

Figure 1: timing-pattern

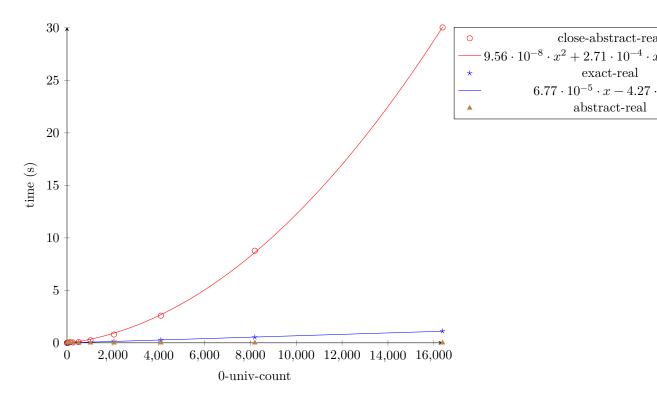
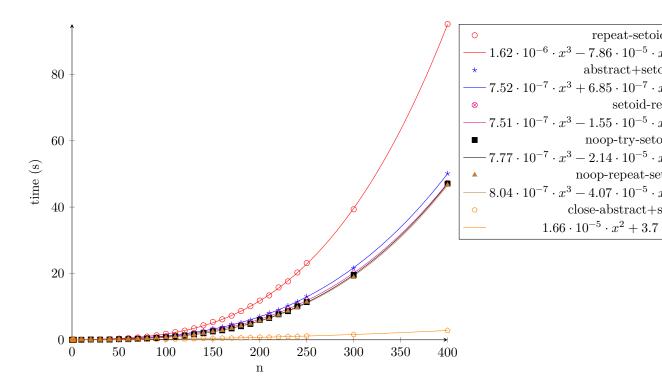


Figure 2: timing-n-polymorphic-universes param-1-n  $\,0\,$ 



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

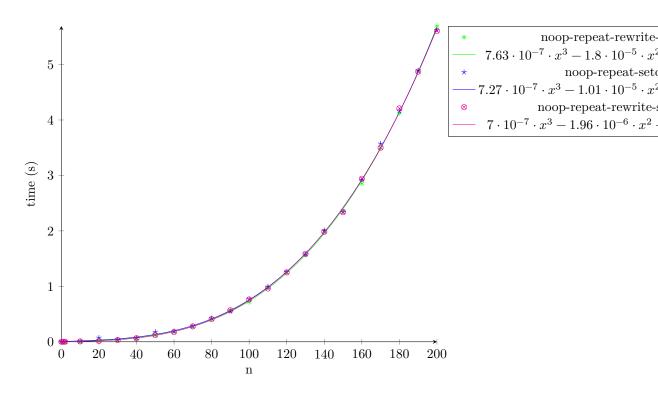


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

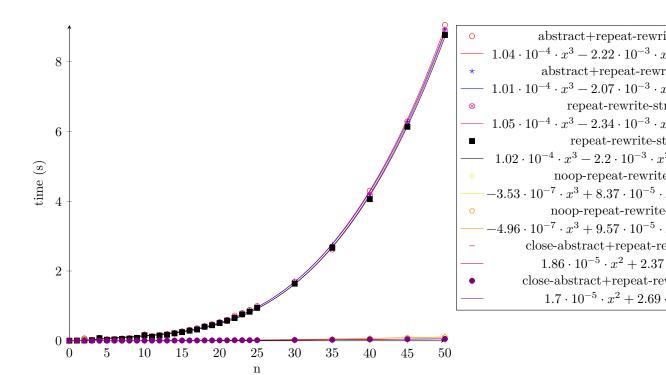
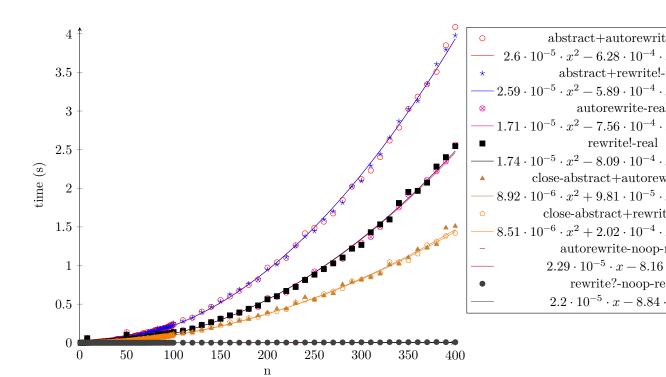


