

Figure 1: timing-pattern

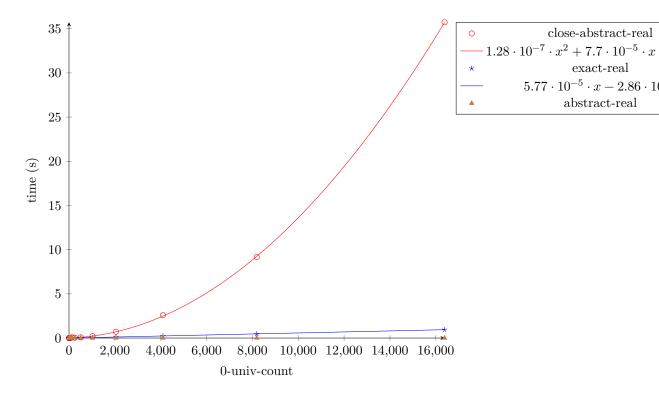


Figure 2: timing-n-polymorphic-universes param-1-n 0

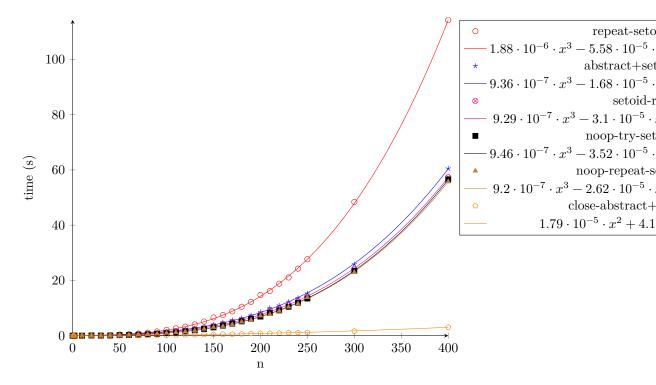
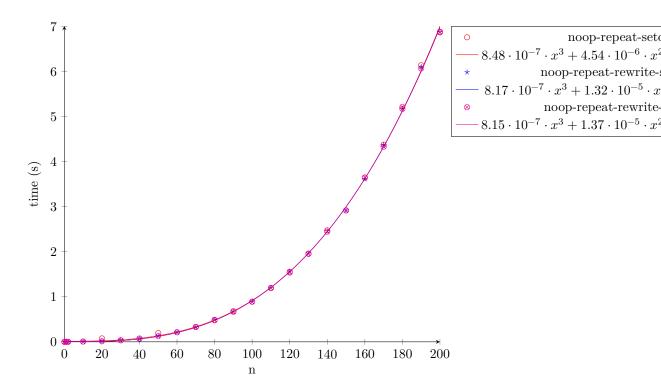
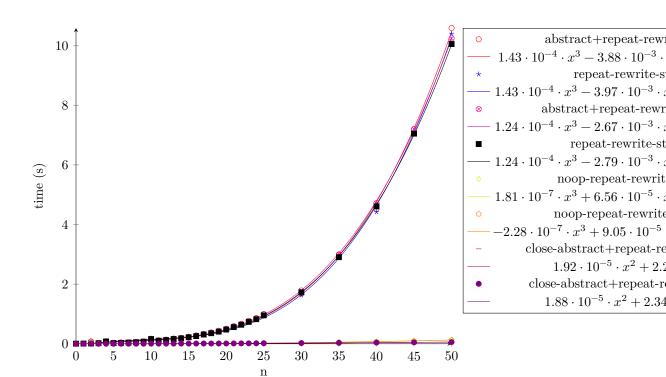


