

Figure 1: timing-pattern

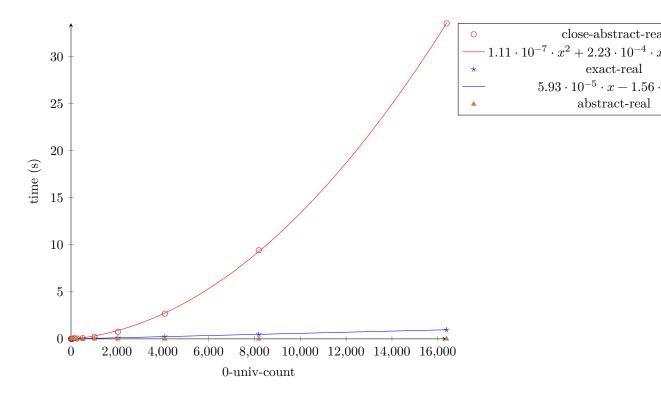


Figure 2: timing-n-polymorphic-universes param-1-n 0

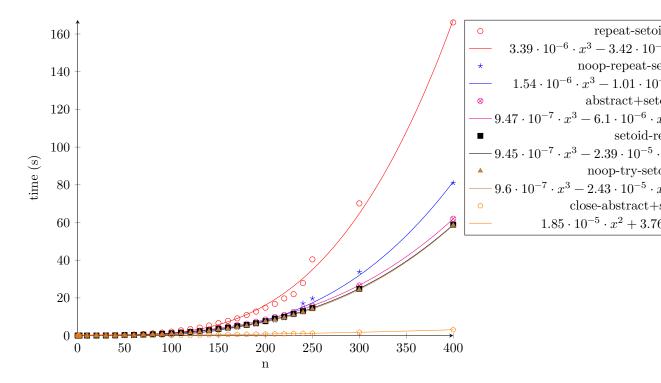
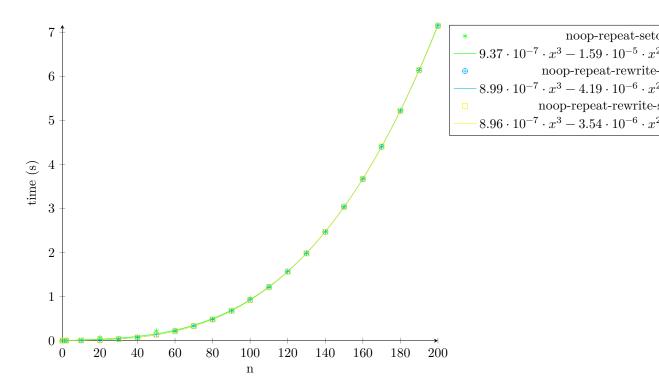
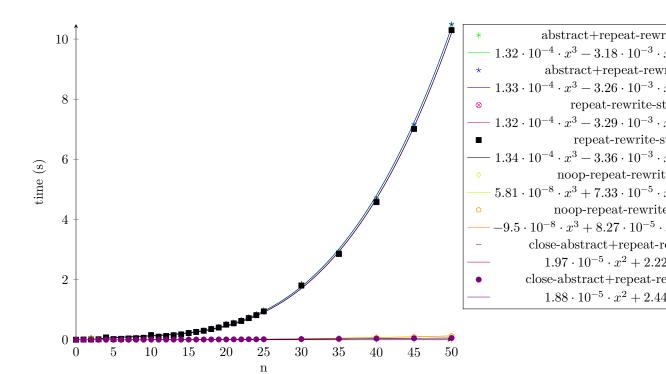


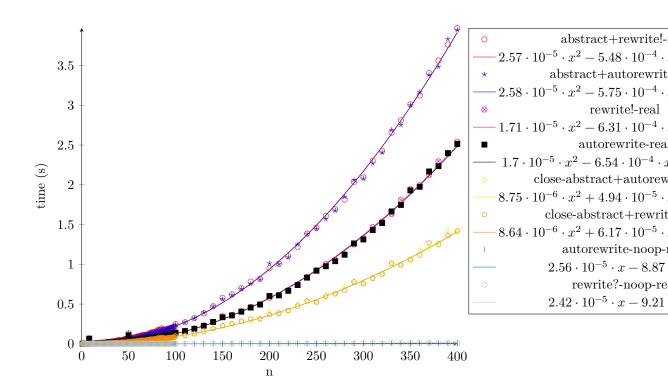
Figure 3: timing-repeat-setoid-rewrite-under-binders



