

Figure 1: timing-pattern

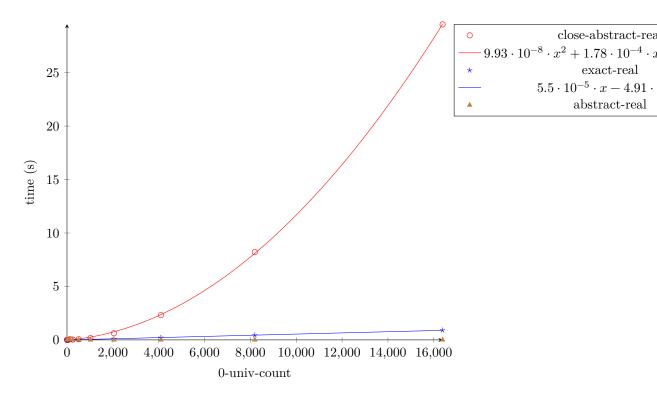


Figure 2: timing-n-polymorphic-universes param-1-n 0

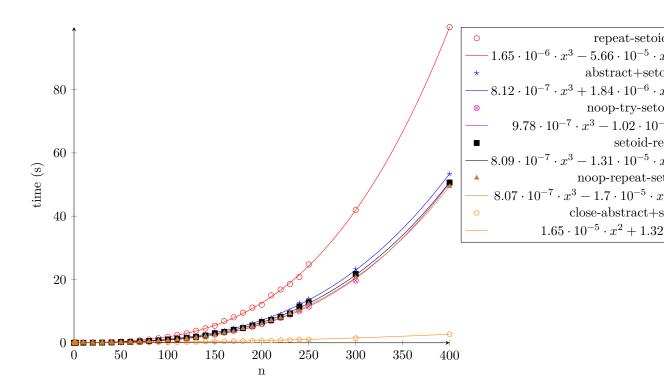
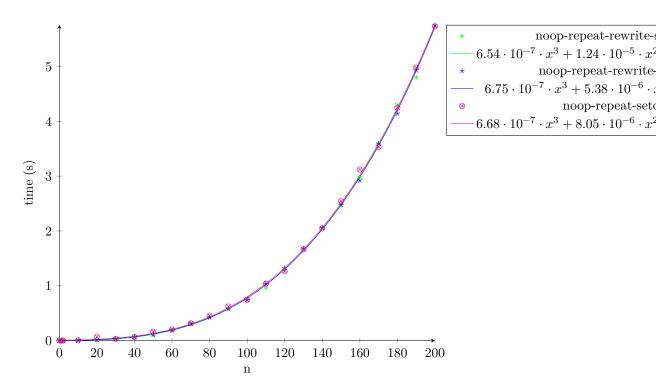
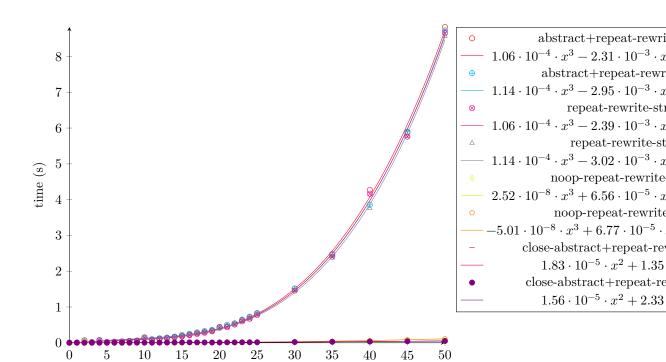