Figure 3: timing-repeat-setoid-rewrite-under-binders



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



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

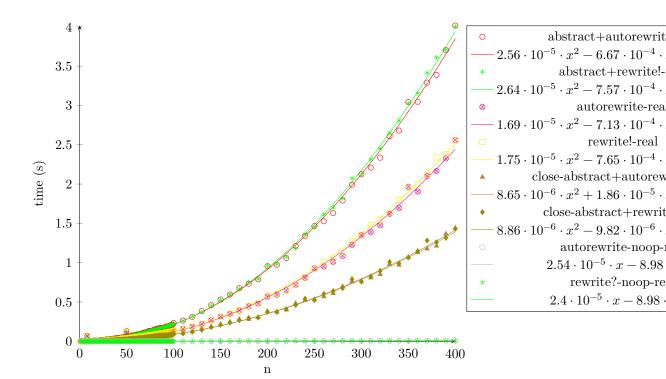
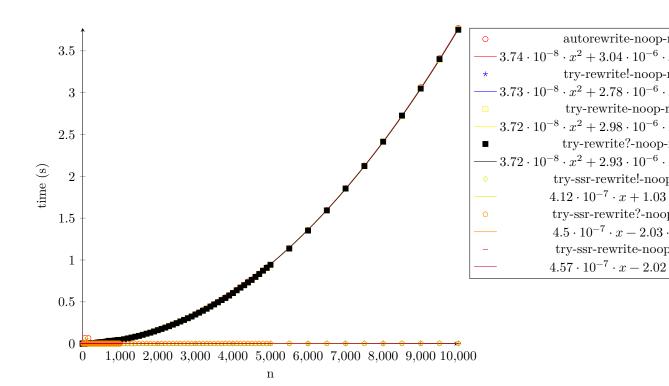
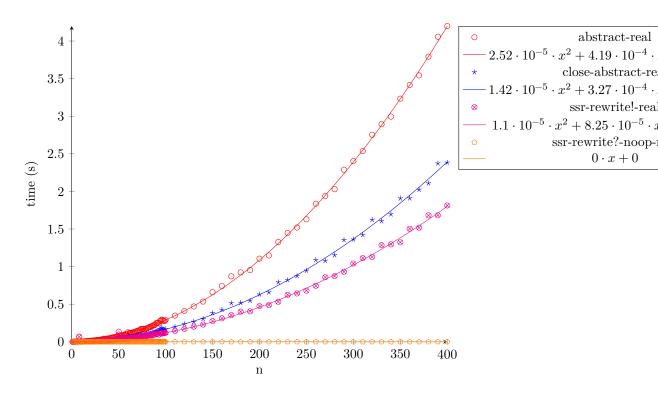


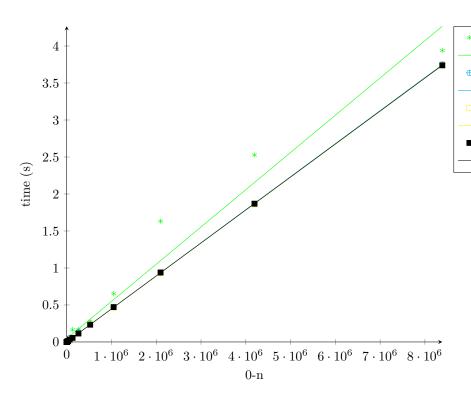
Figure 6: timing-rewrite-repeated-app-autorewrite



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



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



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

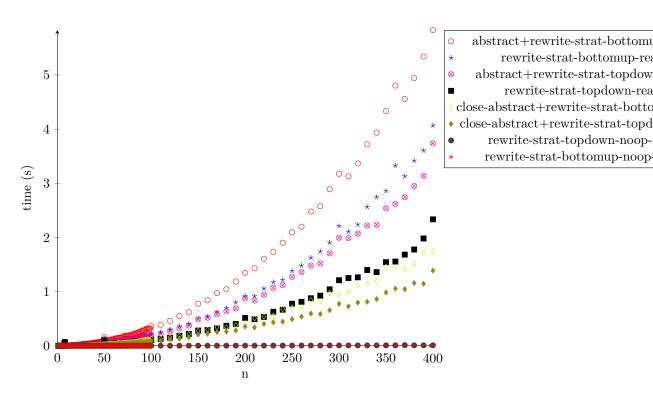
 $5.03 \cdot 10^{-7} \cdot x + 4.43 \cdot 10^{-2}$  try-ssr-rewrite!-noop-real

