

Figure 1: timing-pattern

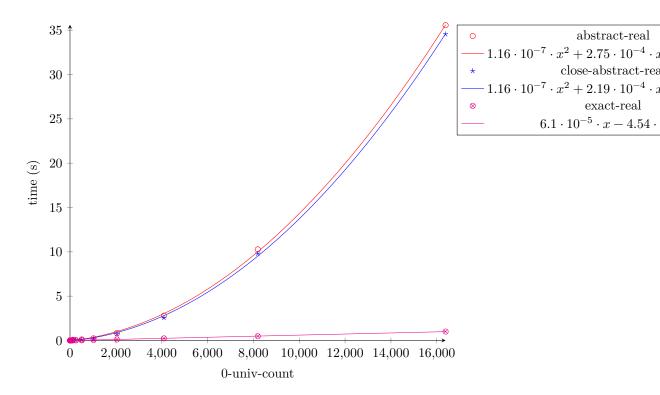
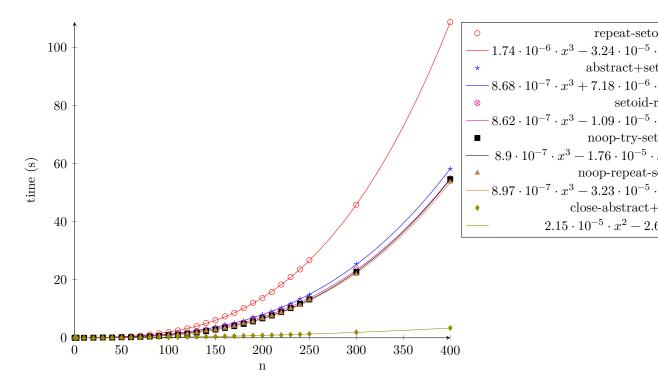
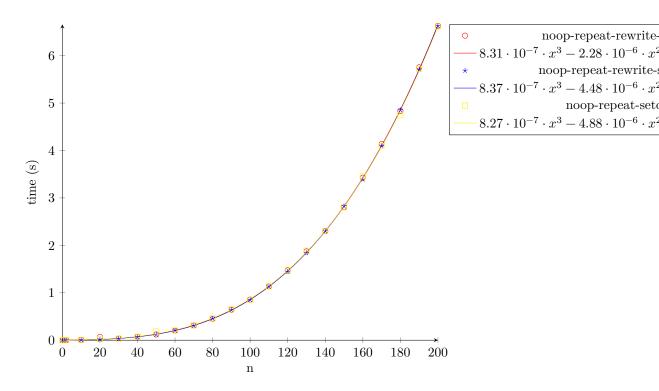


Figure 2: timing-n-polymorphic-universes param-1-n $\,0\,$



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



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

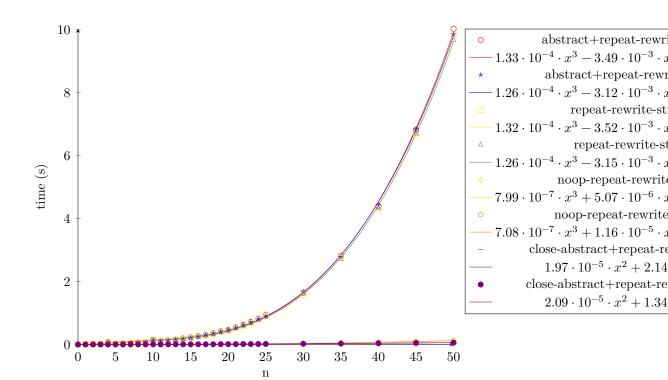
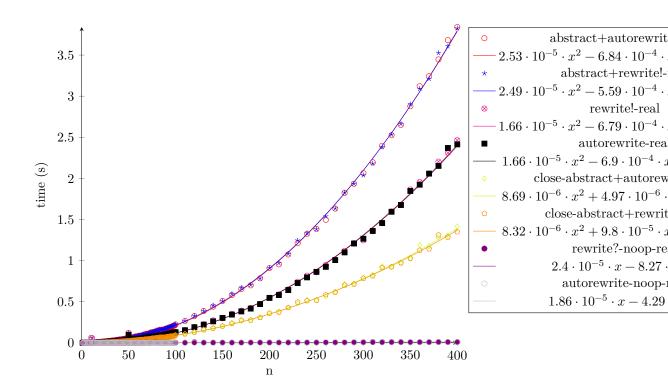
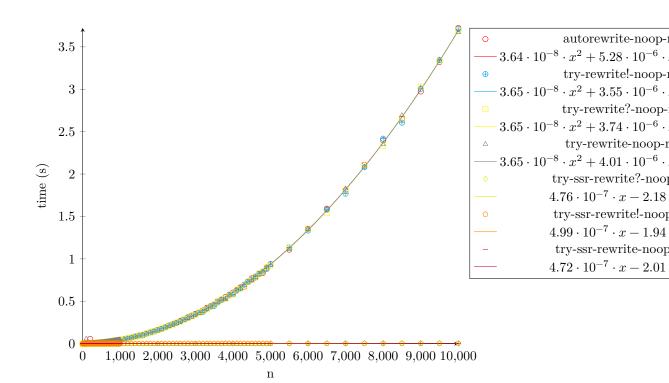