Figure 5: timing-rewrite-strat-under-binders



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

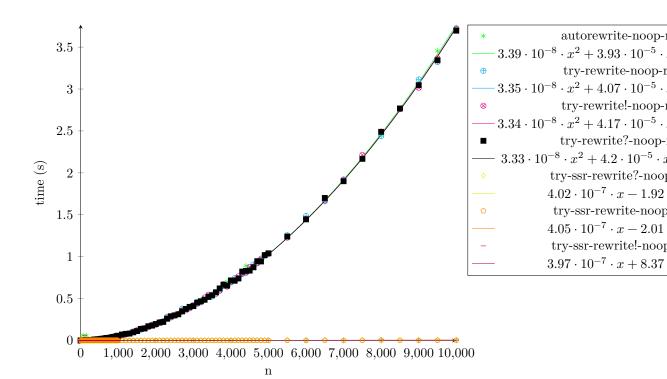
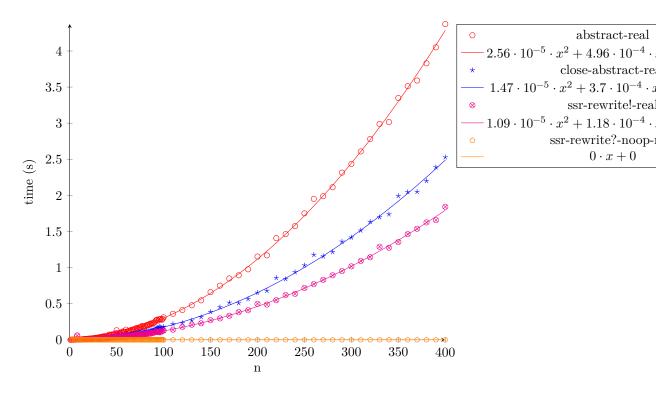
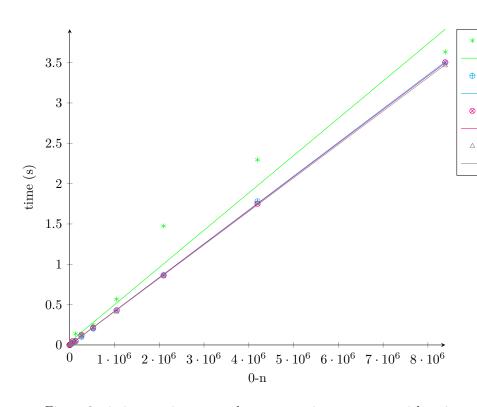


Figure 7: timing-rewrite-repeated-app-autorewrite-noop



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



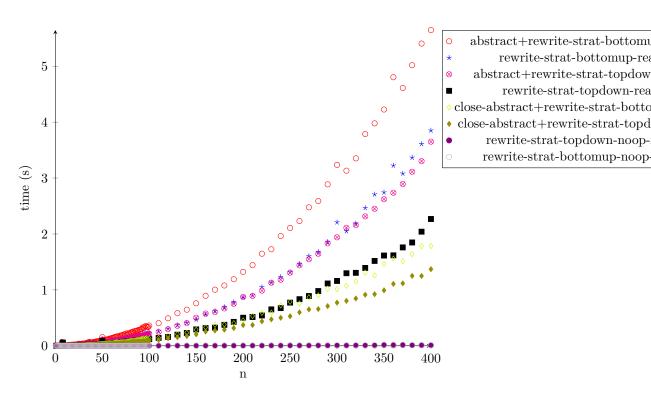
try-ssr-rewrite!-cold-noop-rea $4.62\cdot 10^{-7}\cdot x + 3.55\cdot 10^{-2}$ 

try-ssr-rewrite?-noop-real  $4.19\cdot 10^{-7}\cdot x - 2.02\cdot 10^{-3}$ 

try-ssr-rewrite!-noop-real  $4.17\cdot 10^{-7}\cdot x - 5.87\cdot 10^{-5}$ 

 $\begin{array}{l} \text{try-ssr-rewrite-noop-real} \\ 4.14 \cdot 10^{-7} \cdot x - 1.93 \cdot 10^{-3} \end{array}$ 

