

Figure 1: timing-pattern

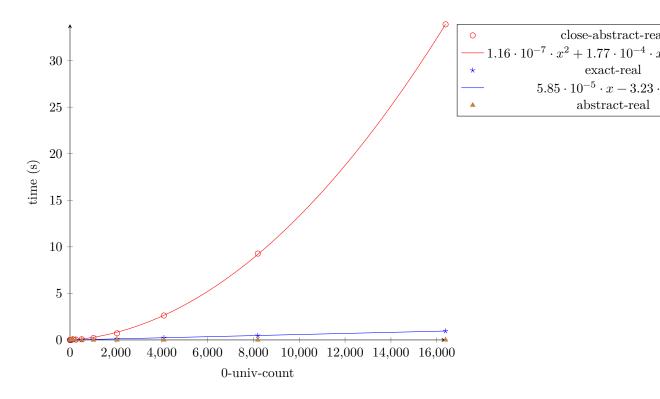


Figure 2: timing-n-polymorphic-universes param-1-n 0

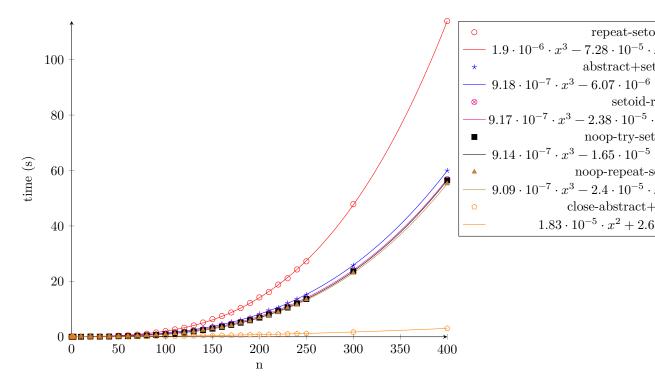
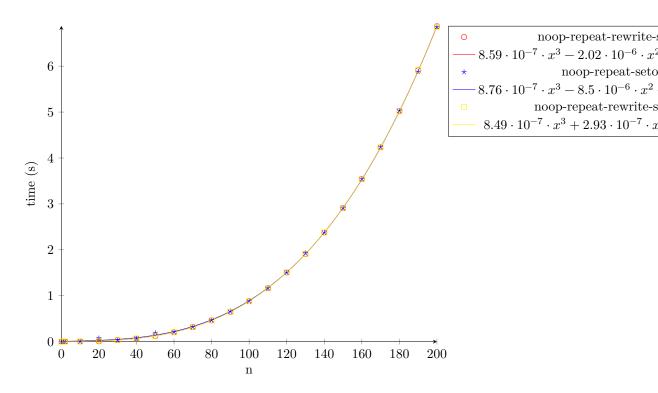
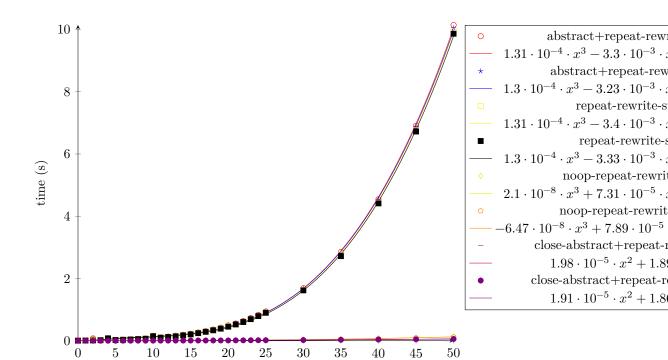