 $4.46 \cdot 10^{-7} \cdot x + 1.95 \cdot 10^{-3}$  try-ssr-rewrite-noop-real

 $4.45\cdot 10^{-7}\cdot x - 8.49\cdot 10^{-4}$  try-ssr-rewrite?-noop-real

 $4.46\cdot 10^{-7}\cdot x - 3.63\cdot 10^{-5}$ 

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

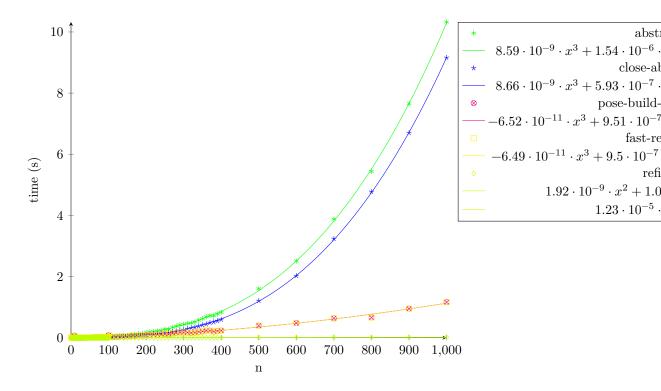


rewrite-strat-bottomup-rea

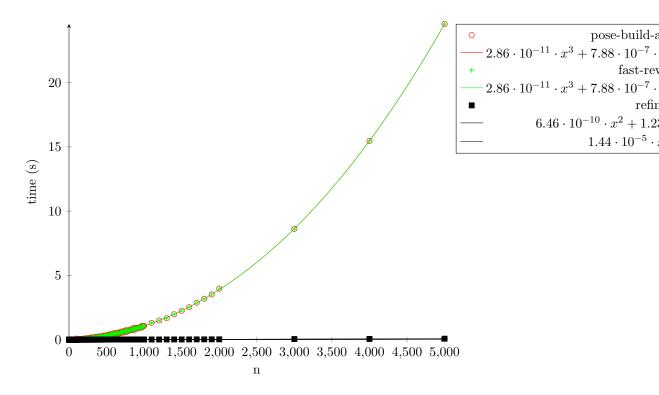
abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

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

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



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



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

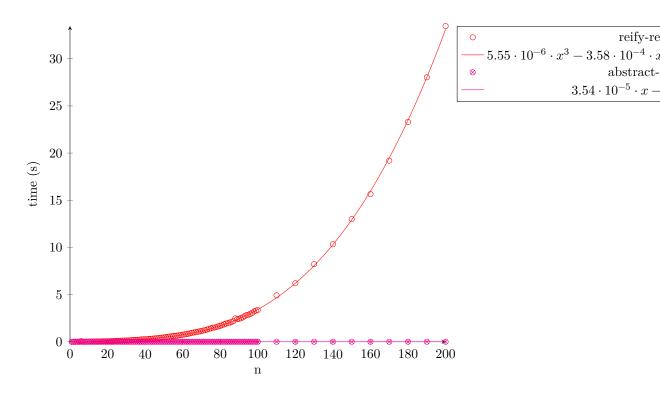


Figure 13: timing-typeclass-reification-let-in-HOAS

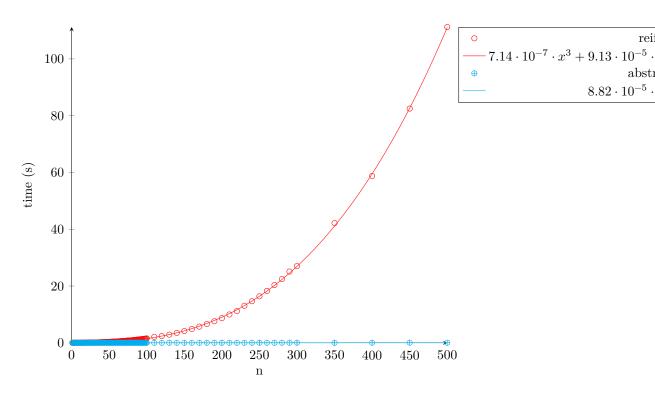
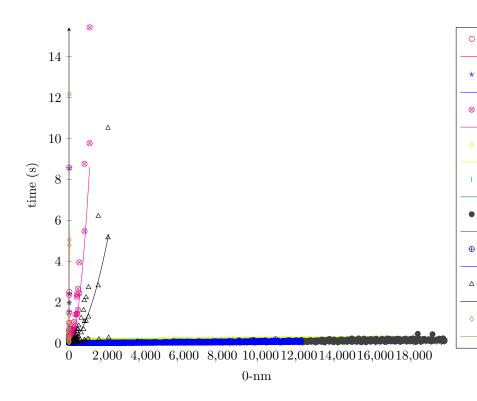


