

Figure 1: timing-pattern

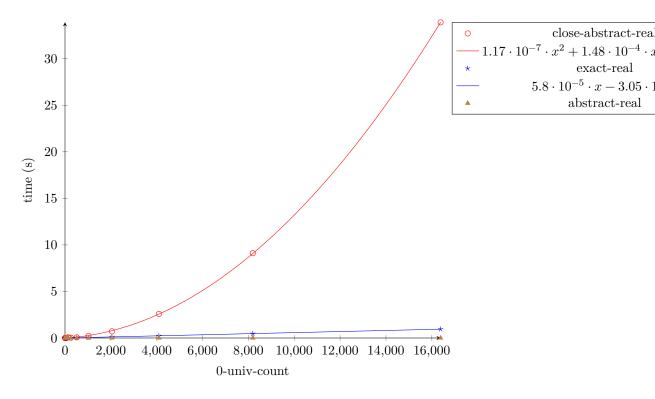


Figure 2: timing-n-polymorphic-universes param-1-n 0

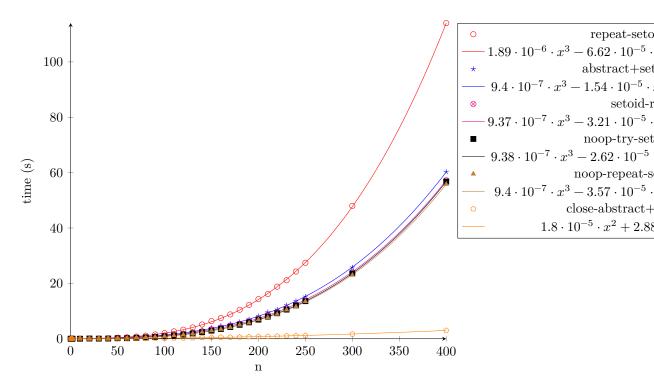
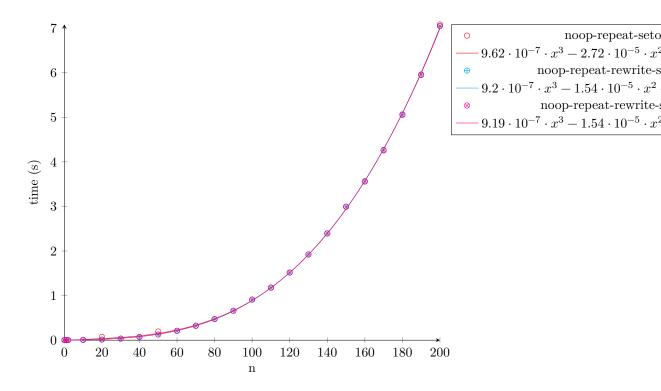
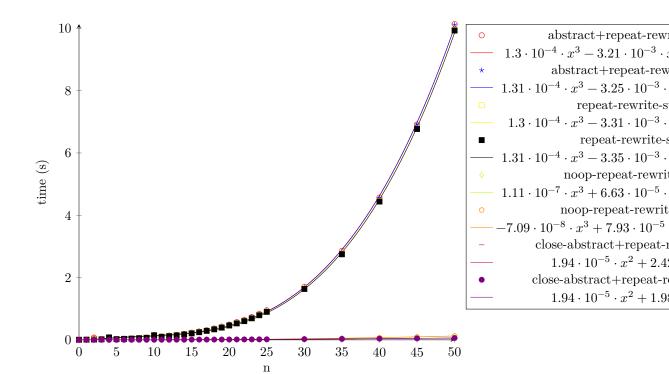


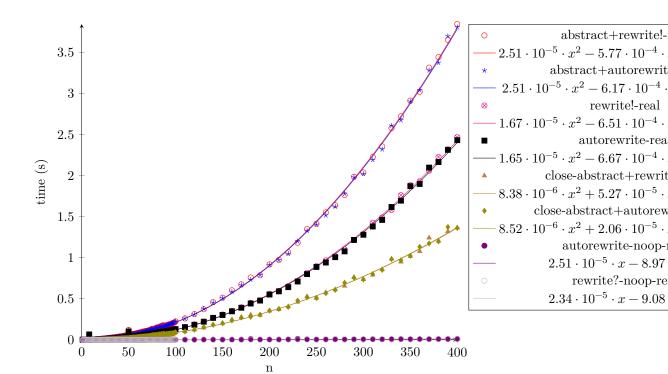
Figure 3: timing-repeat-setoid-rewrite-under-binders



