

Figure 1: timing-pattern

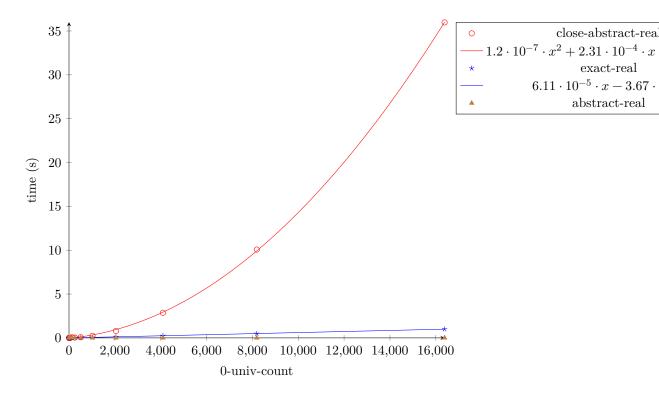
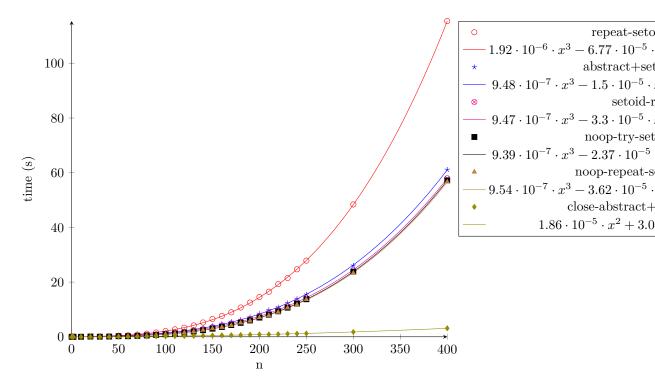
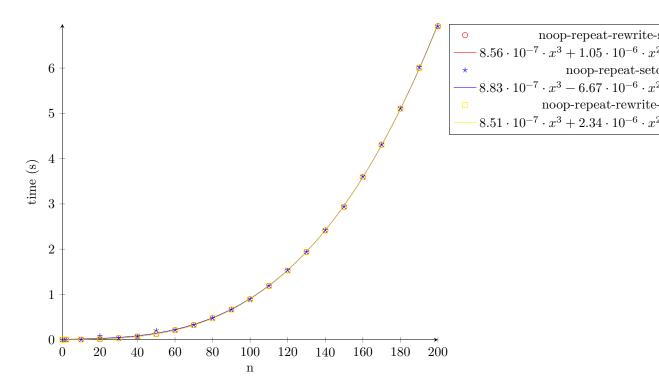


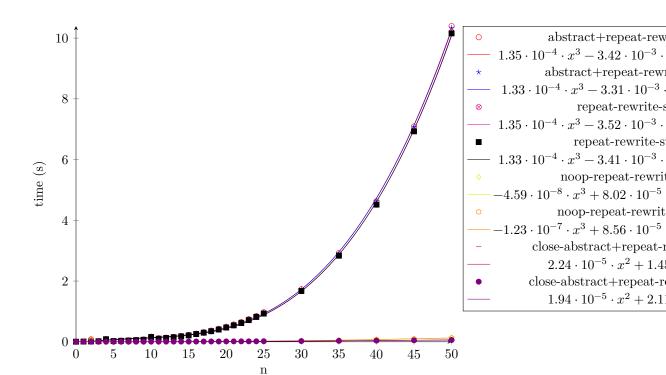
Figure 2: timing-n-polymorphic-universes param-1-n 0



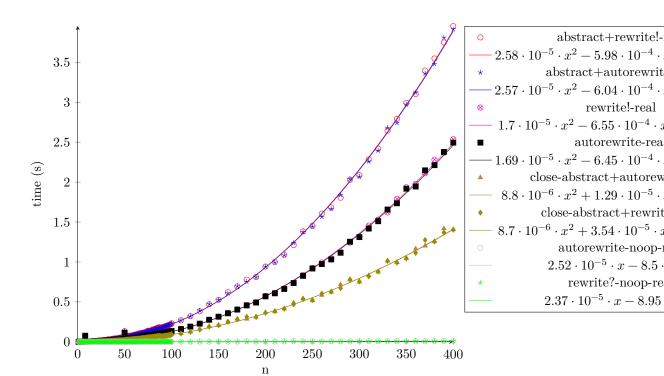
 $Figure \ 3: \ timing-repeat-setoid-rewrite-under-binders$ 



