

Figure 1: timing-pattern

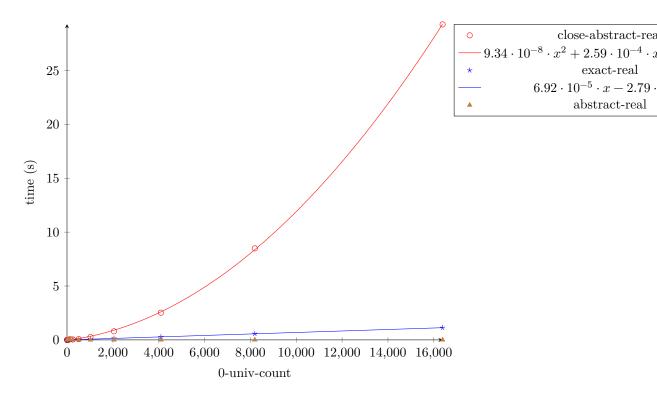
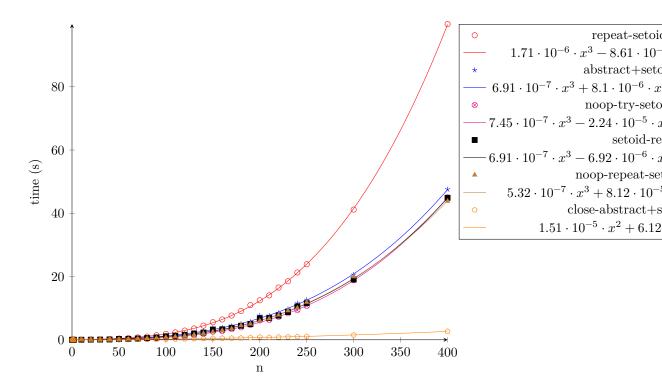


Figure 2: timing-n-polymorphic-universes param-1-n 0



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

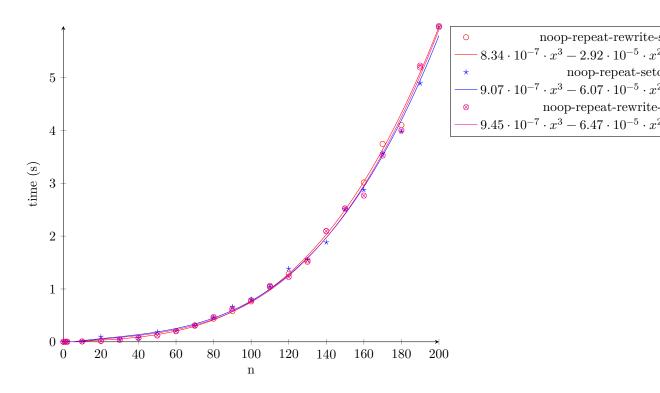
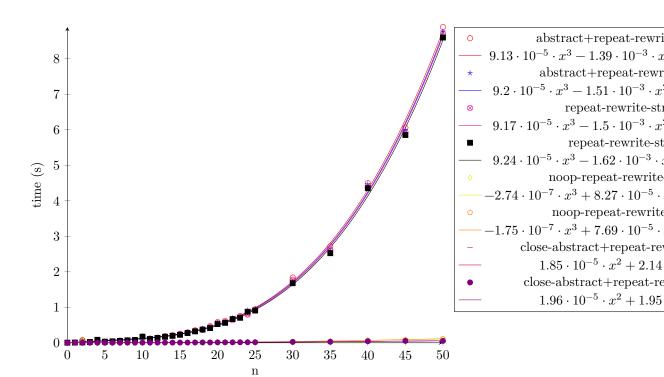
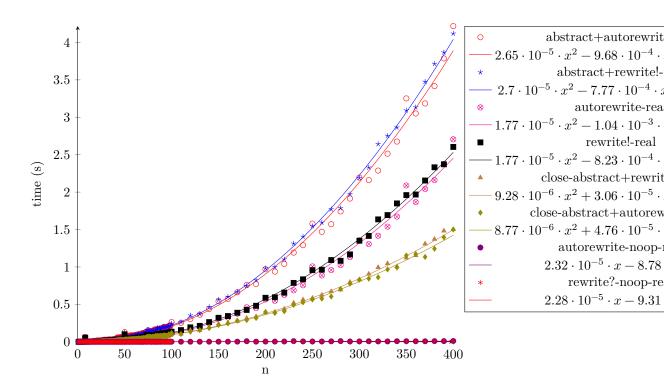


