

Figure 1: timing-pattern

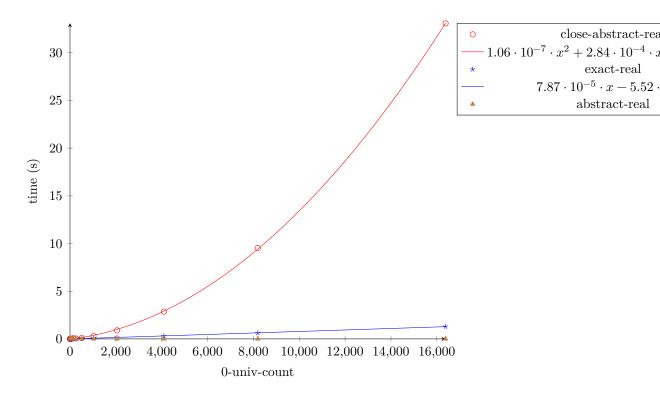
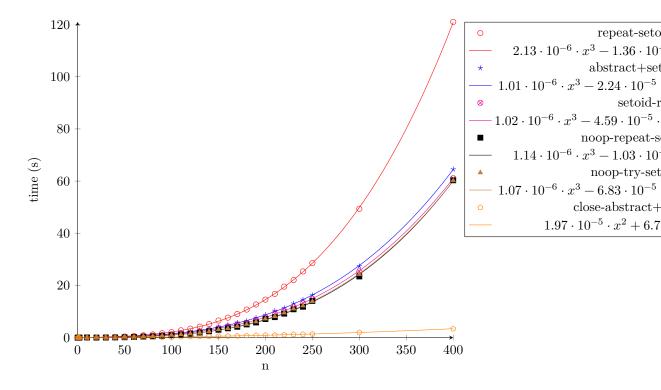


Figure 2: timing-n-polymorphic-universes param-1-n 0



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

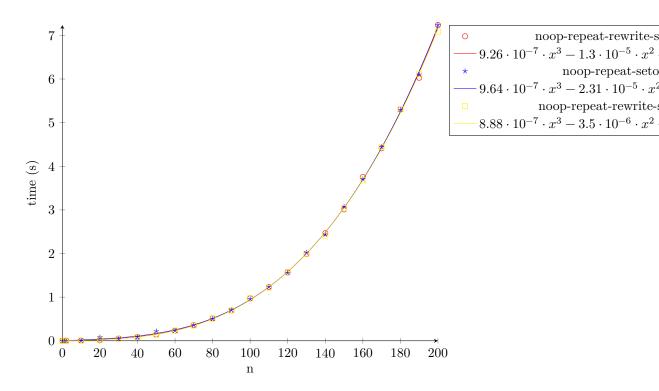
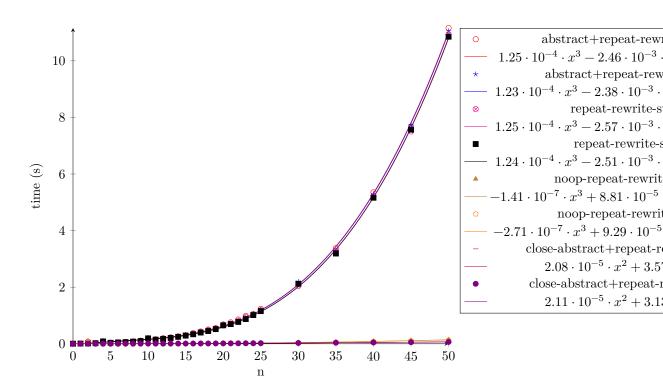
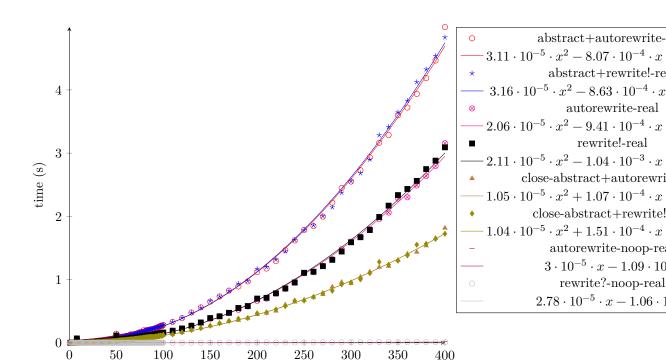