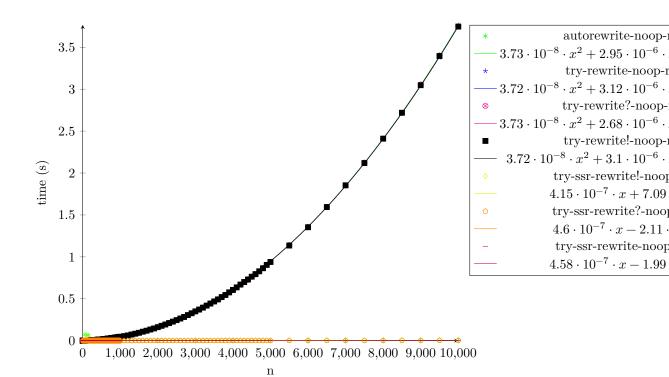
 $Figure\ 4:\ timing-repeat-setoid-rewrite-under-binders-noop$ 



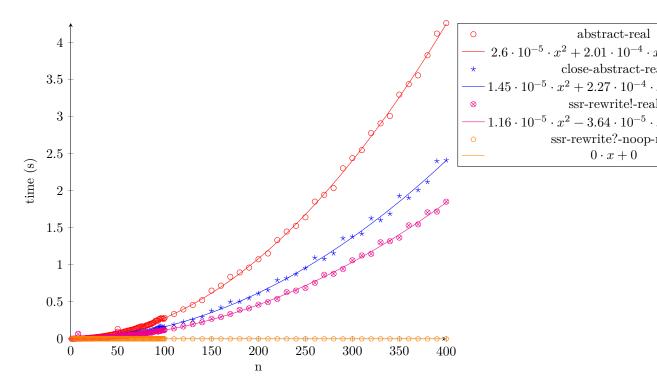
 $Figure \ 5: \ timing-rewrite-strat-under-binders$ 



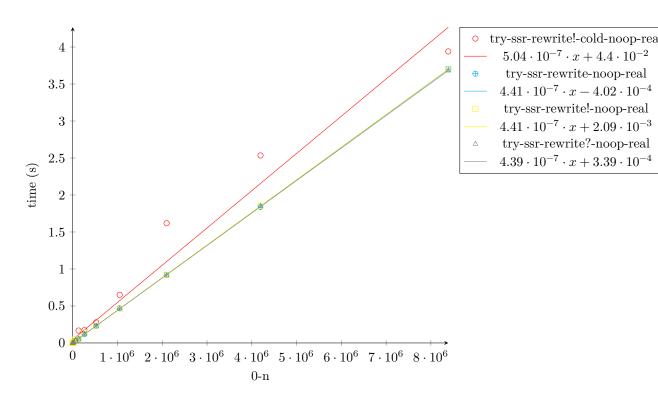
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$ 



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



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



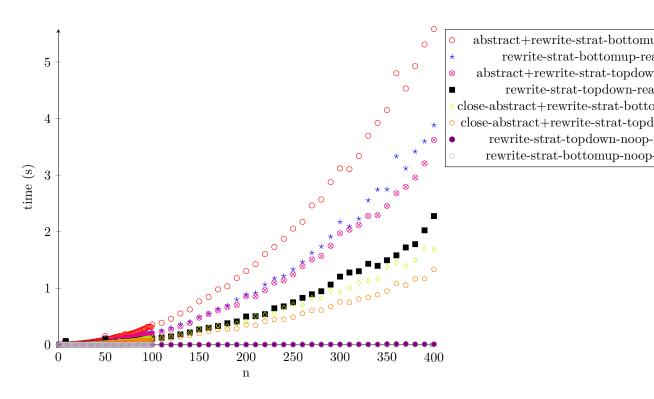
 $5.04 \cdot 10^{-7} \cdot x + 4.4 \cdot 10^{-2}$ try-ssr-rewrite-noop-real