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

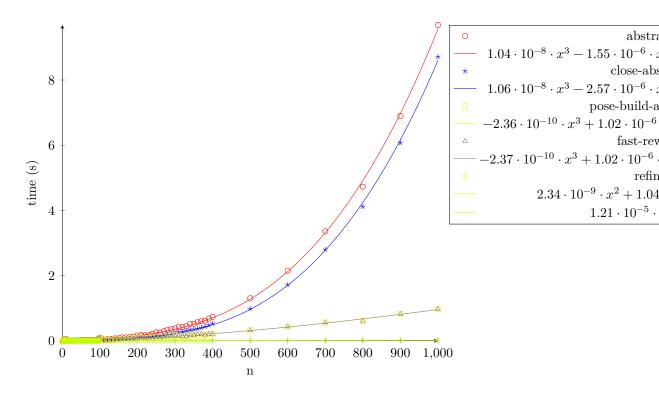


rewrite-strat-bottomup-rea

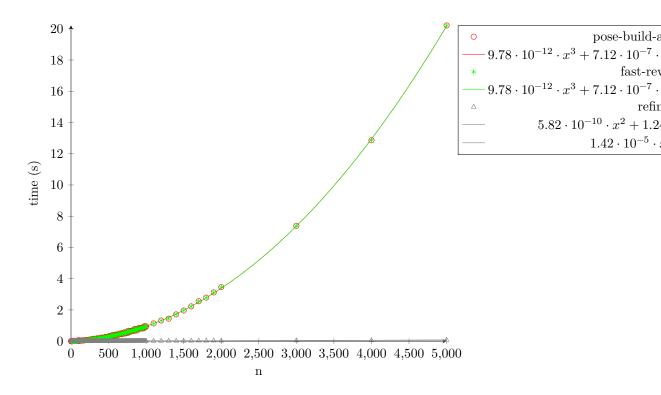
abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

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

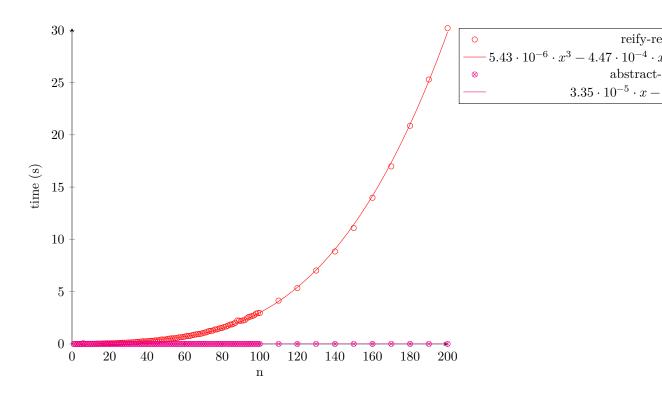
 $Figure~10:~timing\mbox{-rewrite-repeated-app-rewrite-strat}$ 



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



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



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

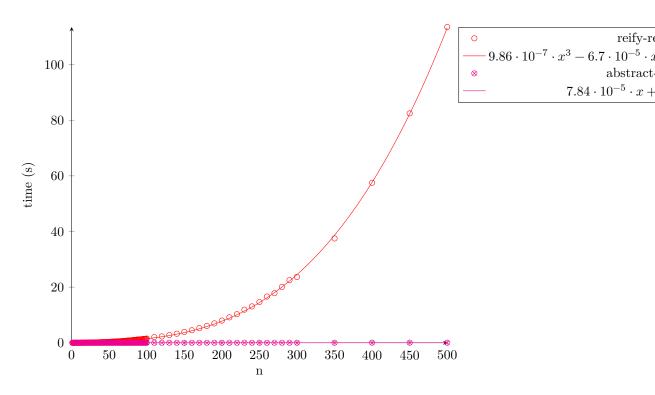
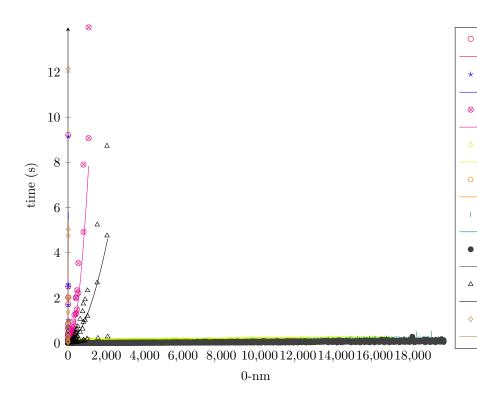