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

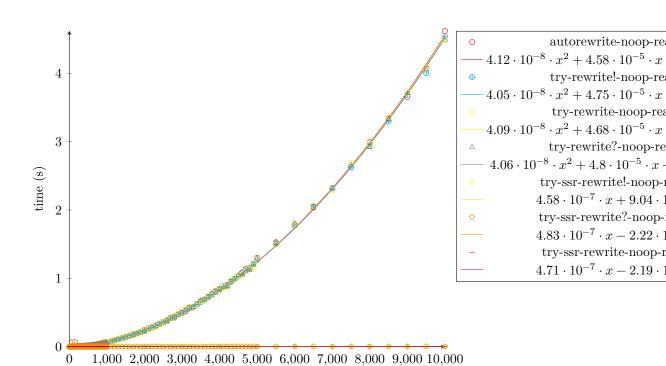


 $Figure\ 5:\ timing-rewrite-strat-under-binders$

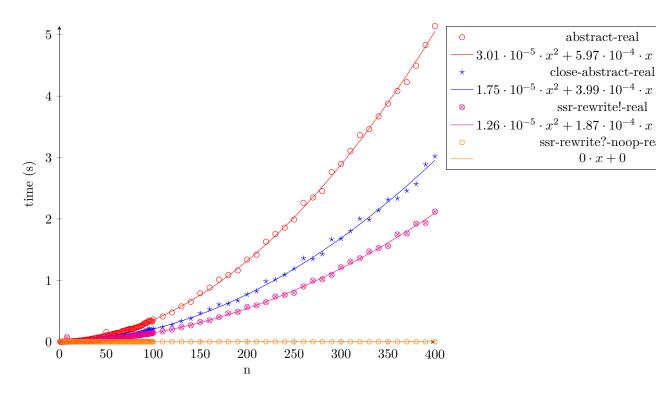


 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$

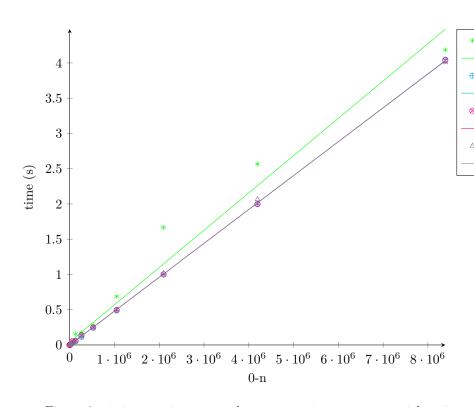
n



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



 ${\bf Figure~8:~timing\text{-}rewrite\text{-}repeated\text{-}app\text{-}ssrrewrite}$



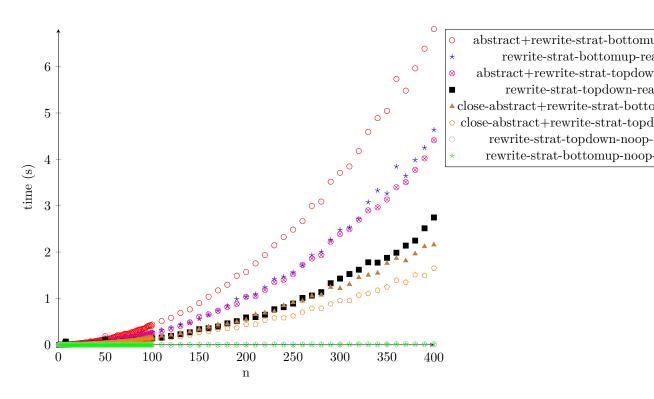
try-ssr-rewrite!-cold-noop-rea $5.29\cdot 10^{-7}\cdot x + 4.08\cdot 10^{-2}$