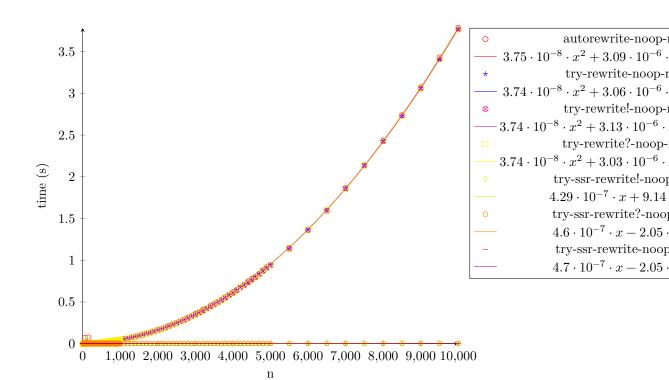
 $Figure \ 4: \ timing-repeat-setoid-rewrite-under-binders-noop \\$ 



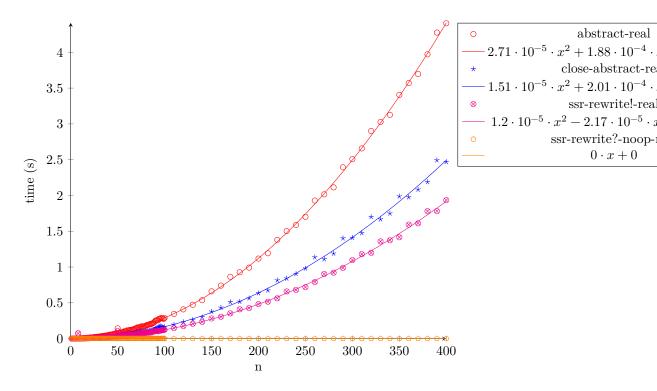
 $Figure\ 5:\ timing-rewrite-strat-under-binders$ 



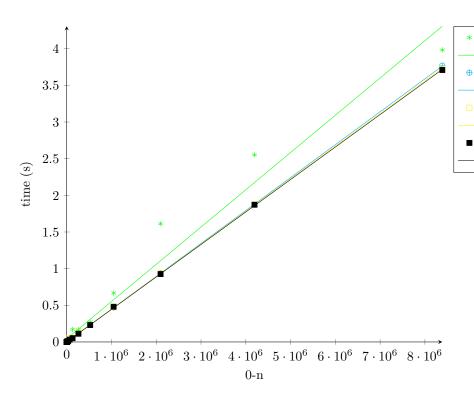
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$ 



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



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



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

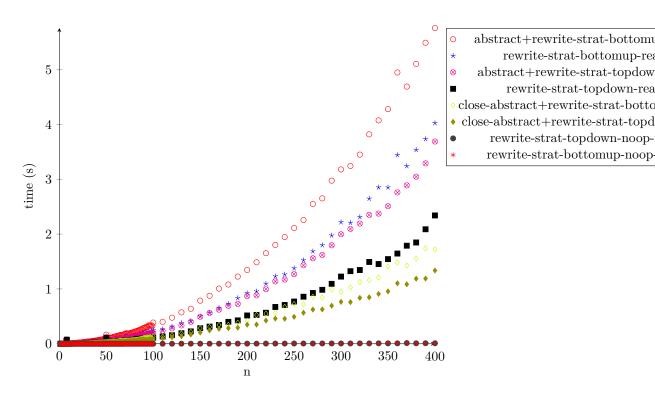
 $5.08 \cdot 10^{-7} \cdot x + 4.32 \cdot 10^{-2}$  try-ssr-rewrite-noop-real