Figure 3: timing-repeat-setoid-rewrite-under-binders

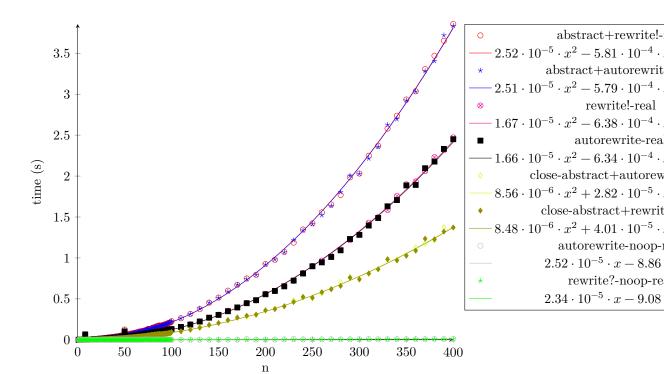


 $Figure\ 4:\ timing-repeat-setoid-rewrite-under-binders-noop$

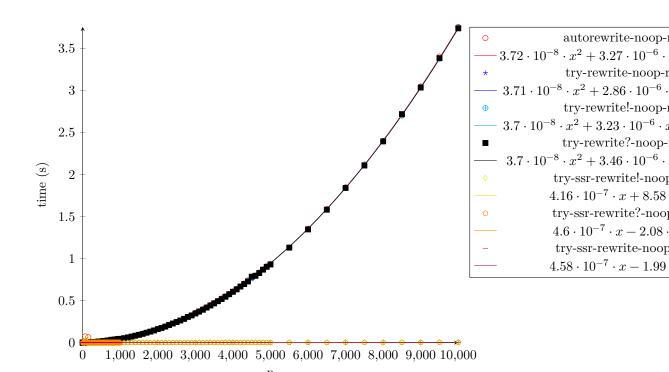


 $Figure \ 5: \ timing-rewrite-strat-under-binders$

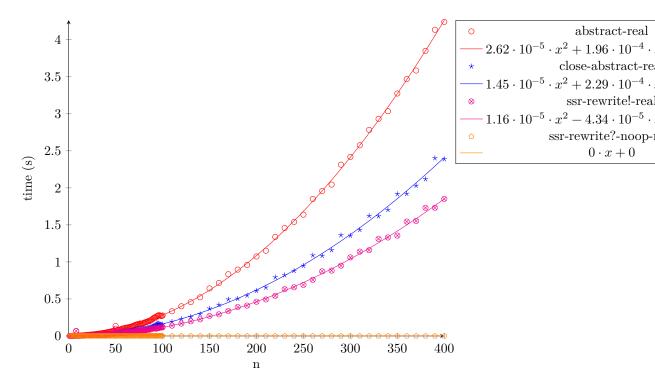
 \mathbf{n}



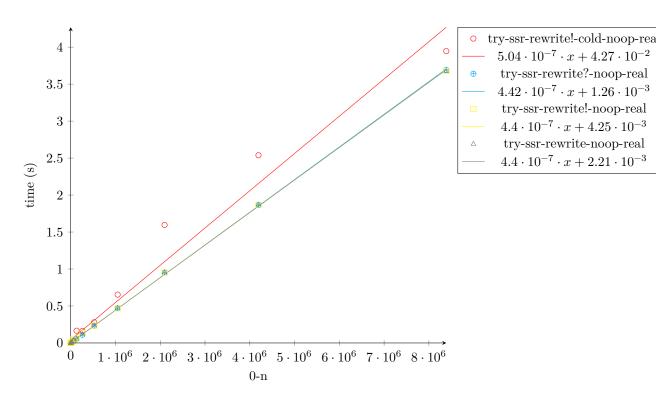
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$



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



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



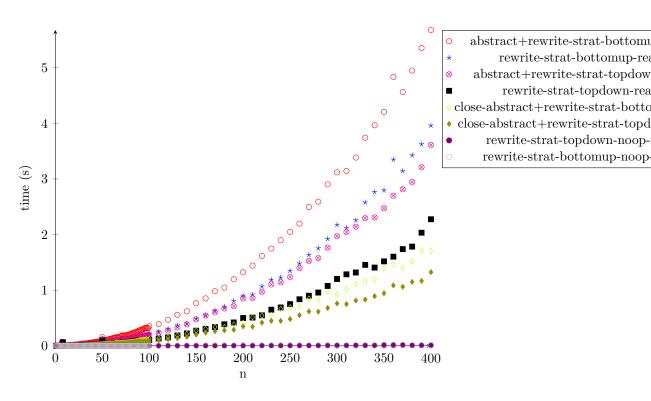
 $5.04 \cdot 10^{-7} \cdot x + 4.27 \cdot 10^{-2}$ try-ssr-rewrite?-noop-real