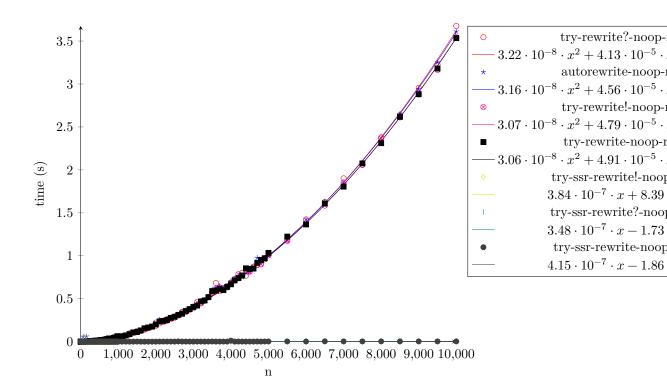
Figure 4: timing-repeat-setoid-rewrite-under-binders-noop



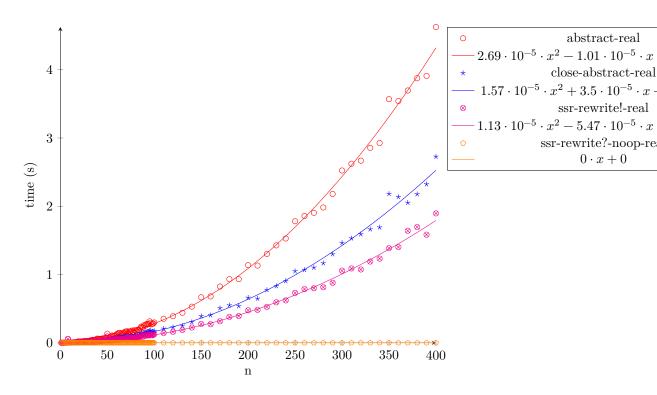
 $Figure\ 5:\ timing-rewrite-strat-under-binders$ 



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



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



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

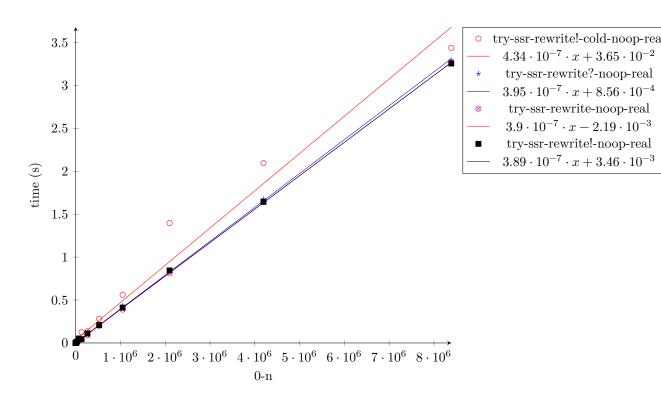
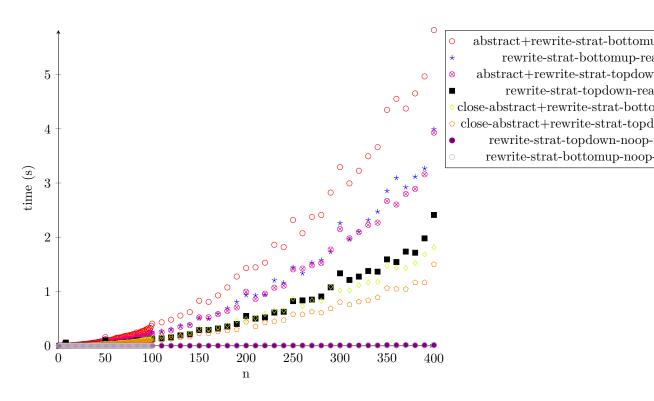


Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn  $\ 1$ 

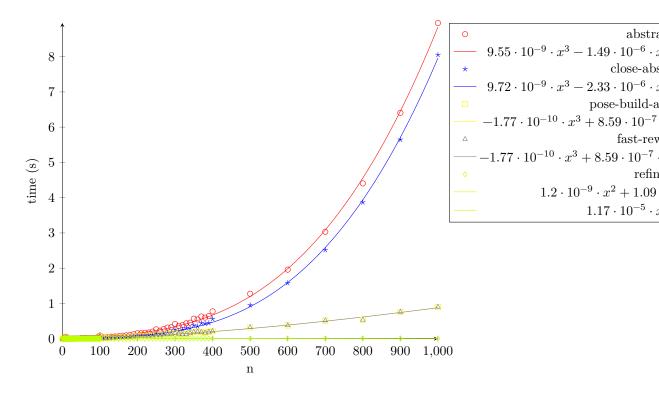


rewrite-strat-bottomup-rea

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

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

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



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

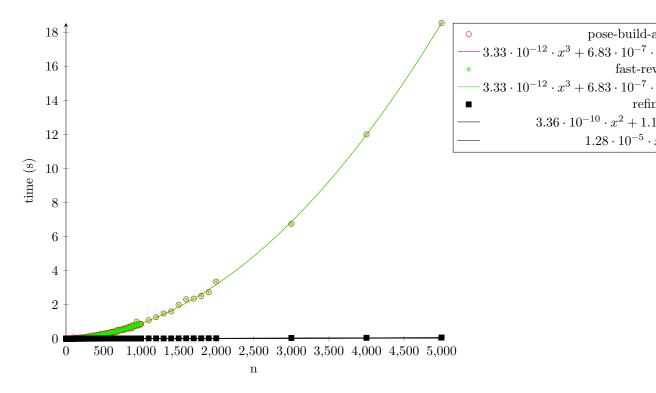


Figure 12: timing-rewrite-repeated-app-fast-rewrite-no-abstract

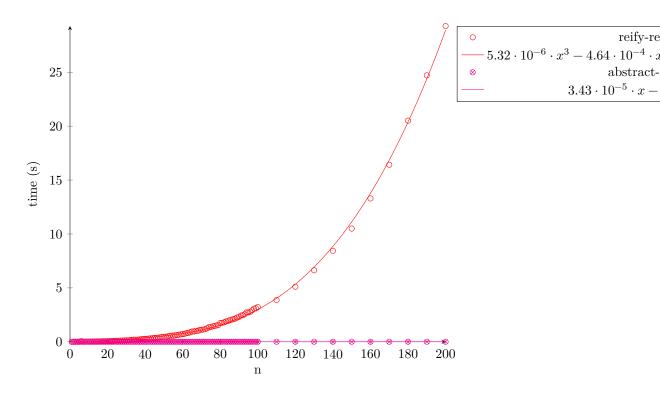
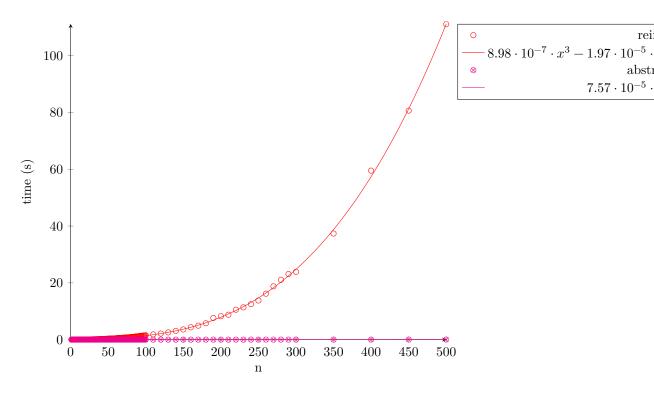
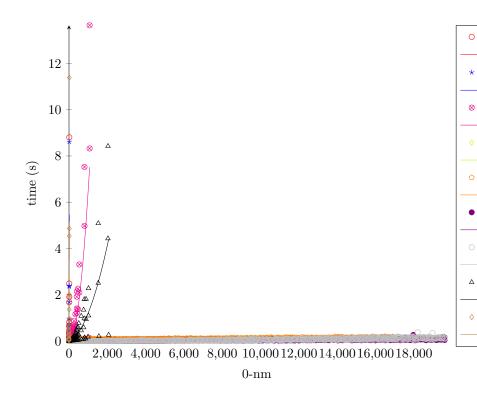