Figure 3: timing-repeat-setoid-rewrite-under-binders

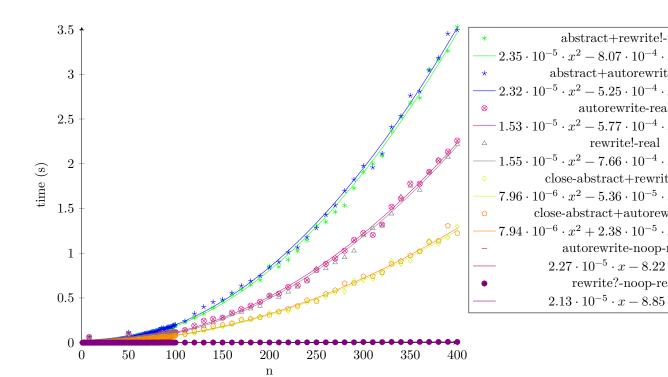


 $Figure\ 4:\ timing-repeat-setoid-rewrite-under-binders-noop$

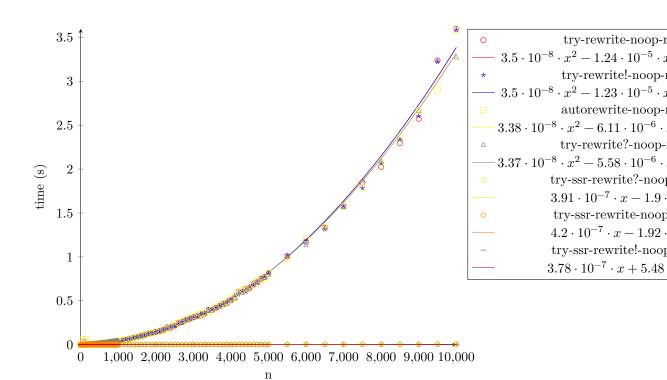


 $Figure\ 5:\ timing-rewrite-strat-under-binders$

n



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



Figure~7:~timing-rewrite-repeated-app-autorewrite-noop

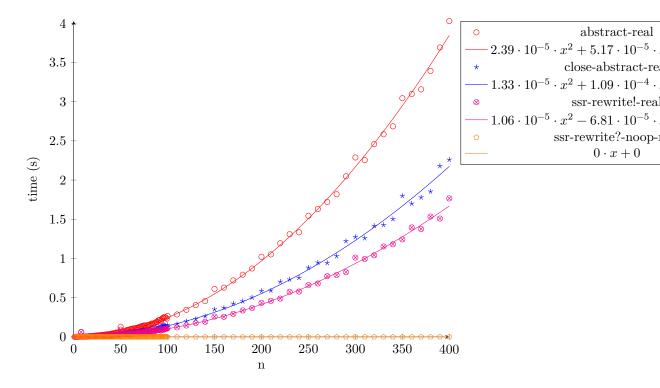
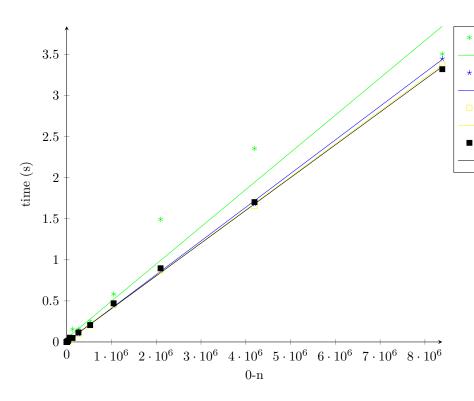


Figure 8: timing-rewrite-repeated-app-ssrrewrite



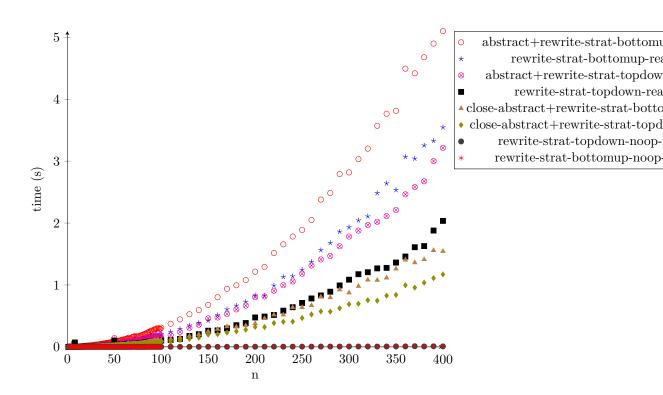
try-ssr-rewrite!-cold-noop-rea $4.53\cdot 10^{-7}\cdot x + 4.28\cdot 10^{-2}$