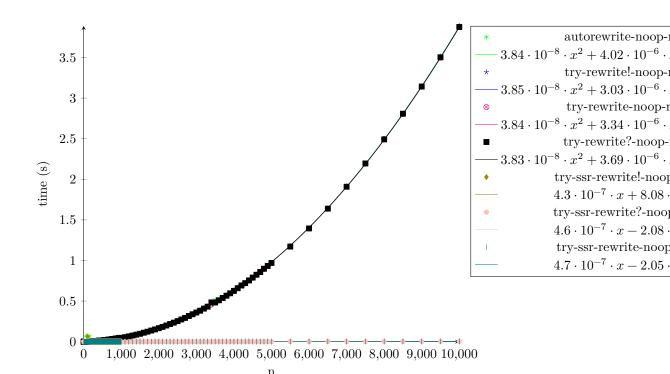
 $Figure\ 4:\ timing-repeat-setoid-rewrite-under-binders-noop$



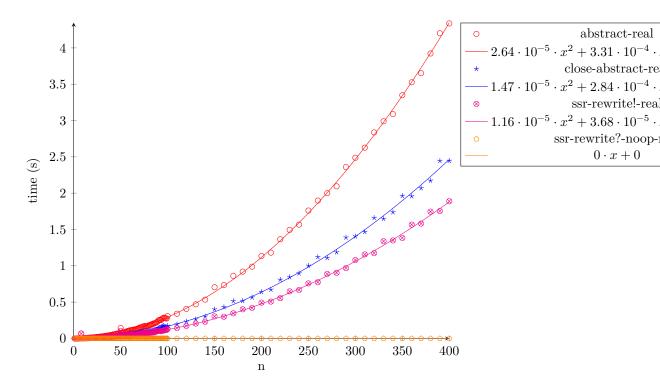
 $Figure\ 5:\ timing-rewrite-strat-under-binders$



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



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



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

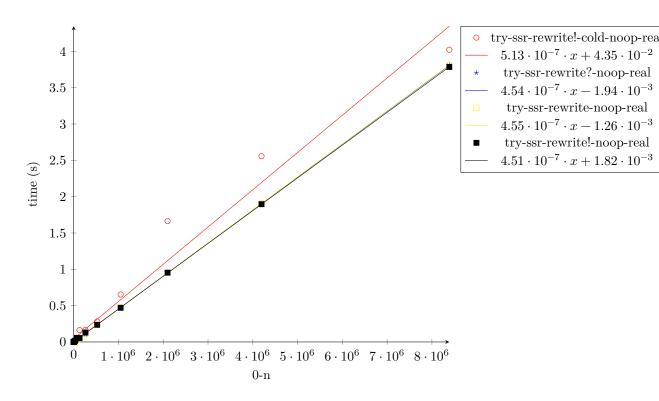
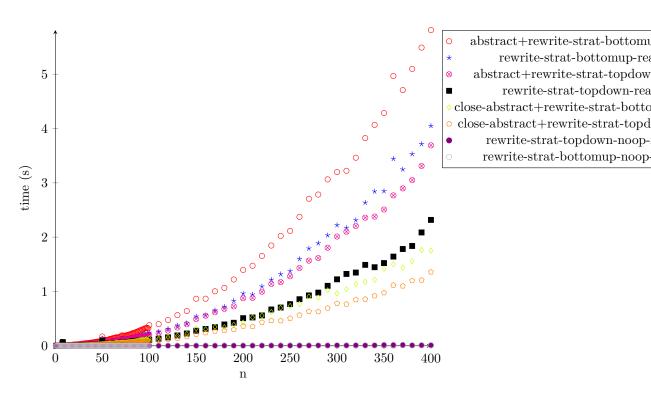


Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn $\ 1$



rewrite-strat-bottomup-rea

rewrite-strat-topdown-rea

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

abstract + rewrite - strat - topdow

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

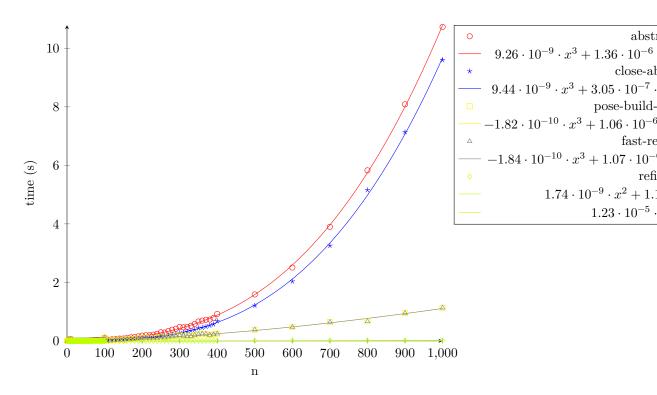
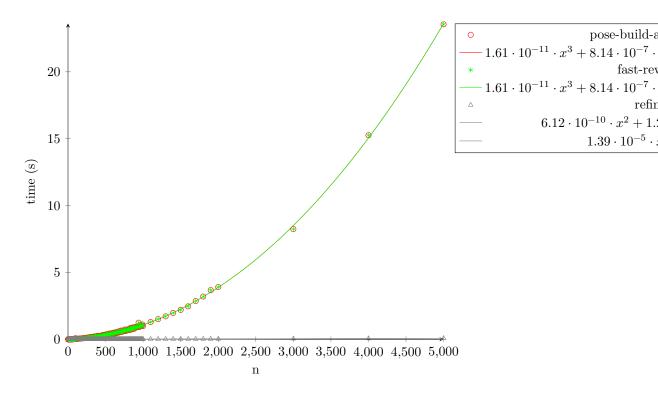


Figure 11: timing-rewrite-repeated-app-fast-rewrite



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

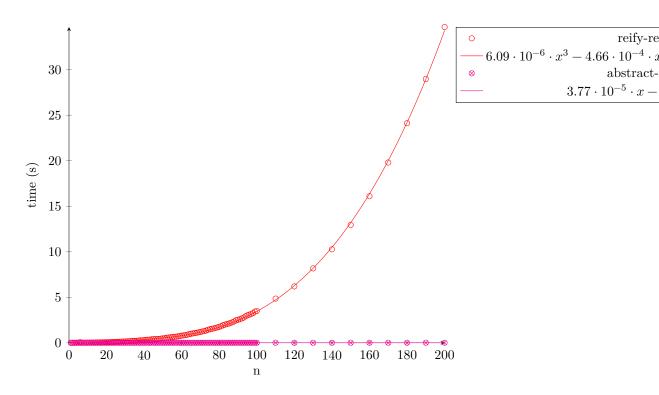
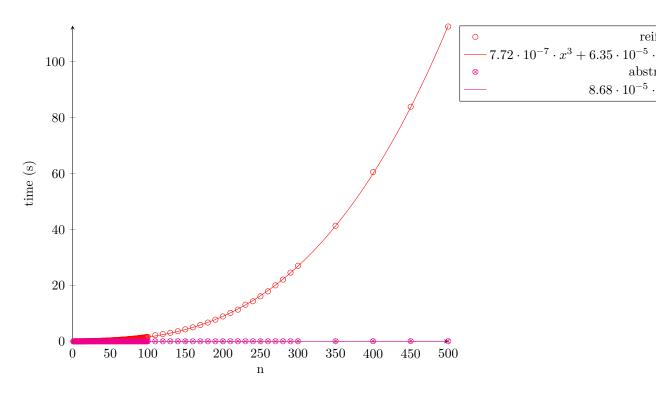
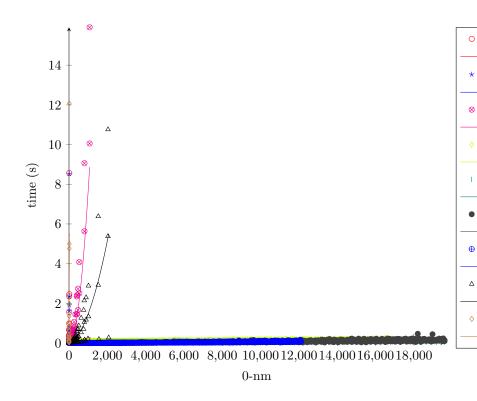


