

Figure 1: timing-pattern

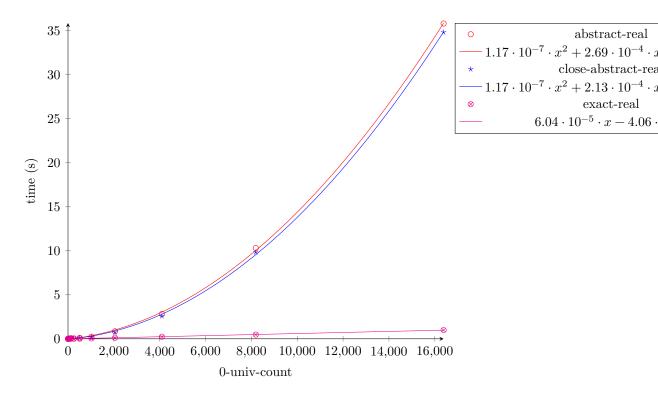
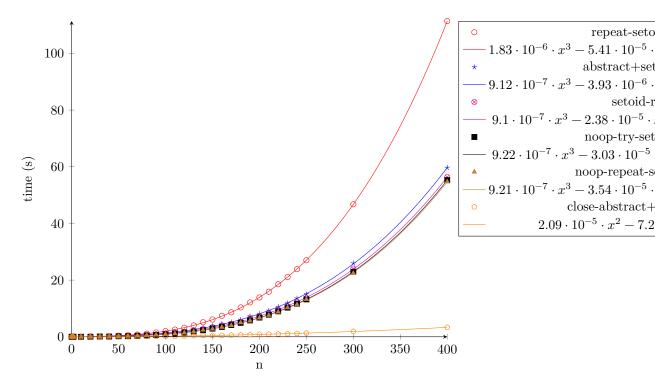


Figure 2: timing-n-polymorphic-universes param-1-n $\,0\,$



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

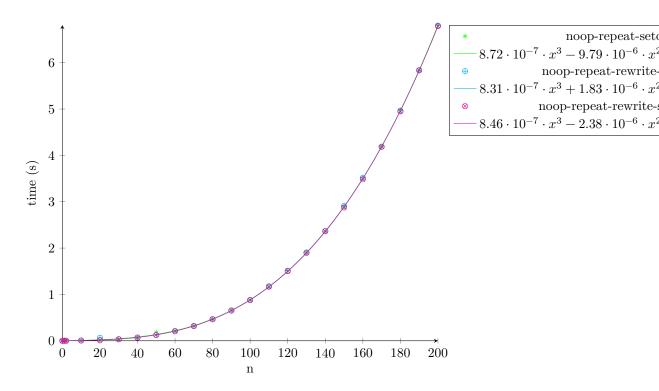
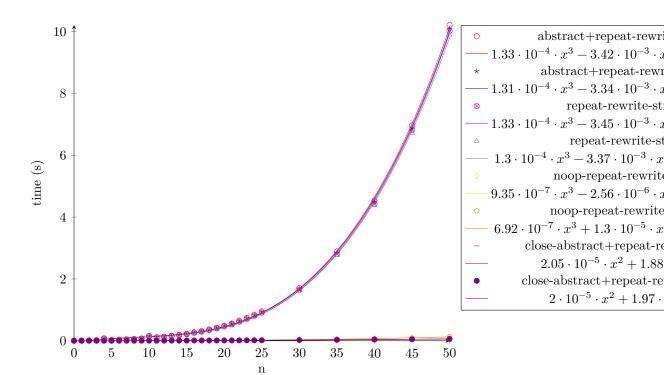


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop



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

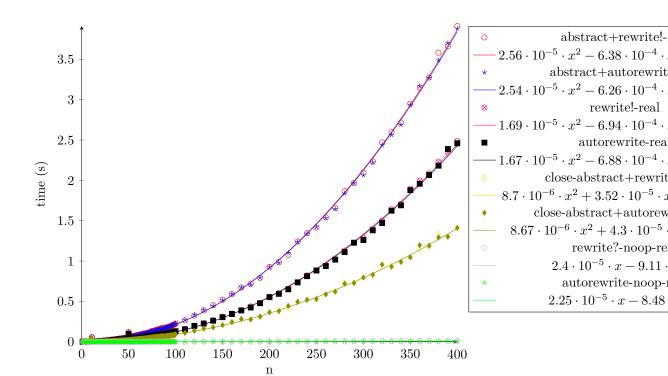
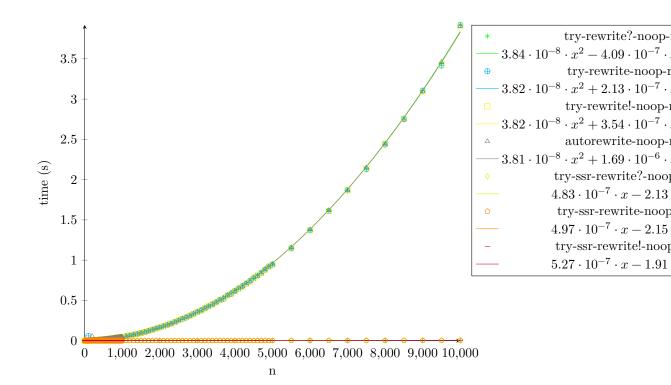