try-ssr-rewrite?-noop-real $4.1\cdot 10^{-7}\cdot x - 4.31\cdot 10^{-4}$

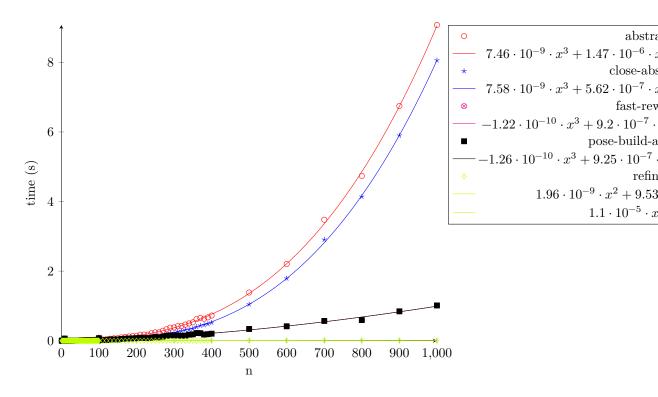
try-ssr-rewrite-noop-real $4.02\cdot 10^{-7}\cdot x + 1.16\cdot 10^{-4}$

try-ssr-rewrite!-noop-real $3.99 \cdot 10^{-7} \cdot x + 6.91 \cdot 10^{-3}$

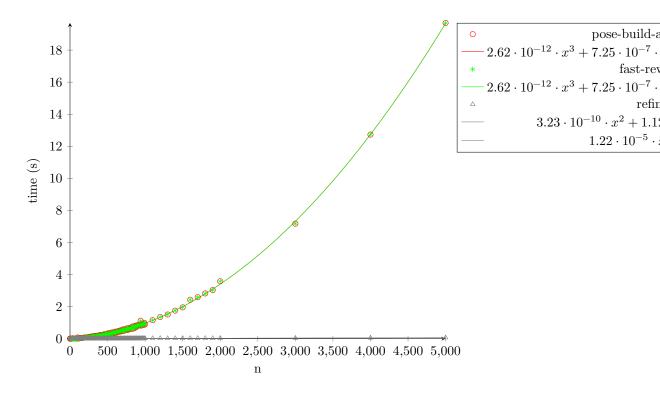
Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn $\,1\,$



 $Figure\ 10:\ timing-rewrite-repeated-app-rewrite-strat$



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



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

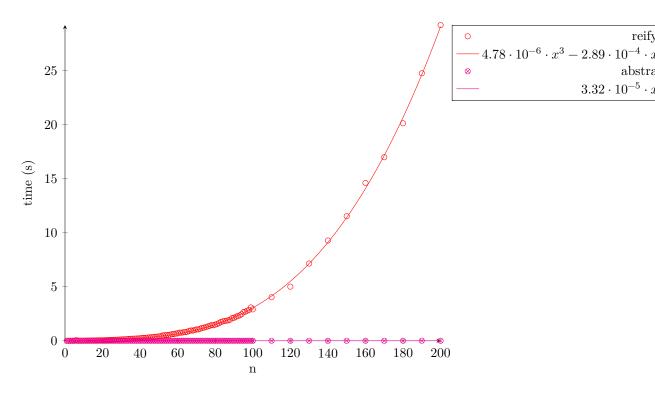


Figure 13: timing-typeclass-reification-let-in-HOAS

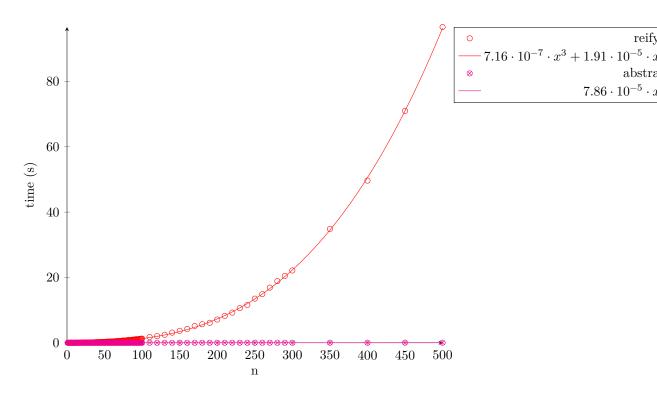
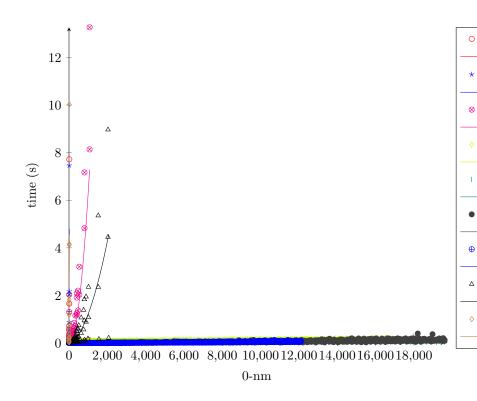