 $4.41\cdot 10^{-7}\cdot x - 4.02\cdot 10^{-4}$ try-ssr-rewrite!-noop-real

 $4.41\cdot 10^{-7}\cdot x + 2.09\cdot 10^{-3}$ try-ssr-rewrite?-noop-real

 $4.39 \cdot 10^{-7} \cdot x + 3.39 \cdot 10^{-4}$ 

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

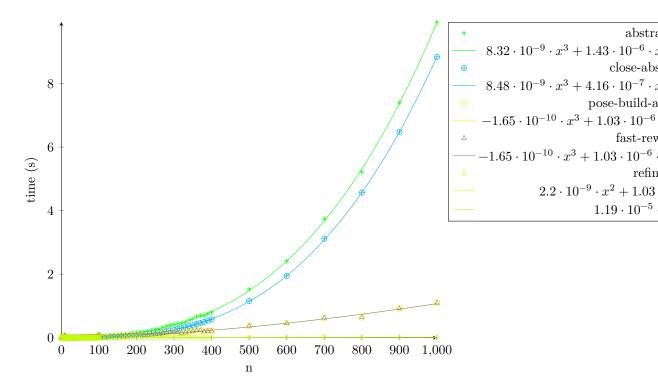


rewrite-strat-bottomup-rea

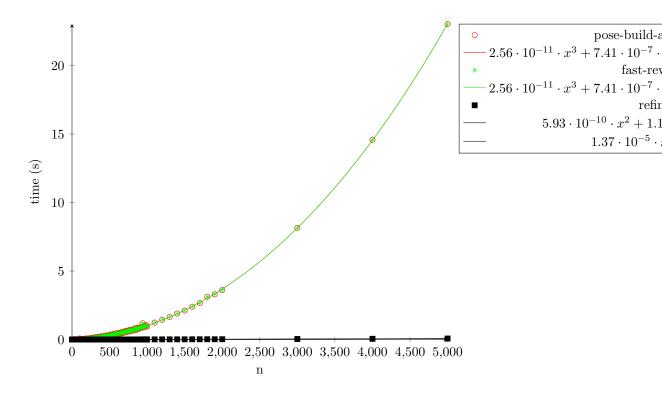
rewrite-strat-topdown-rea

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

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



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



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

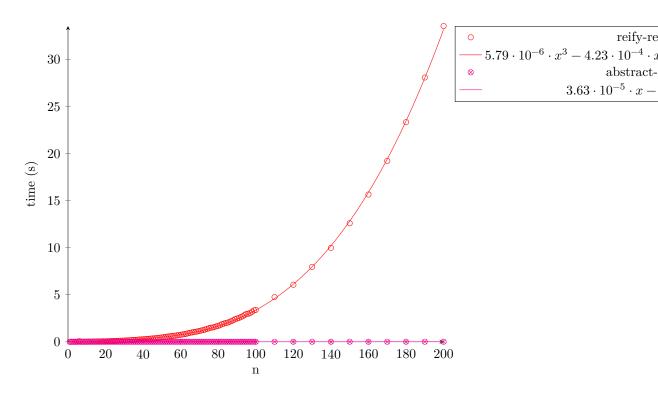
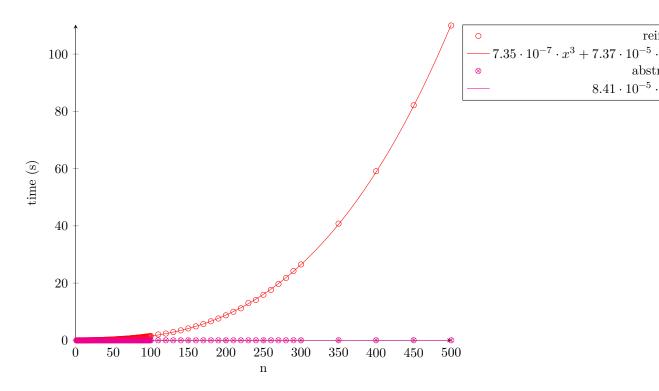
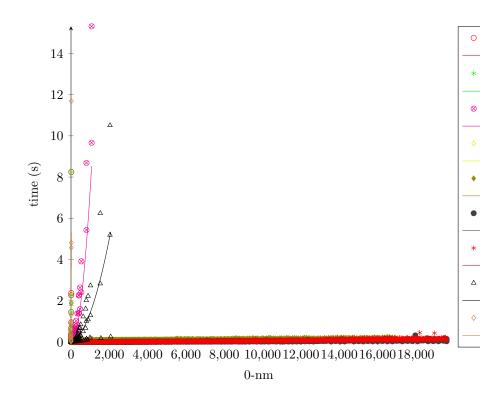


