

Figure 1: timing-pattern

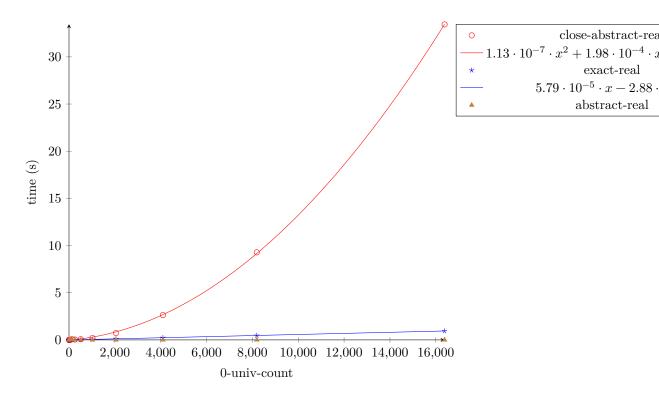
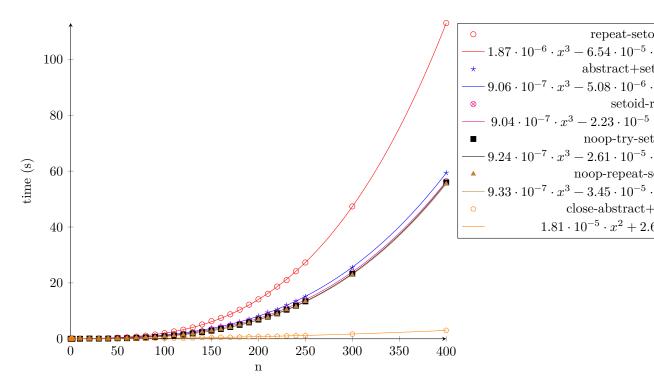
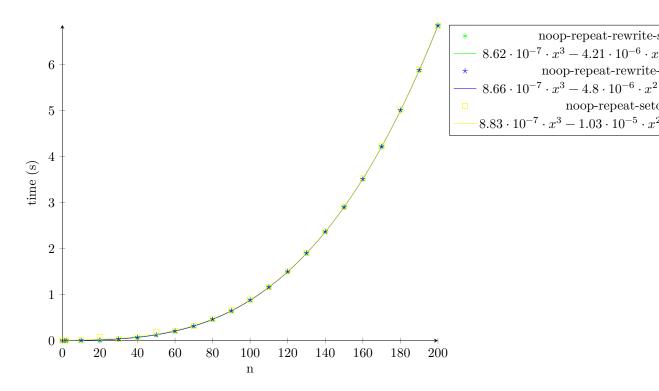


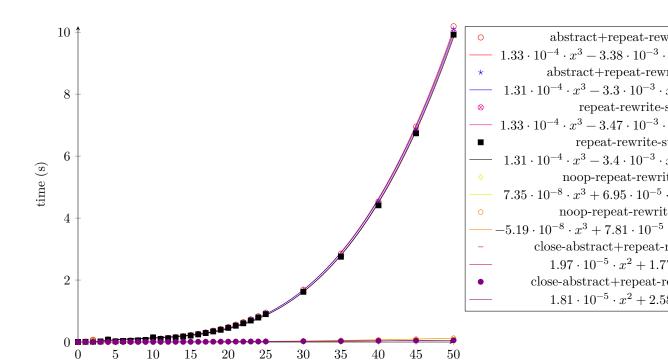
Figure 2: timing-n-polymorphic-universes param-1-n 0