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(bottomup-bot  $6.14 \cdot 10^{-3} \exp{(0.45 \cdot ($ 

rewrite-strat (topdown-bot 7.06  $\cdot$  10<sup>-3</sup> exp (0.45  $\cdot$  (

 $6.99 \cdot 10^{-6} \cdot x^2 - 2.52 \cdot 10^{-4} \cdot x^2$ 

 $5.86 \cdot 10^{-11} \cdot x^2 + 5 \cdot 10^{-6} \cdot x$ 

 $1.27 \cdot 10^{-10} \cdot x^2 + 4.05 \cdot 10^{-6} \cdot$ 

 $2.17 \cdot 10^{-10} \cdot x^2 + 3.76 \cdot 10^{-6} \cdot$ 

 $9.2 \cdot 10^{-11} \cdot x^2 + 3.25 \cdot 10^{-6} \cdot x^2$ 

 $9.09 \cdot 10^{-7} \cdot x^2 + 3.56 \cdot 10^{-4} \cdot x^2$ 

 $-7.06 \cdot 10^{-3} \cdot x^3 + 0.23 \cdot x^2 -$ 

cps+cbn-real

cps+native-compute

cps+vm-compute-

cps+lazy-real

cps+cbv-real

cps+simpl-real

setoid-rewrite-re

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

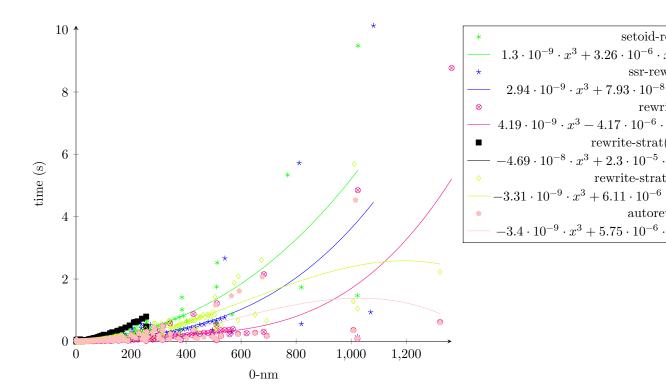
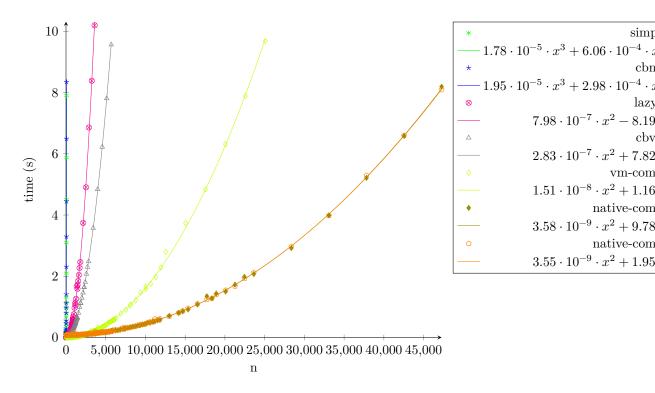


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

lazy

vm-com

native-com

native-com

 $7.98 \cdot 10^{-7} \cdot x^2 - 8.19$ 

 $2.83 \cdot 10^{-7} \cdot x^2 + 7.82$ 

 $1.51 \cdot 10^{-8} \cdot x^2 + 1.16$ 

 $3.58 \cdot 10^{-9} \cdot x^2 + 9.78$ 

 $3.55 \cdot 10^{-9} \cdot x^2 + 1.95$ 

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

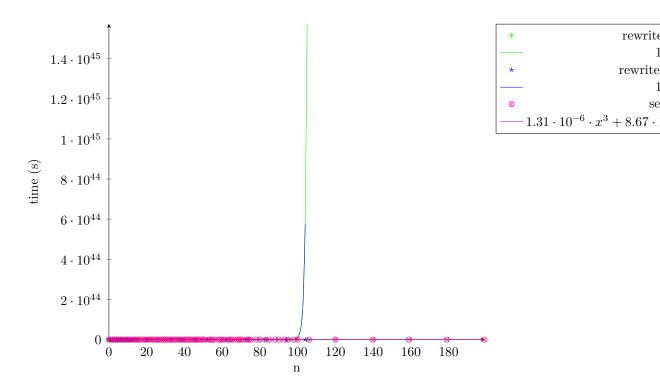


Figure 18: timing-rewrite-under-lets-plus-0  $\,$