Figure 13: timing-typeclass-reification-let-in-HOAS



 ${\bf Figure~14:~timing-type class-reification-let-in-PHOAS}$ 



rewrite-strat(bottomup-bot  $6.59 \cdot 10^{-3} exp(0.45 \cdot ($ 

rewrite-strat (topdown-bot 6.89  $\cdot$  10<sup>-3</sup> exp (0.45  $\cdot$  (

 $6.62\cdot 10^{-6}\cdot x^2 - 1.54\cdot 10^{-4}\cdot x^2 + 1.54\cdot 1$ 

 $1.43 \cdot 10^{-10} \cdot x^2 + 3.82 \cdot 10^{-6} \cdot$ 

 $1.17 \cdot 10^{-10} \cdot x^2 + 3.93 \cdot 10^{-6} \cdot$ 

 $8.12\cdot 10^{-11}\cdot x^2 + 3.29\cdot 10^{-6}\cdot \\$ 

 $1.98 \cdot 10^{-10} \cdot x^2 + 3.85 \cdot 10^{-6} \cdot$ 

 $8.51 \cdot 10^{-7} \cdot x^2 + 3.75 \cdot 10^{-4} \cdot x^2$ 

 $-6.68 \cdot 10^{-3} \cdot x^3 + 0.21 \cdot x^2 - \\$ 

cps+cbn-real

 $\operatorname{cps+cbv-real}$ 

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

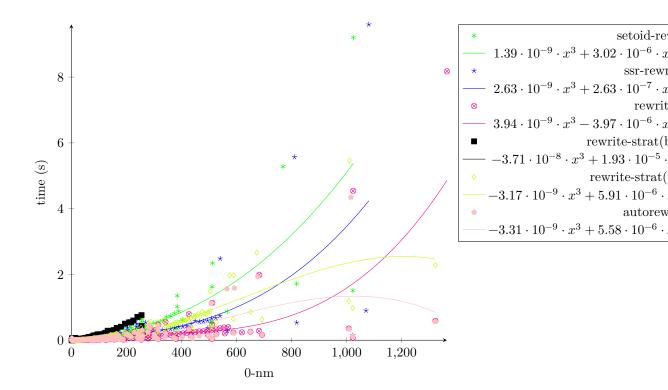
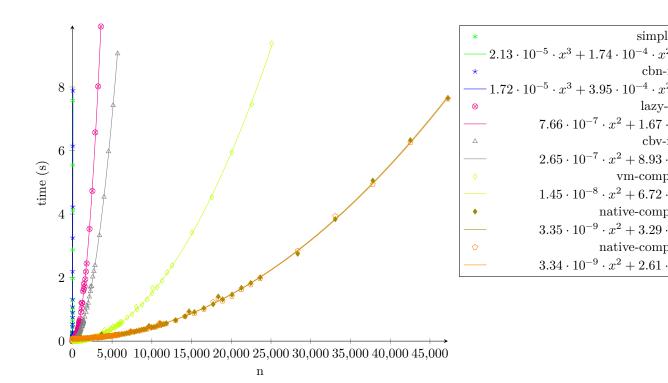


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



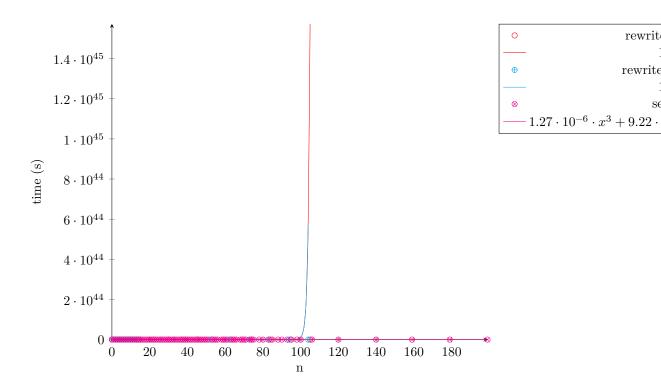
simpl

vm-comp

native-comp

native-comp

Figure 17: timing-sieve-of-eratosthenes



rewrite

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