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



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



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

 \mathbf{n}

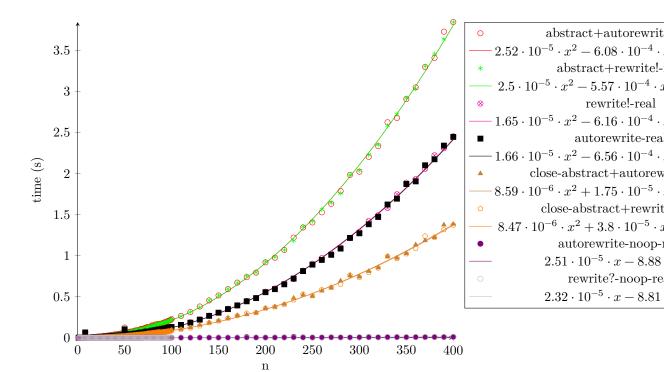
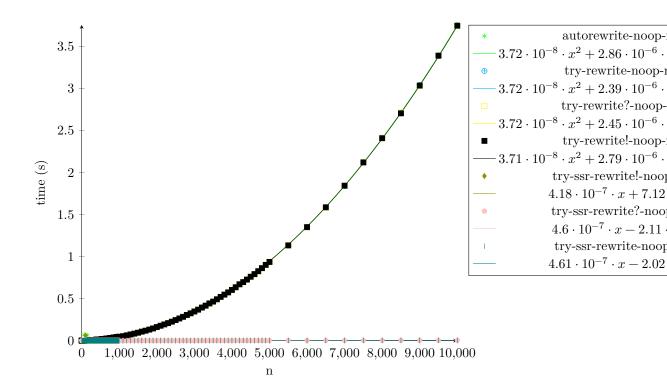
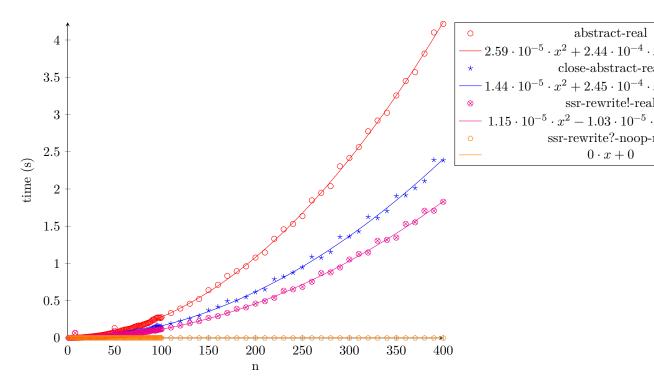


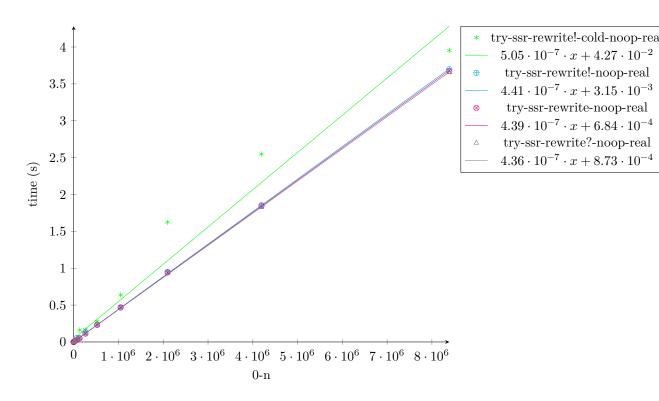
Figure 6: timing-rewrite-repeated-app-autorewrite



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



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



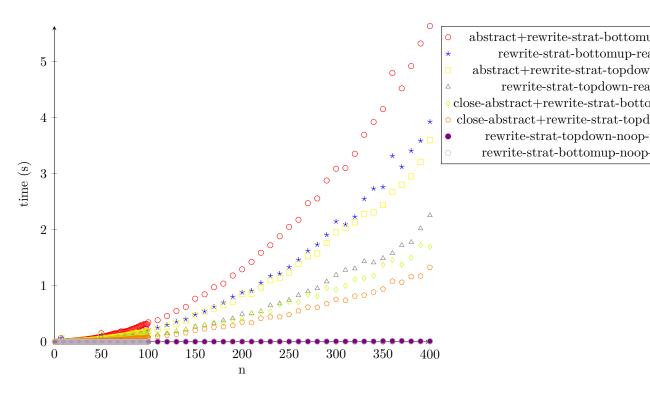
 $5.05 \cdot 10^{-7} \cdot x + 4.27 \cdot 10^{-2}$ try-ssr-rewrite!-noop-real