try-ssr-rewrite-noop-real $4.81\cdot 10^{-7}\cdot x - 2.88\cdot 10^{-3}$

try-ssr-rewrite!-noop-real $4.8\cdot 10^{-7}\cdot x + 4.97\cdot 10^{-4}$

try-ssr-rewrite?-noop-real $4.81\cdot 10^{-7}\cdot x + 2.76\cdot 10^{-4}$

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

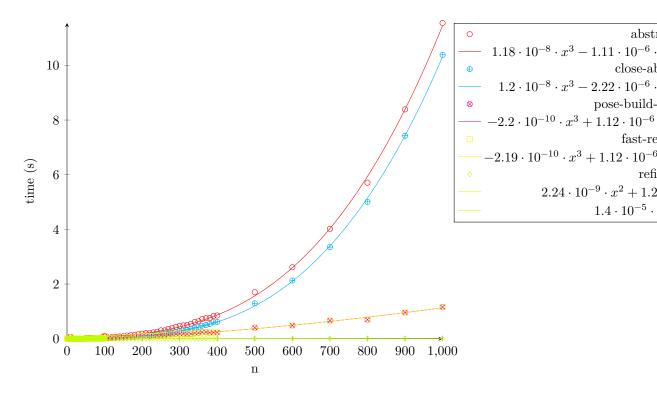


rewrite-strat-bottomup-rea

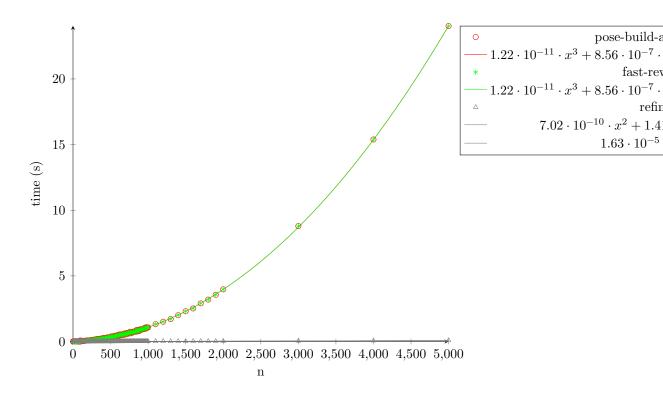
abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

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

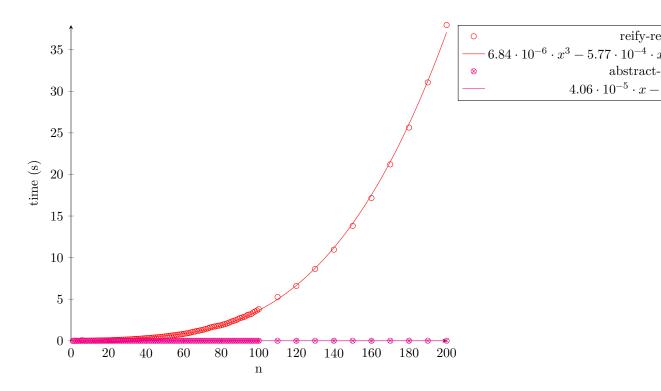
 $Figure\ 10:\ timing-rewrite-repeated-app-rewrite-strat$



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



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



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

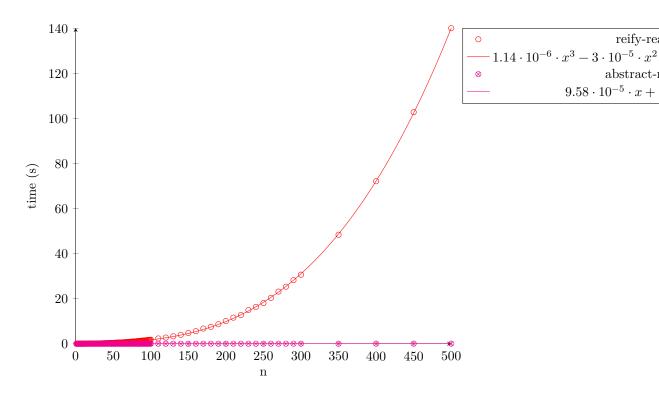
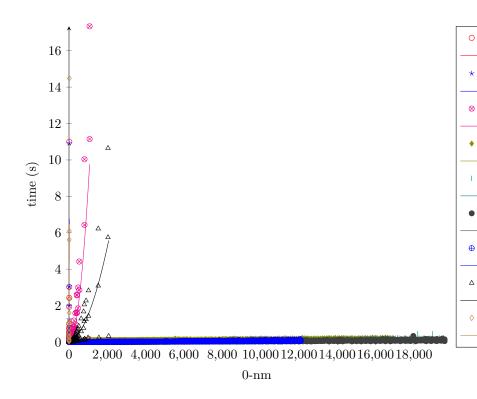