 $\begin{aligned} &4.49 \cdot 10^{-7} \cdot x - 1.46 \cdot 10^{-3} \\ &\text{try-ssr-rewrite!-noop-real} \\ &4.45 \cdot 10^{-7} \cdot x + 2.75 \cdot 10^{-3} \end{aligned}$ 

try-ssr-rewrite?-noop-real

 $4.43\cdot 10^{-7}\cdot x + 3.24\cdot 10^{-4}$ 

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

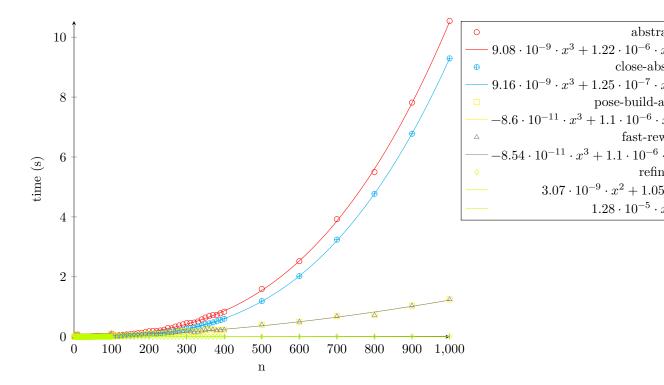


rewrite-strat-bottomup-rea

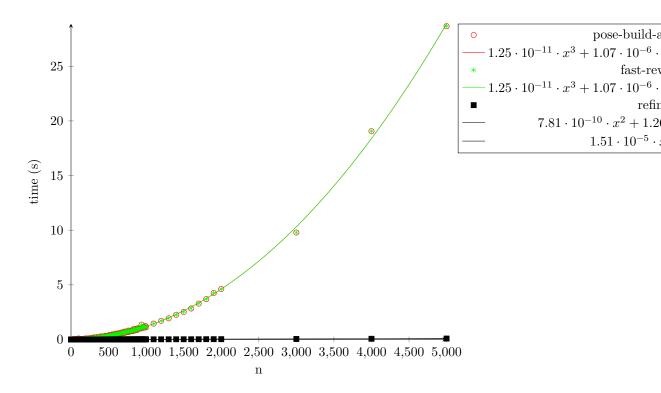
rewrite-strat-topdown-rea

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

 $Figure\ 10:\ timing-rewrite-repeated-app-rewrite-strat$ 



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



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

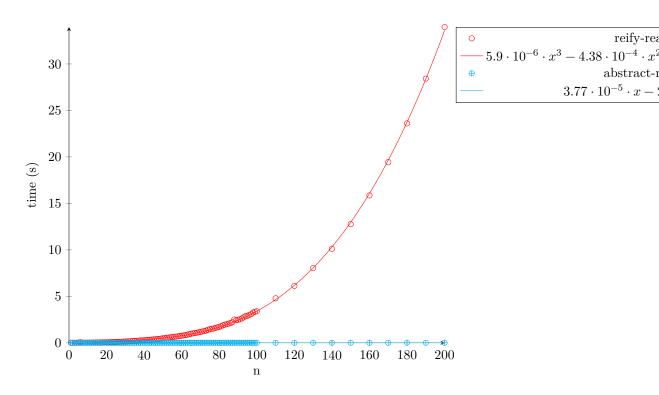


Figure 13: timing-typeclass-reification-let-in-HOAS

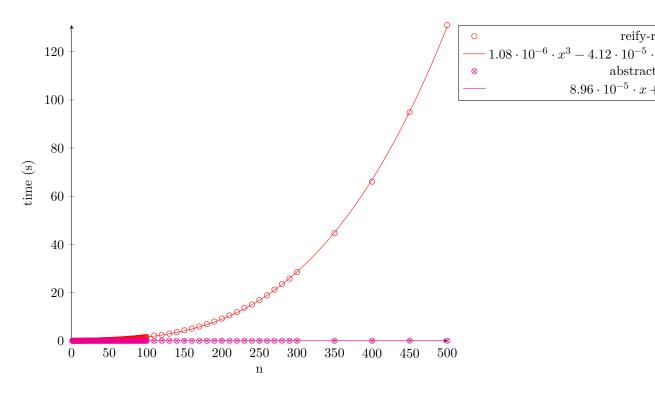
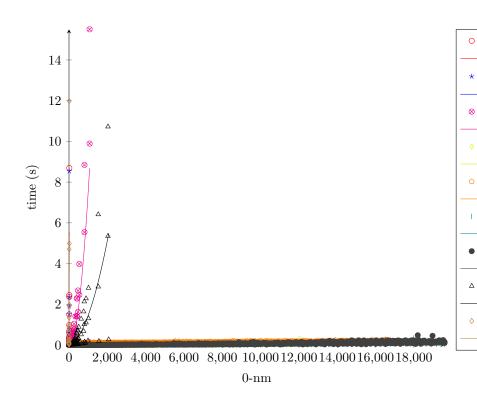