 $4.41 \cdot 10^{-7} \cdot x + 3.15 \cdot 10^{-3}$ try-ssr-rewrite-noop-real

 $4.39 \cdot 10^{-7} \cdot x + 6.84 \cdot 10^{-4}$ try-ssr-rewrite?-noop-real

 $4.36\cdot 10^{-7}\cdot x + 8.73\cdot 10^{-4}$

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

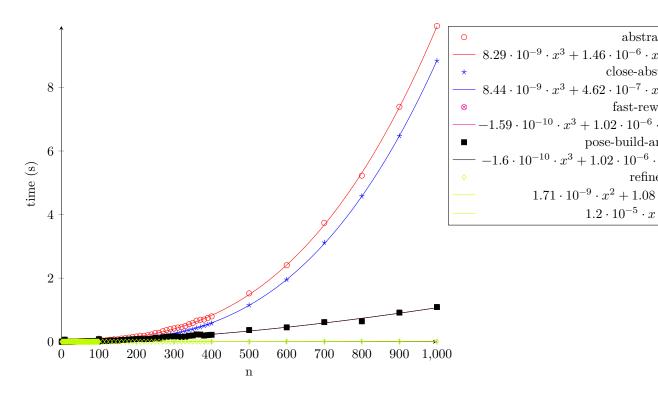


rewrite-strat-bottomup-rea

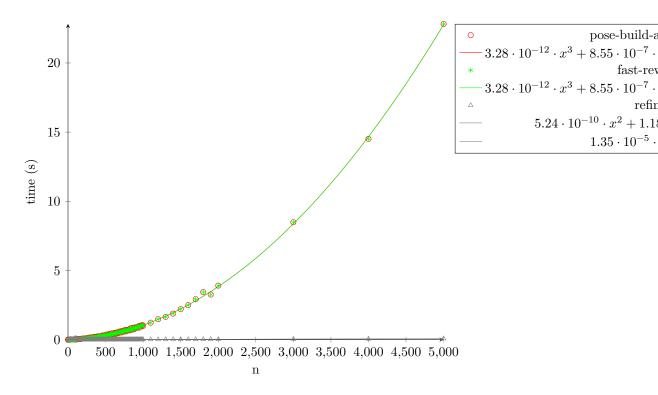
abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

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

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



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



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

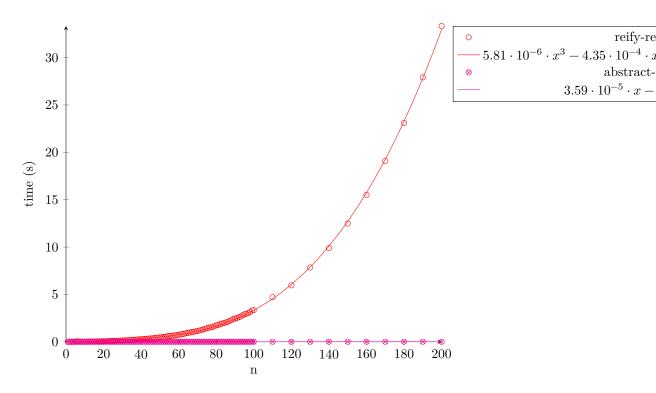
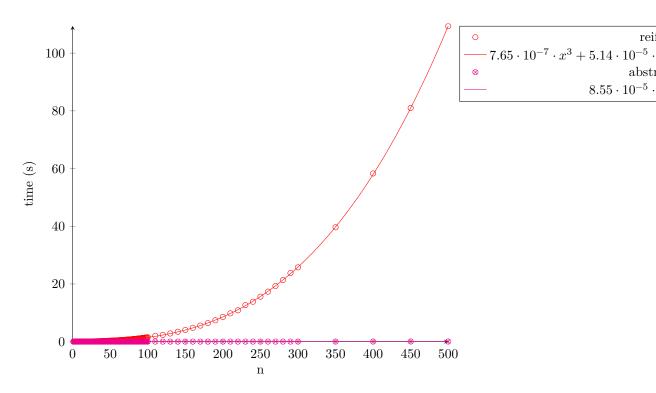
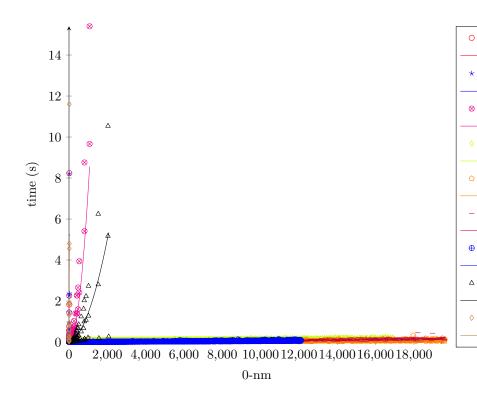