Figure 13: timing-typeclass-reification-let-in-HOAS



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



rewrite-strat(topdown-bot) $5.96 \cdot 10^{-3} exp(0.46 \cdot ($

rewrite-strat (bottomup-bot 5.99 \cdot 10⁻³ exp (0.45 \cdot (

 $7.78 \cdot 10^{-6} \cdot x^2 - 1.57 \cdot 10^{-4} \cdot .$

 $1.83\cdot 10^{-11}\cdot x^2 + 6.6\cdot 10^{-6}\cdot$

 $1.05 \cdot 10^{-10} \cdot x^2 + 3.71 \cdot 10^{-6} \cdot$

 $2.12\cdot 10^{-10}\cdot x^2 + 4.92\cdot 10^{-6}\cdot \\$

 $1.51\cdot 10^{-10}\cdot x^2 + 5.21\cdot 10^{-6}\cdot \\$

 $1.1 \cdot 10^{-6} \cdot x^2 + 3.96 \cdot 10^{-4} \cdot x^2$

 $-7 \cdot 10^{-3} \cdot x^3 + 0.22 \cdot x^2 - 1$

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

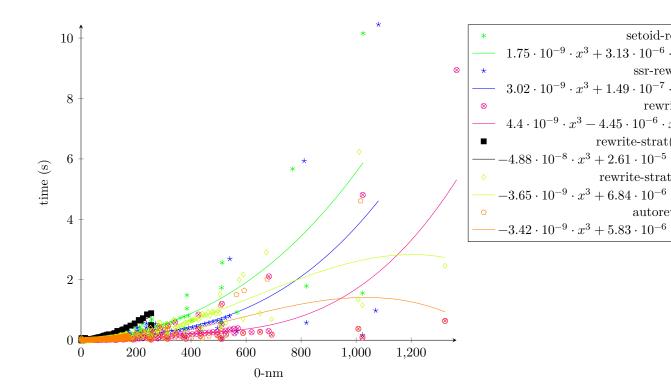
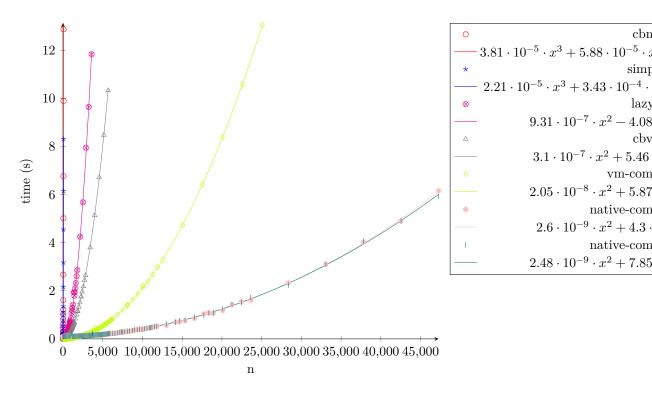


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



cbn

simp

vm-com

native-com

native-com

 $9.31 \cdot 10^{-7} \cdot x^2 - 4.08$

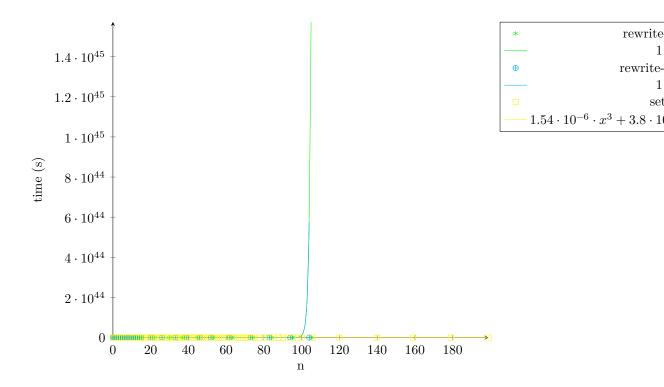
 $3.1 \cdot 10^{-7} \cdot x^2 + 5.46$

 $2.05 \cdot 10^{-8} \cdot x^2 + 5.87$

 $2.6 \cdot 10^{-9} \cdot x^2 + 4.3 \cdot$

 $2.48 \cdot 10^{-9} \cdot x^2 + 7.85$

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



rewrite

rewrite-

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