Figure 5: timing-rewrite-strat-under-binders



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



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

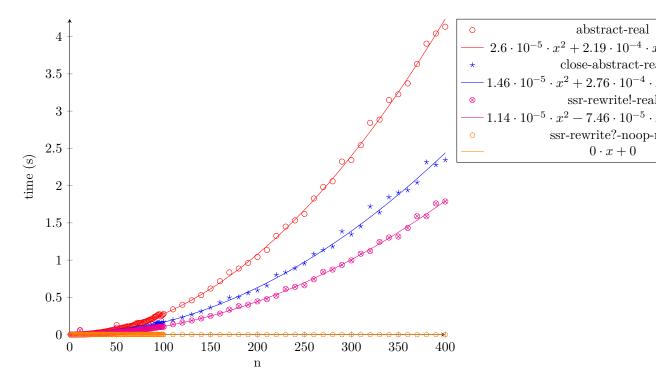
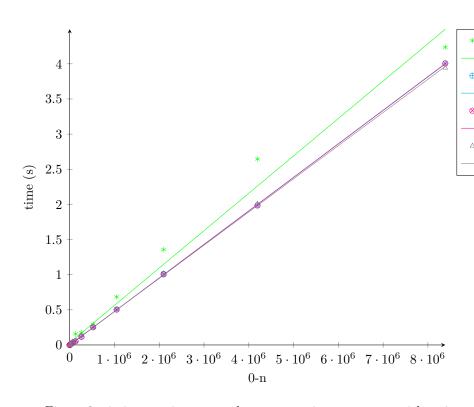


Figure 8: timing-rewrite-repeated-app-ssrrewrite



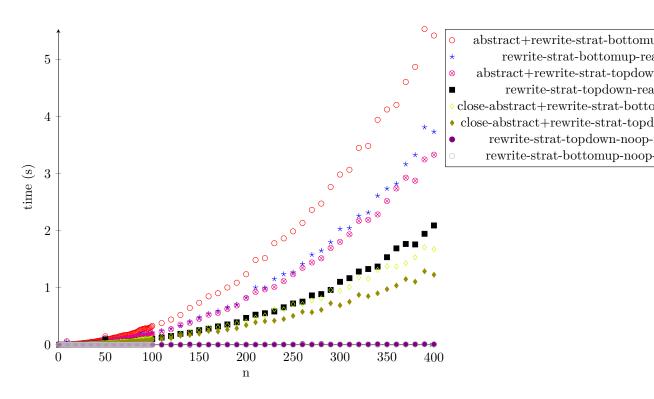
try-ssr-rewrite!-cold-noop-rea $5.32\cdot 10^{-7}\cdot x + 3.1\cdot 10^{-2}$

