

Figure 1: timing-pattern

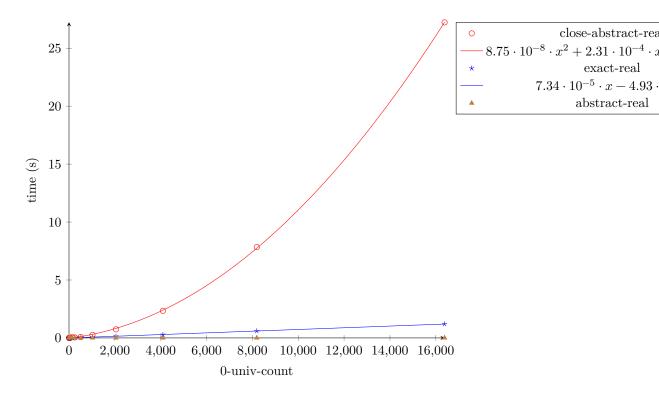
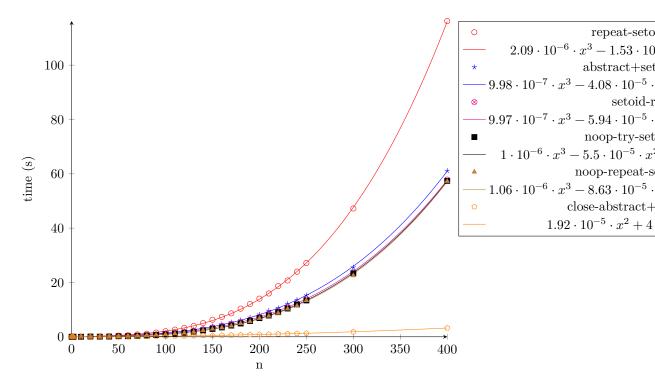
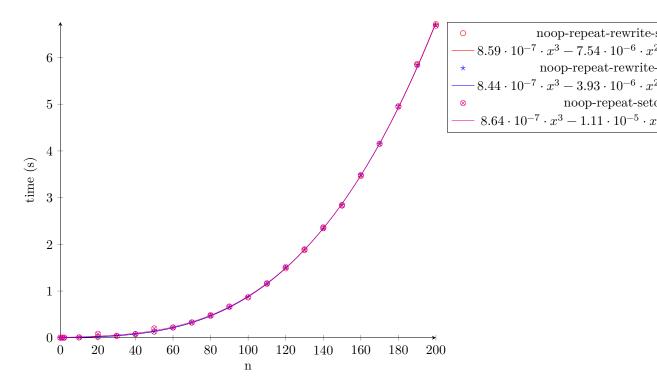


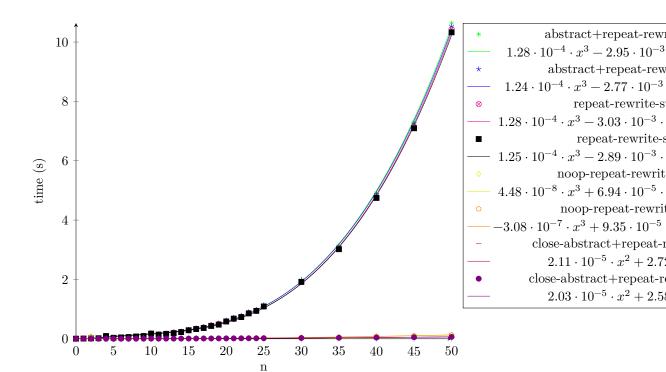
Figure 2: timing-n-polymorphic-universes param-1-n 0



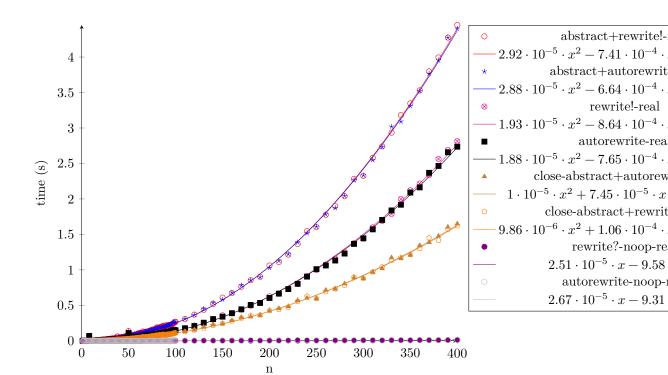
 $Figure \ 3: \ timing-repeat-setoid-rewrite-under-binders$



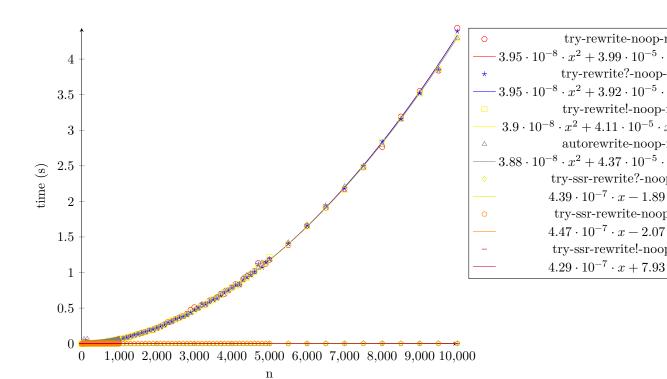
 $Figure \ 4: \ timing-repeat-setoid-rewrite-under-binders-noop \\$