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(topdown-bot)  $5.42 \cdot 10^{-3} exp(0.46 \cdot ($ 

rewrite-strat (bottomup-bot 5.5  $\cdot$   $10^{-3}$  exp (0.46  $\cdot$  (6

 $7.63\cdot 10^{-6}\cdot x^2 - 1.66\cdot 10^{-4}\cdot x^2 - 1.66\cdot 1$ 

 $1.83 \cdot 10^{-10} \cdot x^2 + 5.14 \cdot 10^{-6} \cdot$ 

 $6.39 \cdot 10^{-11} \cdot x^2 + 6.07 \cdot 10^{-6}$ 

 $1.11\cdot 10^{-10}\cdot x^2 + 3.84\cdot 10^{-6}\cdot \\$ 

 $2.38 \cdot 10^{-10} \cdot x^2 + 4.9 \cdot 10^{-6} \cdot x^$ 

 $1.1 \cdot 10^{-6} \cdot x^2 + 3.72 \cdot 10^{-4} \cdot x^2$ 

 $-6.97 \cdot 10^{-3} \cdot x^3 + 0.22 \cdot x^2 -$ 

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

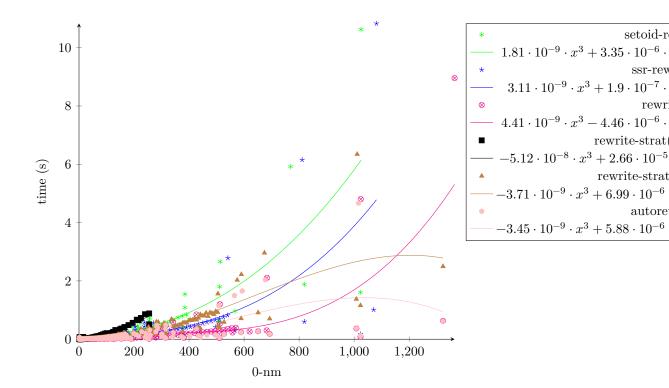
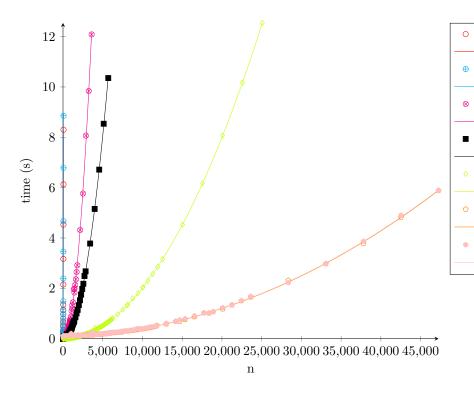


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $2.27 \cdot 10^{-5} \cdot x^3 + 2.81 \cdot 10^{-4} \cdot x^3$ 

 $2.28 \cdot 10^{-5} \cdot x^3 + 1.17 \cdot 10^{-4} \cdot x^3$ 

 $9.52 \cdot 10^{-7} \cdot x^2 - 4.87$ 

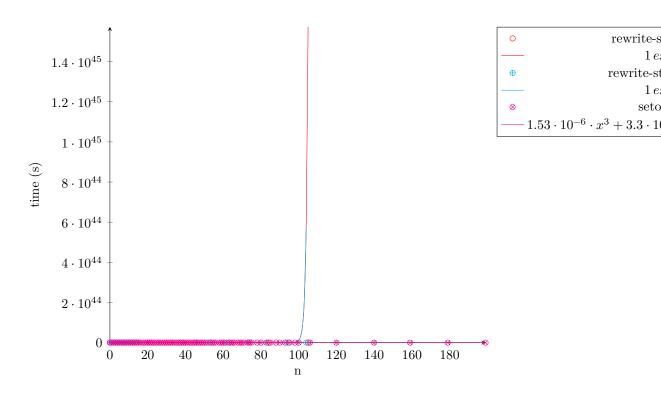
 $3.11 \cdot 10^{-7} \cdot x^2 + 5.97$ 

 $1.97 \cdot 10^{-8} \cdot x^2 + 4.86$ 

 $2.47 \cdot 10^{-9} \cdot x^2 + 5.79$ 

 $2.47 \cdot 10^{-9} \cdot x^2 + 6.33$ 

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



rewrite-s

rewrite-st

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