Figure 6: timing-rewrite-repeated-app-autorewrite



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

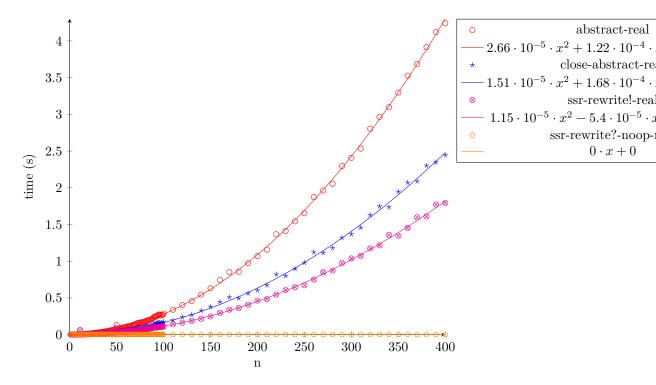
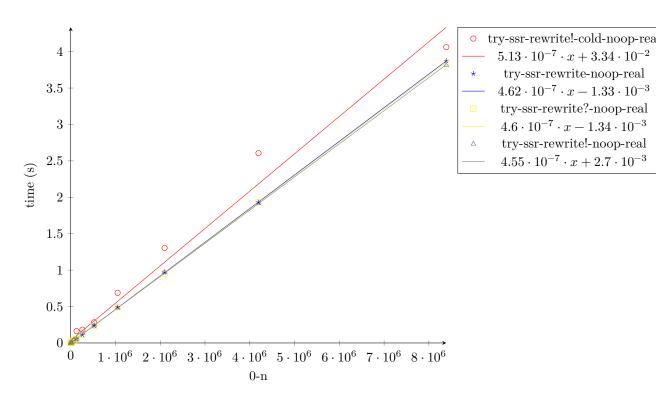


Figure 8: timing-rewrite-repeated-app-ssrrewrite



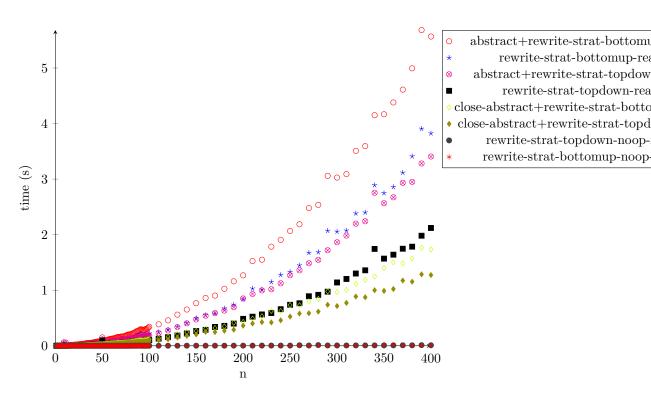
 $5.13 \cdot 10^{-7} \cdot x + 3.34 \cdot 10^{-2}$ try-ssr-rewrite-noop-real $4.62\cdot 10^{-7}\cdot x - 1.3\vec{3}\cdot 10^{-3}$

try-ssr-rewrite?-noop-real

 $4.6\cdot 10^{-7}\cdot x - 1.34\cdot 10^{-3}$ try-ssr-rewrite!-noop-real

 $4.55\cdot 10^{-7}\cdot x + 2.7\cdot 10^{-3}$

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-

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

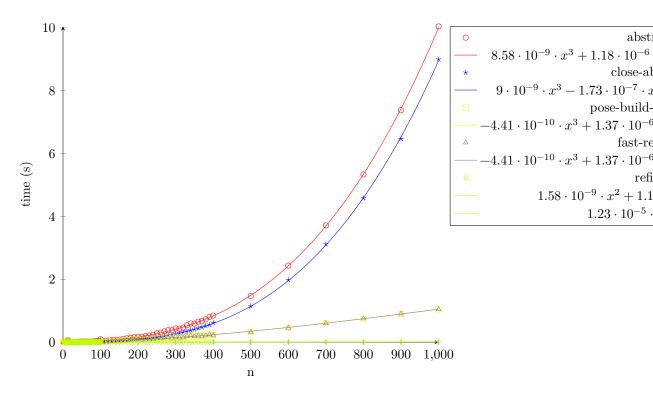
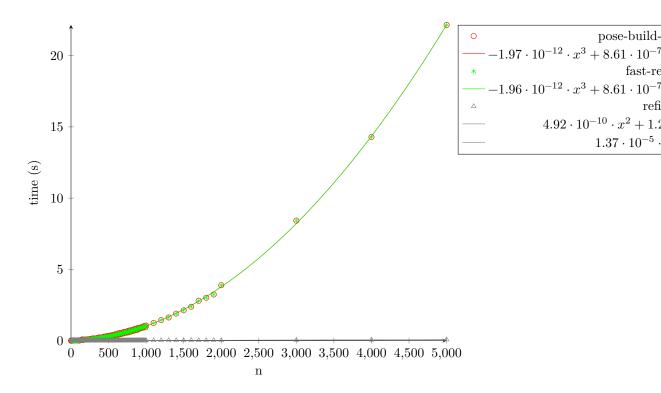