 $4.42\cdot 10^{-7}\cdot x + 1.26\cdot 10^{-3}$ try-ssr-rewrite!-noop-real

 $4.4 \cdot 10^{-7} \cdot x + 4.25 \cdot 10^{-3}$ try-ssr-rewrite-noop-real

 $4.4\cdot 10^{-7}\cdot x + 2.21\cdot 10^{-3}$

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

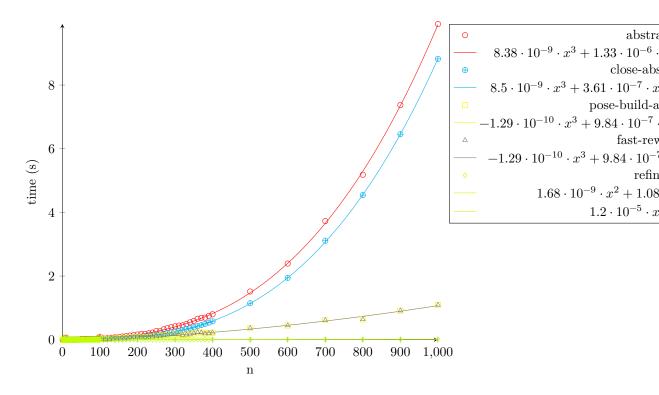


rewrite-strat-bottomup-rea

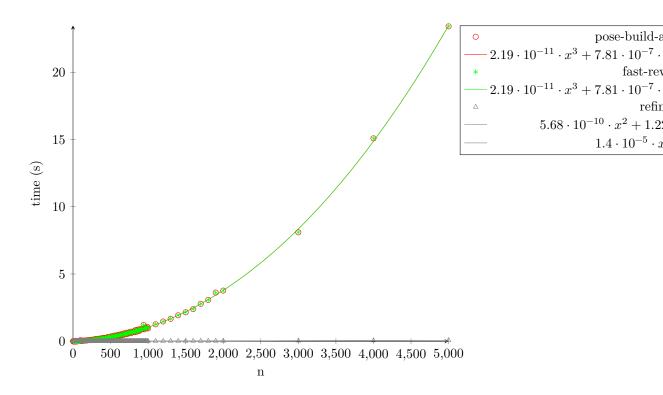
abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

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

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



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



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

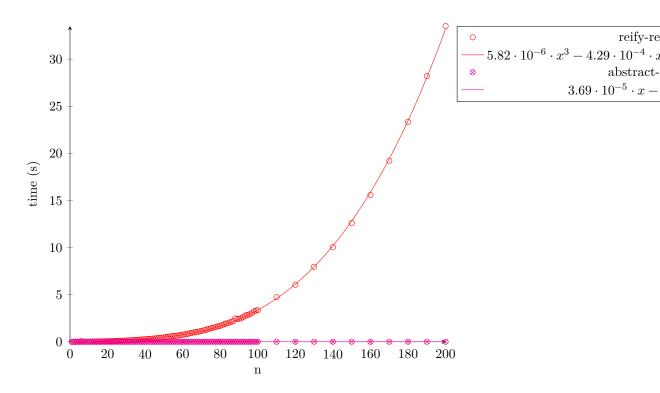
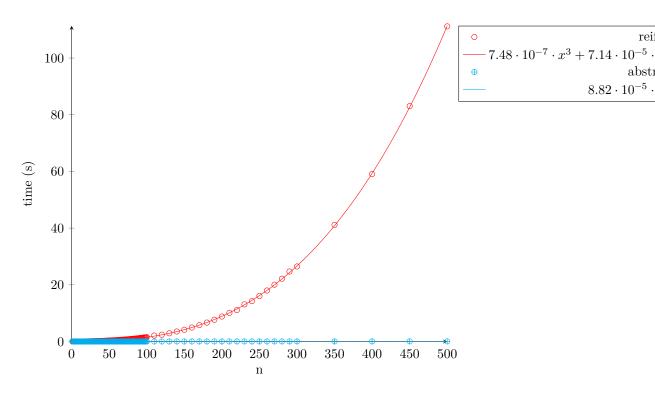
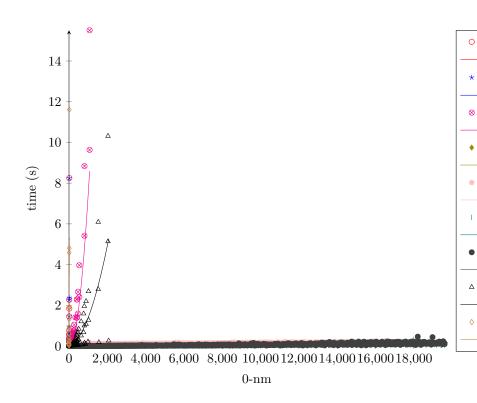


