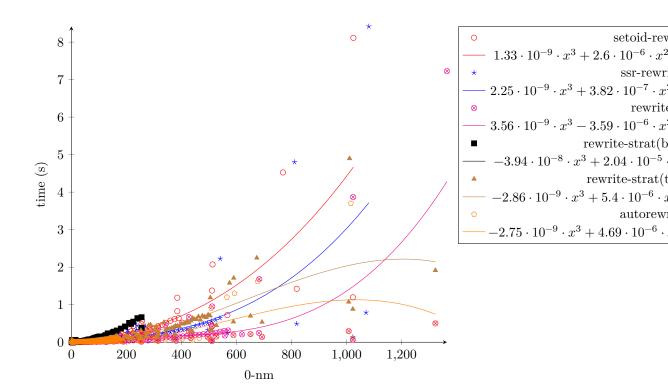
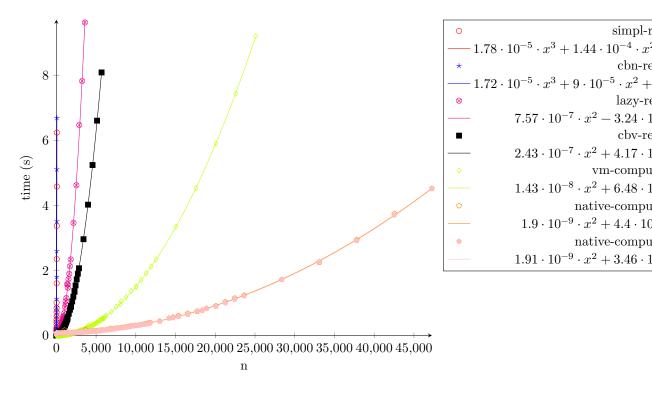


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simpl-r

lazy-re

vm-compu

native-compu

native-compu

 $-1.72 \cdot 10^{-5} \cdot x^3 + 9 \cdot 10^{-5} \cdot x^2 +$ 

 $7.57 \cdot 10^{-7} \cdot x^2 - 3.24 \cdot 1$ 

 $2.43 \cdot 10^{-7} \cdot x^2 + 4.17 \cdot 1$ 

 $1.43 \cdot 10^{-8} \cdot x^2 + 6.48 \cdot 1$ 

 $1.9 \cdot 10^{-9} \cdot x^2 + 4.4 \cdot 10^{-9}$ 

 $1.91 \cdot 10^{-9} \cdot x^2 + 3.46 \cdot 1$ 

 $Figure\ 17:\ timing\mbox{-sieve-of-eratos} thenes$ 

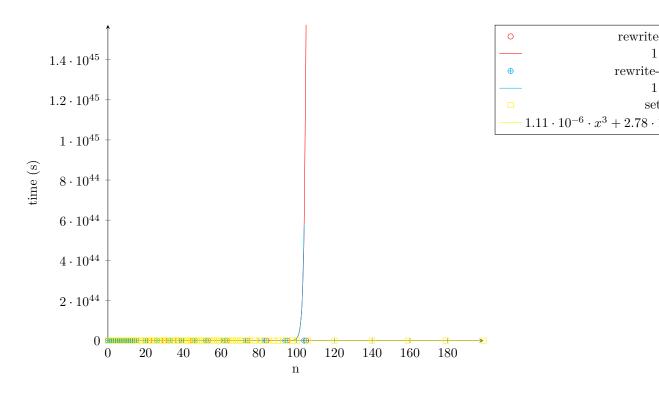


Figure 18: timing-rewrite-under-lets-plus-0  $\,$