Figure 11: timing-rewrite-repeated-app-fast-rewrite



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

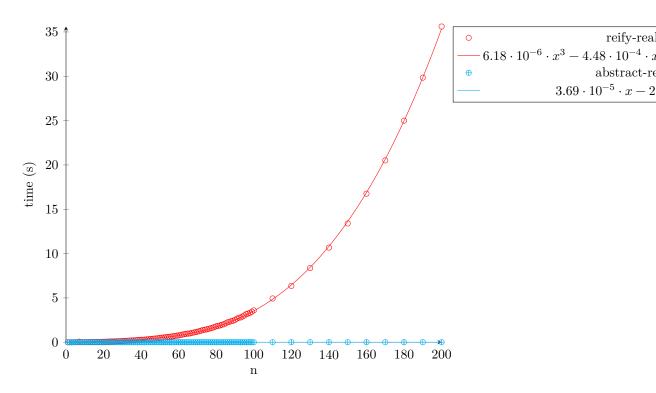
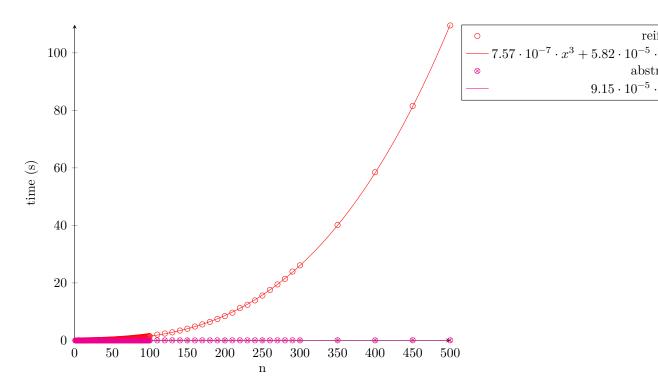
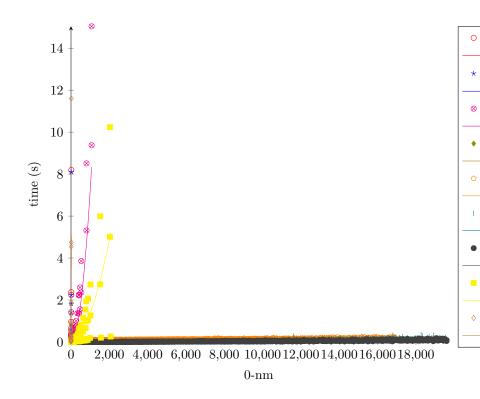


Figure 13: timing-typeclass-reification-let-in-HOAS



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



rewrite-strat (top down-bot)

 $7.28 \cdot 10^{-6} \cdot x^2 - 1.08 \cdot 10^{-4} \cdot x^2 + 1.08 \cdot 10^{-4} \cdot x^2$