try-ssr-rewrite-noop-real $4.77\cdot 10^{-7}\cdot x - 9.37\cdot 10^{-4}$

try-ssr-rewrite?-noop-real $4.77\cdot 10^{-7}\cdot x - 1.16\cdot 10^{-3}$

try-ssr-rewrite!-noop-real $4.72 \cdot 10^{-7} \cdot x + 3.66 \cdot 10^{-3}$

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-

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

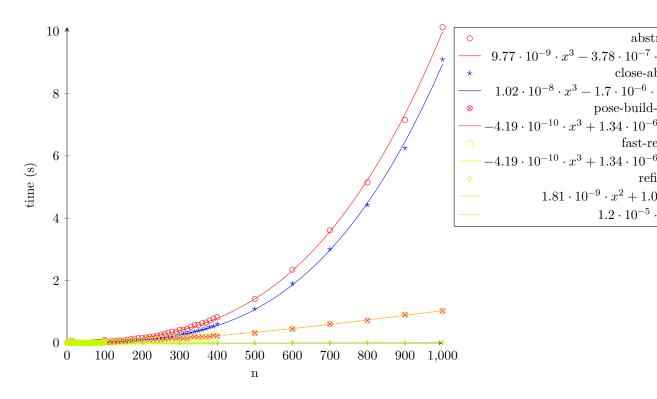
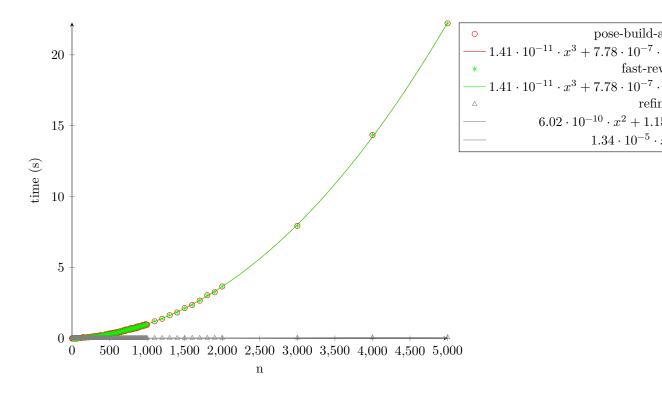
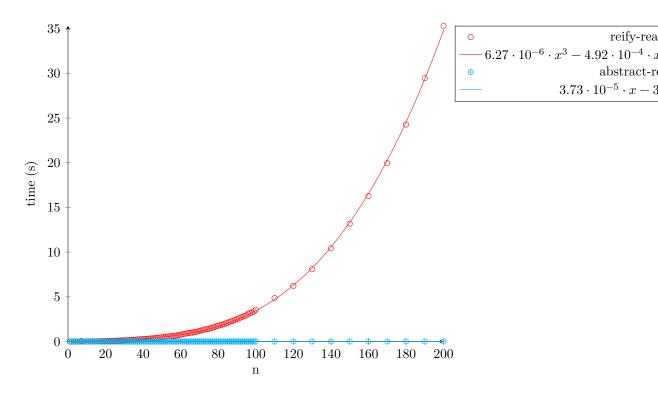


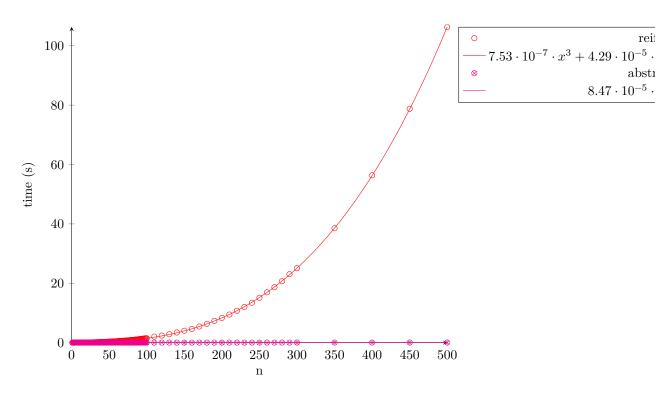
Figure 11: timing-rewrite-repeated-app-fast-rewrite



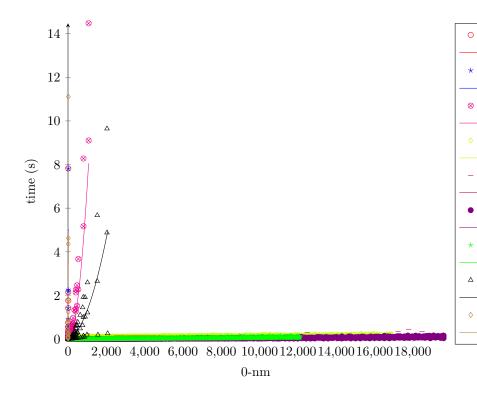
Figure~12:~timing-rewrite-repeated-app-fast-rewrite-no-abstract



 ${\bf Figure~13:~timing-type class-reification-let-in-HOAS}$



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



rewrite-strat(bottomup-bot $5.27 \cdot 10^{-3} \exp{(0.45 \cdot (\text{rewrite-strat(topdown-bottomup-botto$

 $7.02 \cdot 10^{-6} \cdot x^2 - 8.61 \cdot 10^{-5} \cdot x^2 = 8.61 \cdot 10^{-5} \cdot x^2$