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(topdown-bot  $5.51 \cdot 10^{-3} exp(0.46 \cdot ($ 

rewrite-strat (bottomup-bot 5.46  $\cdot$   $10^{-3} \exp{\left(0.46 \cdot \left( \right.\right)}$ 

 $7.55\cdot 10^{-6}\cdot x^2 - 1.47\cdot 10^{-4}\cdot x^{-1}$ 

 $6.74 \cdot 10^{-11} \cdot x^2 + 5.72 \cdot 10^{-6} \cdot$ 

 $9.42 \cdot 10^{-11} \cdot x^2 + 3.87 \cdot 10^{-6} \cdot$ 

 $1.91\cdot 10^{-10}\cdot x^2 + 5.18\cdot 10^{-6}\cdot \\$ 

 $9.54 \cdot 10^{-11} \cdot x^2 + 5.72 \cdot 10^{-6} \cdot \\$ 

 $1.07 \cdot 10^{-6} \cdot x^2 + 3.68 \cdot 10^{-4}$ 

 $-7.08 \cdot 10^{-3} \cdot x^3 + 0.23 \cdot x^2 -$ 

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

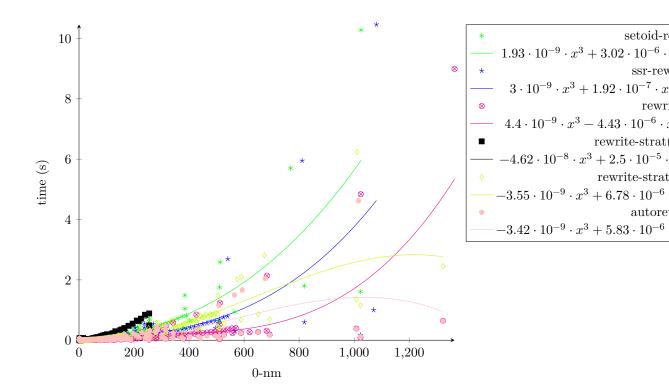
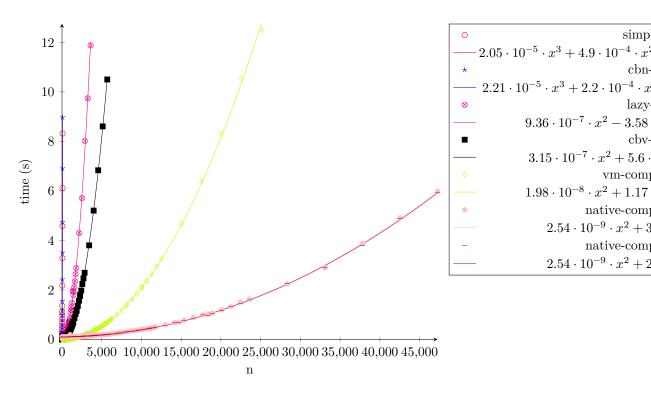


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

lazy

cbv-

vm-com

native-comp  $2.54 \cdot 10^{-9} \cdot x^2 + 3$ 

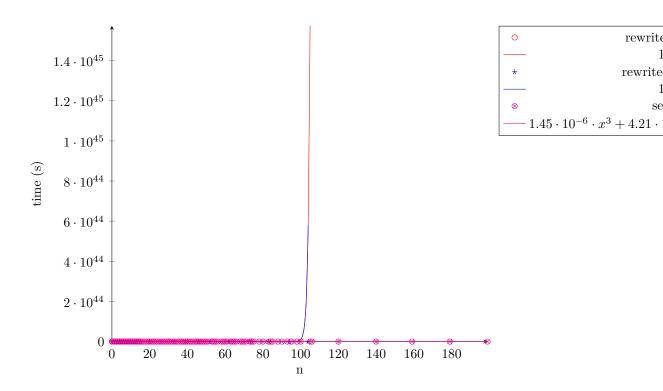
native-comp  $2.54 \cdot 10^{-9} \cdot x^2 + 2$ 

 $9.36\cdot 10^{-7}\cdot x^2 - 3.58$ 

 $3.15 \cdot 10^{-7} \cdot x^2 + 5.6 \cdot$ 

 $1.98 \cdot 10^{-8} \cdot x^2 + 1.17$ 

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



rewrite

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