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(bottomup-bot

 $8.51\cdot 10^{-6}\cdot x^2 - 1.03\cdot 10^{-4}\cdot x^2 + 1.03\cdot 1$

 $4.09 \cdot 10^{-11} \cdot x^2 + 6.32 \cdot 10^{-6} \cdot$

 $2.43 \cdot 10^{-10} \cdot x^2 + 4.69 \cdot 10^{-6} \cdot$

 $1.14 \cdot 10^{-10} \cdot x^2 + 3.81 \cdot 10^{-6} \cdot$

 $1.94\cdot 10^{-10}\cdot x^2 + 5.04\cdot 10^{-6}\cdot \\$

 $1.11 \cdot 10^{-6} \cdot x^2 + 3.94 \cdot 10^{-4} \cdot x^2$

 $-8.4 \cdot 10^{-3} \cdot x^3 + 0.27 \cdot x^2 -$

 $6.88\cdot 10^{-3} \exp{(0.46\cdot ($ rewrite-strat(topdown-both

 $6.27 \cdot 10^{-3} \exp{(0.47 \cdot ($

cps+native-compute

cps+cbn-real

cps+lazy-real

cps+cbv-real

cps+simpl-real

setoid-rewrite-re

cps+vm-compute-

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

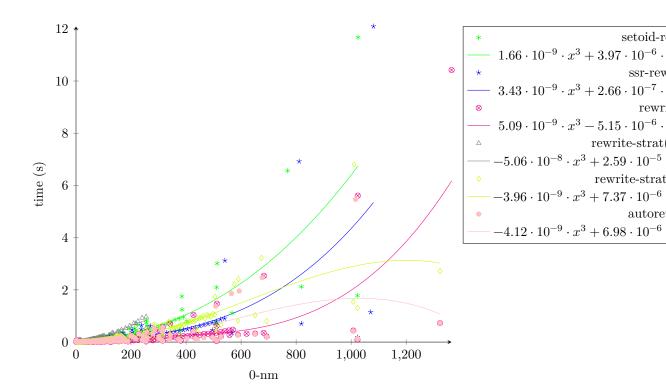
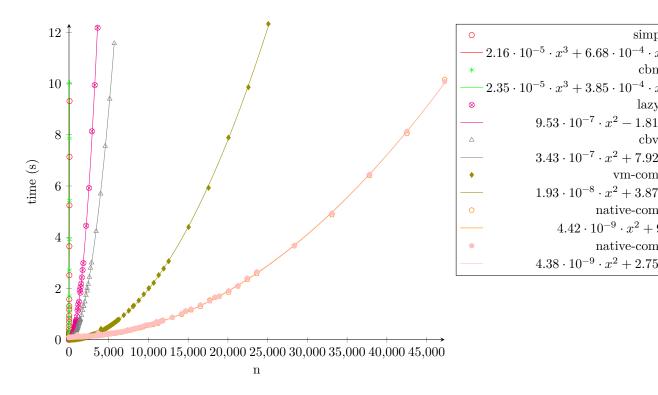


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

lazy

vm-com

native-com $4.42 \cdot 10^{-9} \cdot x^2 + 9$

native-com

 $9.53 \cdot 10^{-7} \cdot x^2 - 1.81$

 $3.43 \cdot 10^{-7} \cdot x^2 + 7.92$

 $1.93 \cdot 10^{-8} \cdot x^2 + 3.87$

 $4.38 \cdot 10^{-9} \cdot x^2 + 2.75$

Figure 17: timing-sieve-of-eratosthenes

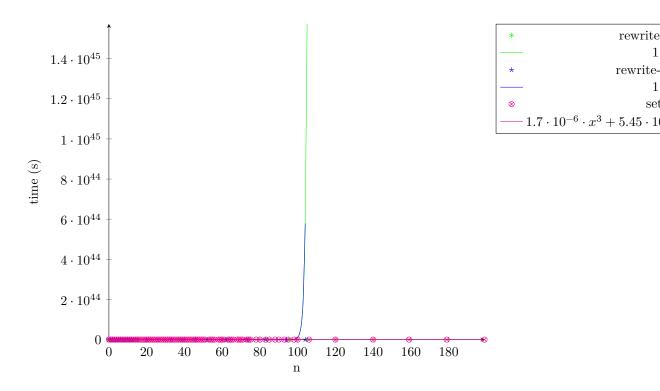


Figure 18: timing-rewrite-under-lets-plus-0 $\,$