 $5.16 \cdot 10^{-11} \cdot x^2 + 5.58 \cdot 10^{-6} \cdot$

 $2.1 \cdot 10^{-10} \cdot x^2 + 4.49 \cdot 10^{-6} \cdot x^2$

 $1.16\cdot 10^{-10}\cdot x^2 + 3.06\cdot 10^{-6}\cdot \\$

 $1.84 \cdot 10^{-10} \cdot x^2 + 5.27 \cdot 10^{-6}$

 $9.94 \cdot 10^{-7} \cdot x^2 + 3.37 \cdot 10^{-4} \cdot x^2$

 $-6.43 \cdot 10^{-3} \cdot x^3 + 0.21 \cdot x^2 -$

 $5.63 \cdot 10^{-3} exp (0.45 \cdot ($

cps+native-compute

cps+cbn-real

cps+lazy-real

cps+cbv-real

cps+vm-compute-

cps+simpl-real

setoid-rewrite-re

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

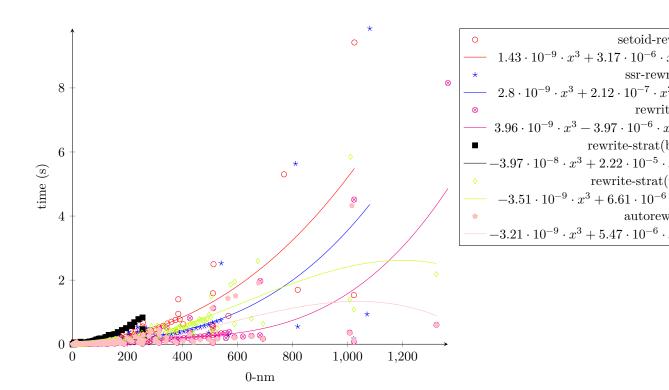
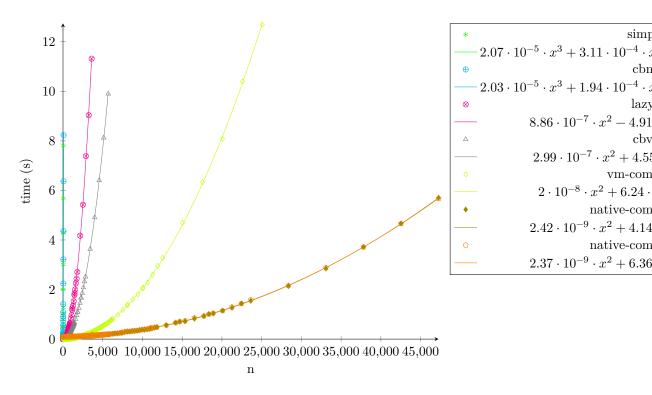


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $8.86 \cdot 10^{-7} \cdot x^2 - 4.91$

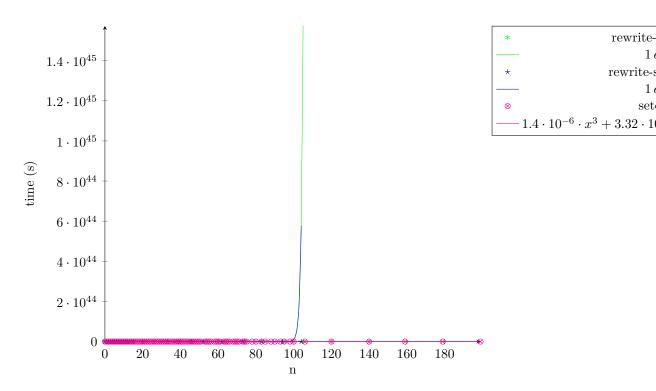
 $2.99 \cdot 10^{-7} \cdot x^2 + 4.55$

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

 $2.42 \cdot 10^{-9} \cdot x^2 + 4.14$

 $2.37 \cdot 10^{-9} \cdot x^2 + 6.36$

Figure 17: timing-sieve-of-eratosthenes



rewrite-

rewrite-s

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

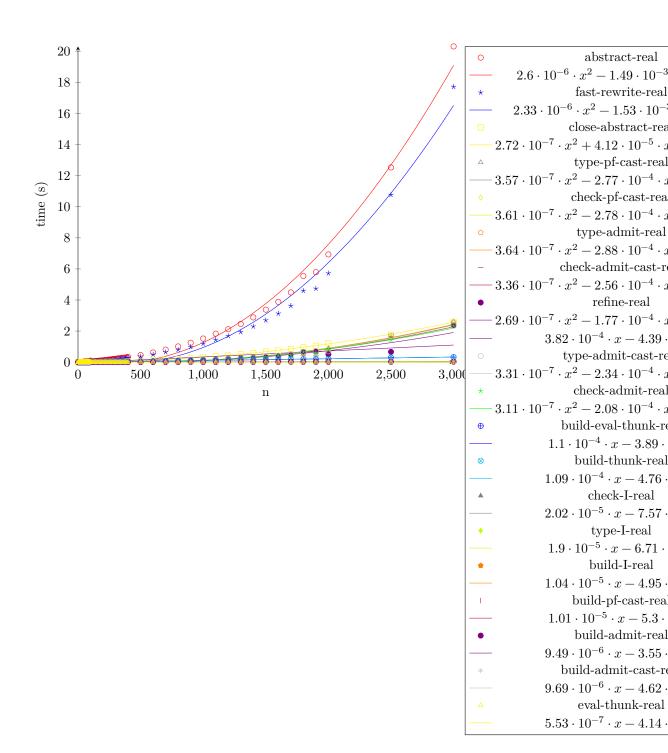


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2