Figure 13: timing-typeclass-reification-let-in-HOAS



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



rewrite-strat(topdown-bot

 $7.49 \cdot 10^{-6} \cdot x^2 - 1.53 \cdot 10^{-4} \cdot .$ 

 $1.21 \cdot 10^{-10} \cdot x^2 + 5.29 \cdot 10^{-6} \cdot$ 

 $4.49 \cdot 10^{-11} \cdot x^2 + 5.91 \cdot 10^{-6} \cdot$ 

 $1.06\cdot 10^{-10}\cdot x^2 + 3.64\cdot 10^{-6}\cdot \\$ 

 $2.15\cdot 10^{-10}\cdot x^2 + 4.61\cdot 10^{-6}\cdot$ 

 $1.08 \cdot 10^{-6} \cdot x^2 + 3.6 \cdot 10^{-4} \cdot x^2$ 

 $-6.78 \cdot 10^{-3} \cdot x^3 + 0.22 \cdot x^2 -$ 

 $5.4\cdot 10^{-3}\exp{(0.46\cdot(0$ 

cps+cbn-real

cps+vm-compute-

cps+native-compute

cps+cbv-real

cps+lazy-real

cps+simpl-real

setoid-rewrite-re

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

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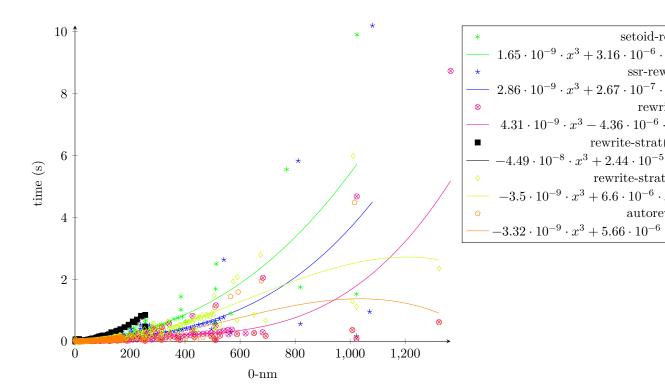
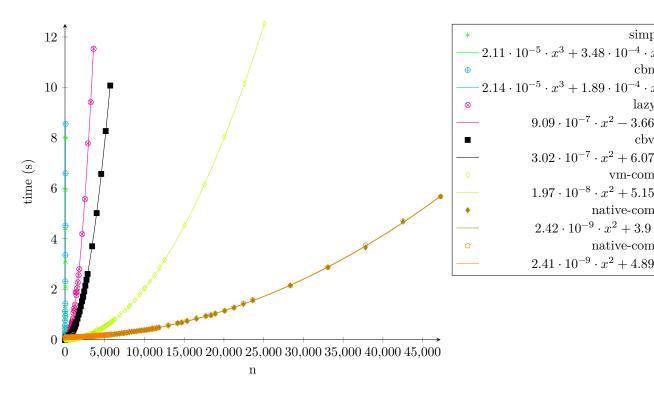


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $9.09 \cdot 10^{-7} \cdot x^2 - 3.66$ 

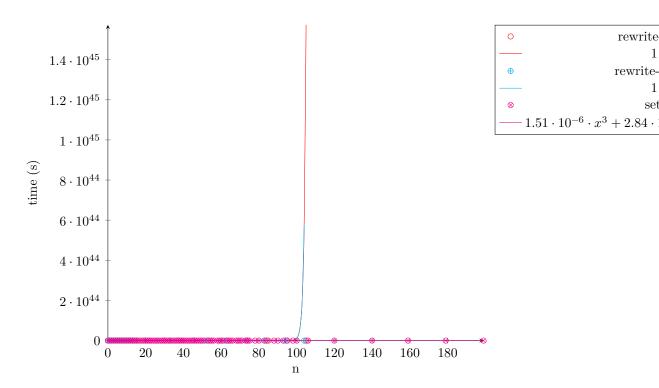
 $3.02 \cdot 10^{-7} \cdot x^2 + 6.07$ 

 $1.97 \cdot 10^{-8} \cdot x^2 + 5.15$ 

 $2.42 \cdot 10^{-9} \cdot x^2 + 3.9$ 

 $2.41 \cdot 10^{-9} \cdot x^2 + 4.89$ 

Figure 17: timing-sieve-of-eratosthenes



rewrite

rewrite-

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