Figure 13: timing-typeclass-reification-let-in-HOAS



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



rewrite-strat(bottomup-bot $2.66 \cdot 10^{-3} exp(0.5 \cdot (0.5))$

rewrite-strat(topdown-bot $5.44 \cdot 10^{-3} exp(0.46 \cdot ($

 $7.52 \cdot 10^{-6} \cdot x^2 - 1.63 \cdot 10^{-4} \cdot .$

 $5.22 \cdot 10^{-11} \cdot x^2 + 5.77 \cdot 10^{-6} \cdot$

 $1.02 \cdot 10^{-10} \cdot x^2 + 3.65 \cdot 10^{-6} \cdot$

 $2.18\cdot 10^{-10}\cdot x^2 + 4.53\cdot 10^{-6}\cdot \\$

 $1.13 \cdot 10^{-10} \cdot x^2 + 5.28 \cdot 10^{-6} \cdot$

 $1.08 \cdot 10^{-6} \cdot x^2 + 3.54 \cdot 10^{-4} \cdot x^2 + 3.54 \cdot 10^{-4}$

 $-6.74 \cdot 10^{-3} \cdot x^3 + 0.22 \cdot x^2 -$

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

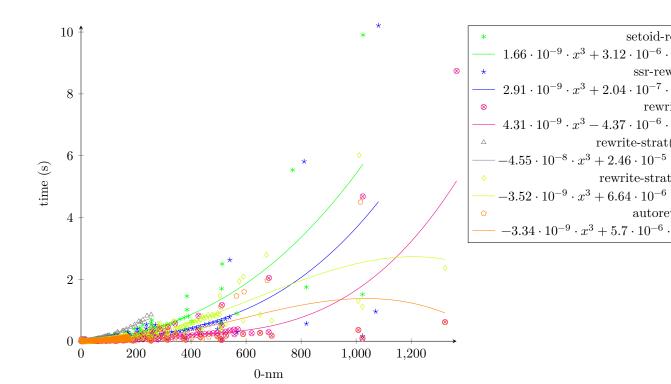
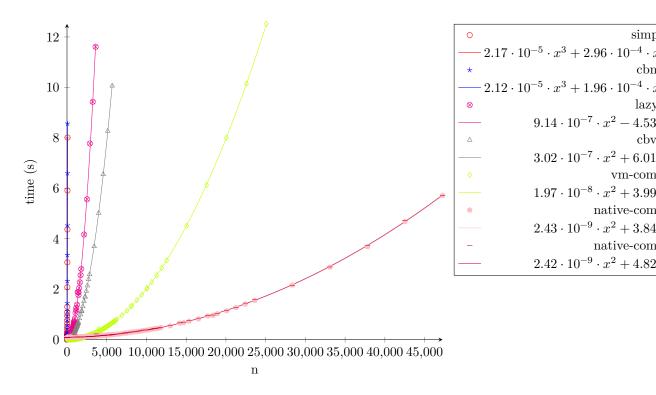


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $9.14 \cdot 10^{-7} \cdot x^2 - 4.53$

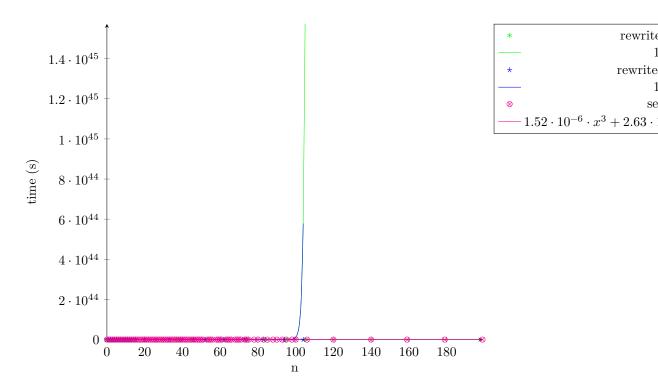
 $3.02 \cdot 10^{-7} \cdot x^2 + 6.01$

 $1.97 \cdot 10^{-8} \cdot x^2 + 3.99$

 $2.43 \cdot 10^{-9} \cdot x^2 + 3.84$

 $2.42 \cdot 10^{-9} \cdot x^2 + 4.82$

Figure 17: timing-sieve-of-eratosthenes



rewrite

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