 $1.67 \cdot 10^{-10} \cdot x^2 + 5.65 \cdot 10^{-6} \cdot$

 $5.98 \cdot 10^{-11} \cdot x^2 + 5.74 \cdot 10^{-6} \cdot$

 $2.34 \cdot 10^{-10} \cdot x^2 + 4.14 \cdot 10^{-6} \cdot \\$

 $1.1 \cdot 10^{-10} \cdot x^2 + 3.33 \cdot 10^{-6} \cdot x^2$

 $1.05 \cdot 10^{-6} \cdot x^2 + 3.44 \cdot 10^{-4} \cdot$

 $-6.69 \cdot 10^{-3} \cdot x^3 + 0.21 \cdot x^2 -$

 $2.97 \cdot 10^{-3} \exp{(0.5 \cdot (0.5 \cdot (0.5$

 $2.57 \cdot 10^{-3} exp (0.5 \cdot (0.5 \cdot (0.5 + cbn-real)))$

cps+vm-compute-

cps+native-compute

cps+lazy-real

cps+cbv-real

cps+simpl-real

setoid-rewrite-re

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

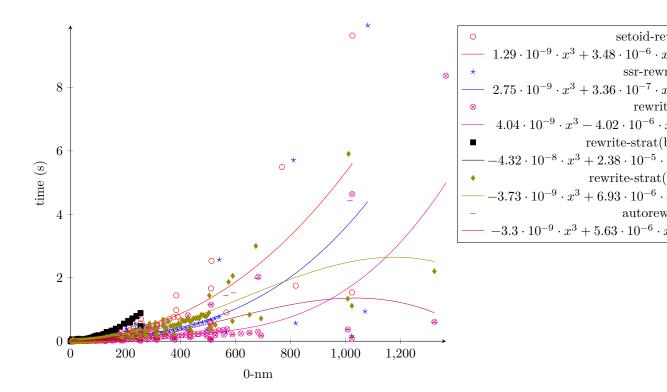
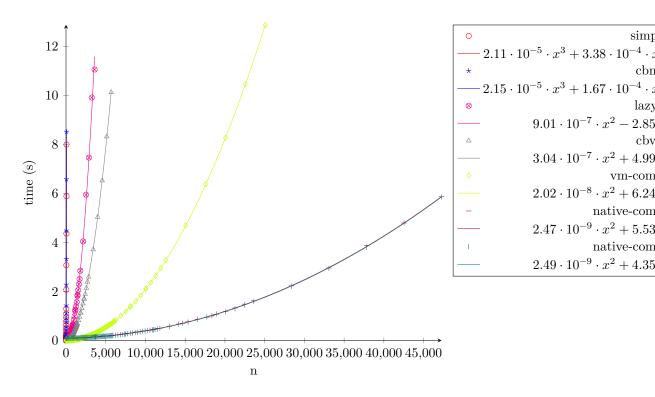


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



 $\begin{array}{c} {\rm lazy} \\ 9.01 \cdot 10^{-7} \cdot x^2 - 2.85 \end{array}$

 $3.04 \cdot 10^{-7} \cdot x^2 + 4.99$

 $2.02 \cdot 10^{-8} \cdot x^2 + 6.24$

 $2.47 \cdot 10^{-9} \cdot x^2 + 5.53$

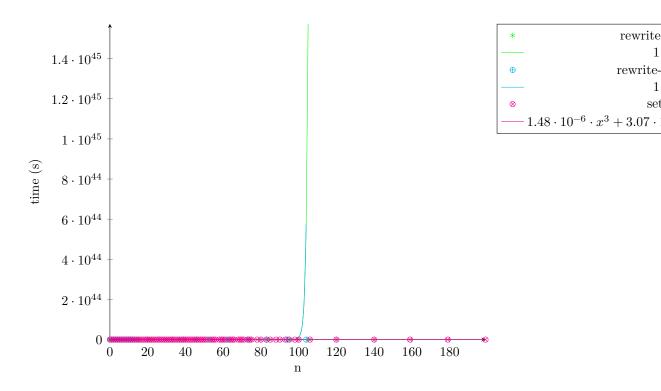
 $2.49 \cdot 10^{-9} \cdot x^2 + 4.35$

vm-com

native-com

native-com

Figure 17: timing-sieve-of-eratosthenes



rewrite

rewrite-

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

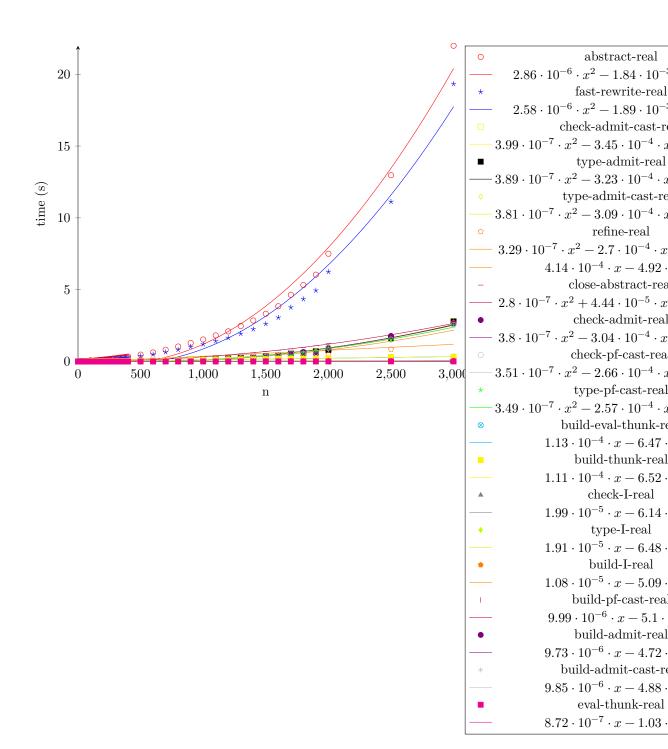


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2