Figure 13: timing-typeclass-reification-let-in-HOAS



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



rewrite-strat(bottomup-bot $5.21 \cdot 10^{-3} \exp{(0.46 \cdot ($

rewrite-strat (topdown-bot) $5.46\cdot 10^{-3} \exp{(0.46\cdot ($

 $7.54 \cdot 10^{-6} \cdot x^2 - 1.56 \cdot 10^{-4} \cdot x^2 + 1.56 \cdot 10^{-4} \cdot x^2$

 $1.17 \cdot 10^{-10} \cdot x^2 + 5.36 \cdot 10^{-6} \cdot$

 $3.6 \cdot 10^{-11} \cdot x^2 + 6.04 \cdot 10^{-6} \cdot x^2$

 $1.08 \cdot 10^{-10} \cdot x^2 + 3.59 \cdot 10^{-6} \cdot$

 $2.18 \cdot 10^{-10} \cdot x^2 + 4.69 \cdot 10^{-6}$

 $1.06 \cdot 10^{-6} \cdot x^2 + 3.52 \cdot 10^{-4} \cdot x^2 + 3.52 \cdot 10^{-4}$

 $-6.77 \cdot 10^{-3} \cdot x^3 + 0.22 \cdot x^2 -$

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

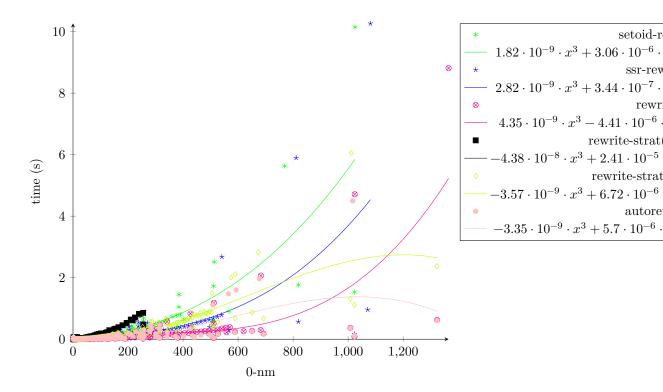
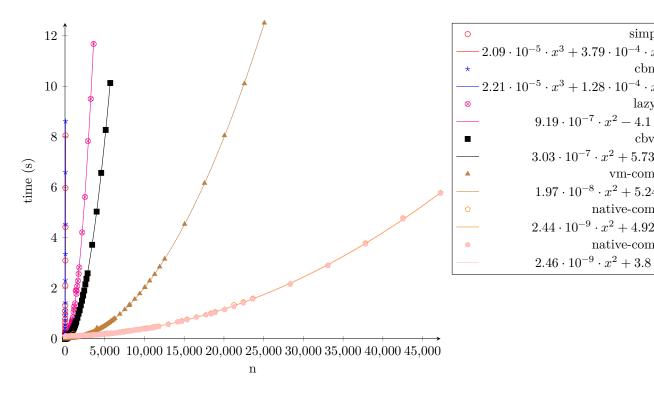


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $9.19 \cdot 10^{-7} \cdot x^2 - 4.1$

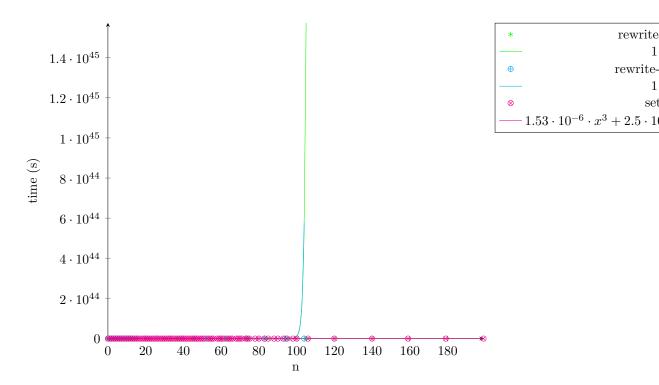
 $3.03 \cdot 10^{-7} \cdot x^2 + 5.73$

 $1.97 \cdot 10^{-8} \cdot x^2 + 5.24$

 $2.44 \cdot 10^{-9} \cdot x^2 + 4.92$

 $2.46 \cdot 10^{-9} \cdot x^2 + 3.8$

Figure 17: timing-sieve-of-eratosthenes



rewrite

rewrite-

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