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(bottomup-bot $4.56 \cdot 10^{-3} exp(0.46 \cdot ($

rewrite-strat (topdown-bot $4.99 \cdot 10^{-3} \exp{(0.46 \cdot ($

 $6.45 \cdot 10^{-6} \cdot x^2 - 1.8 \cdot 10^{-4} \cdot x^2$

 $7.41\cdot 10^{-11}\cdot x^2 + 4.83\cdot 10^{-6}\cdot \\$

 $9.08 \cdot 10^{-11} \cdot x^2 + 3.23 \cdot 10^{-6} \cdot$

 $2.02 \cdot 10^{-10} \cdot x^2 + 3.99 \cdot 10^{-6} \cdot$

 $1.22 \cdot 10^{-10} \cdot x^2 + 4.36 \cdot 10^{-6} \cdot$

 $9.08 \cdot 10^{-7} \cdot x^2 + 3.29 \cdot 10^{-4} \cdot x^2$

 $-5.95 \cdot 10^{-3} \cdot x^3 + 0.19 \cdot x^2 - 0.00 \cdot x^3 + 0.00$

cps+cbn-real

cps+cbv-real

 $\operatorname{cps+lazy-real}$

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

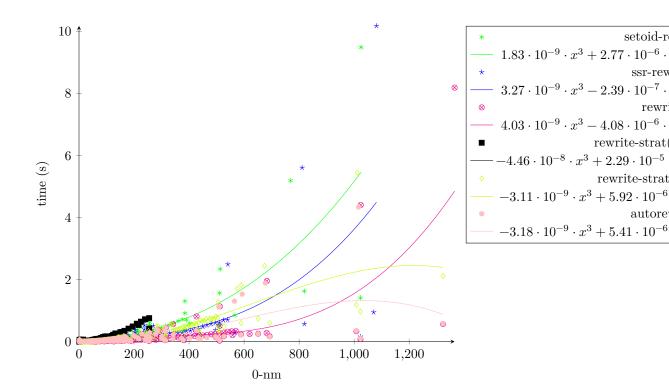
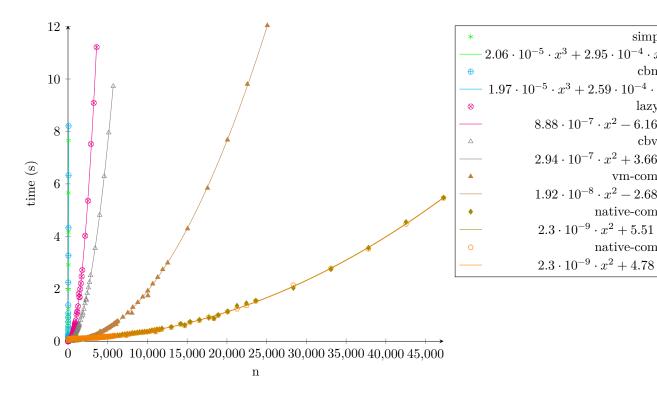


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

lazy

vm-com

native-com

native-com

 $8.88 \cdot 10^{-7} \cdot x^2 - 6.16$

 $2.94 \cdot 10^{-7} \cdot x^2 + 3.66$

 $1.92 \cdot 10^{-8} \cdot x^2 - 2.68$

 $2.3 \cdot 10^{-9} \cdot x^2 + 5.51$

 $2.3 \cdot 10^{-9} \cdot x^2 + 4.78$

Figure 17: timing-sieve-of-eratosthenes

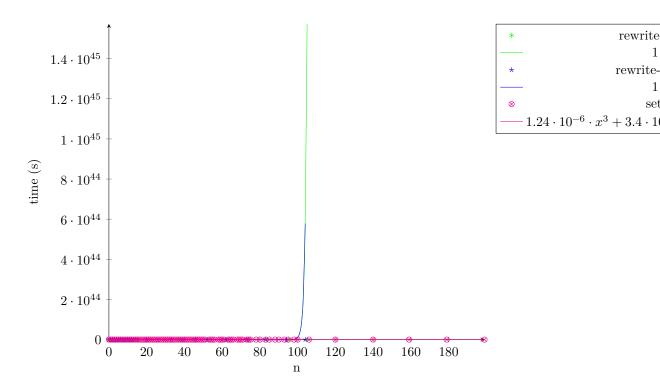


Figure 18: timing-rewrite-under-lets-plus-0 $\,$