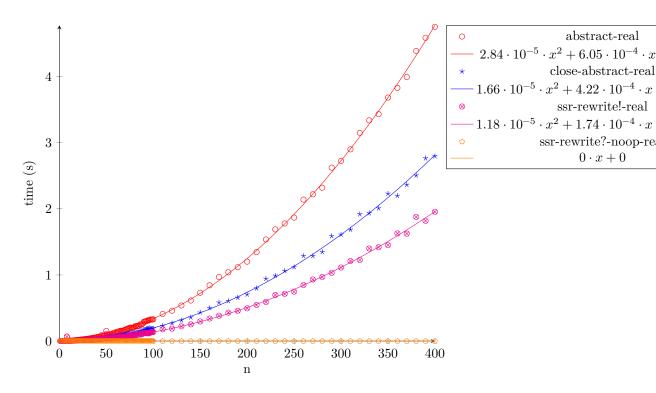
 $Figure\ 5:\ timing-rewrite-strat-under-binders$



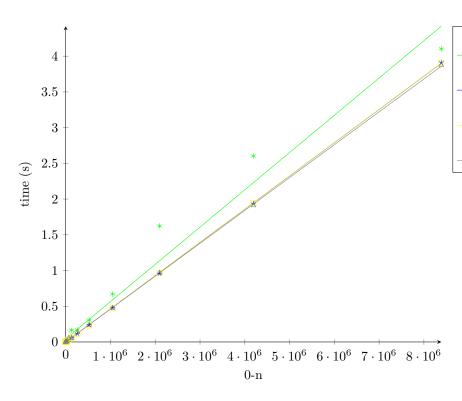
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$



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



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



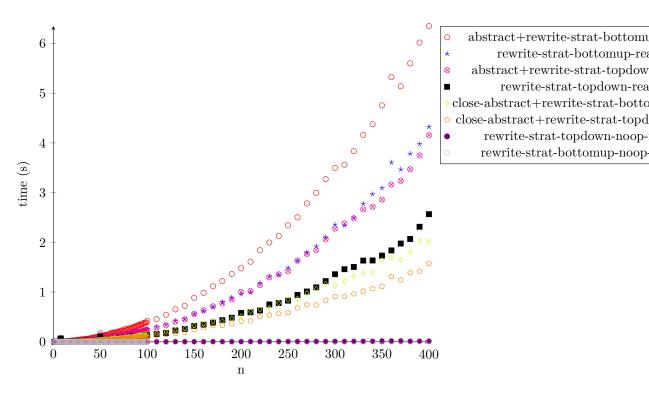
try-ssr-rewrite!-cold-noop-rea $5.22\cdot 10^{-7}\cdot x + 4.23\cdot 10^{-2}$

try-ssr-rewrite-noop-real $4.65\cdot 10^{-7}\cdot x - 2.51\cdot 10^{-3}$

try-ssr-rewrite?-noop-real $4.65\cdot 10^{-7}\cdot x - 2.47\cdot 10^{-3}$

try-ssr-rewrite!-noop-real $4.6\cdot 10^{-7}\cdot x + 7.83\cdot 10^{-4}$

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



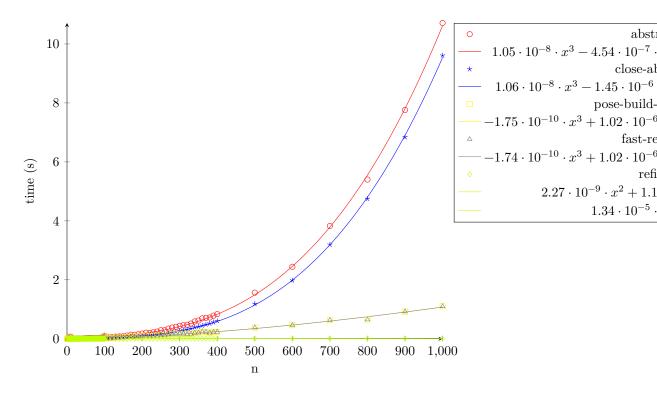
 $abstract + rewrite - strat - bottom \\ u$

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

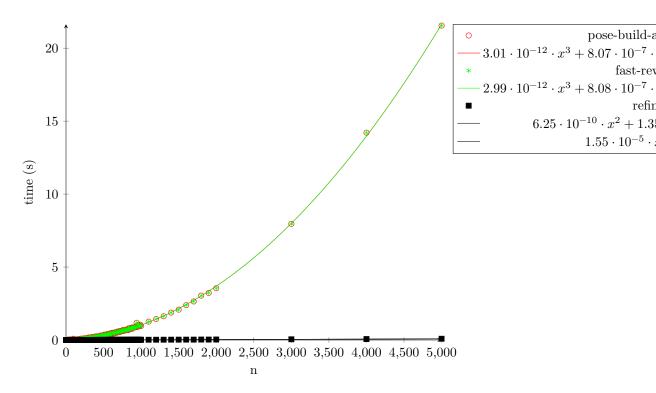
rewrite-strat-topdown-noop-

rewrite-strat-bottomup-noop-

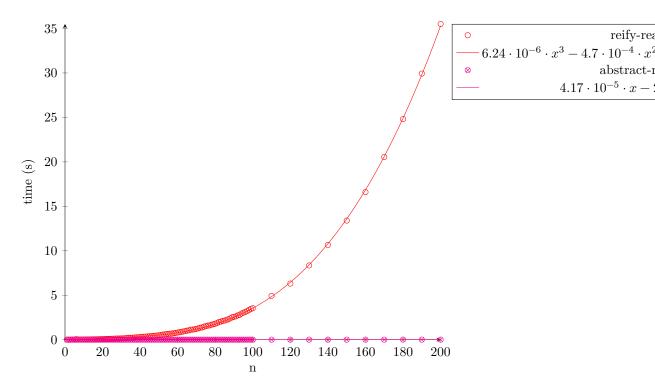
 $Figure~10:~timing\mbox{-rewrite-repeated-app-rewrite-strat}$



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



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



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

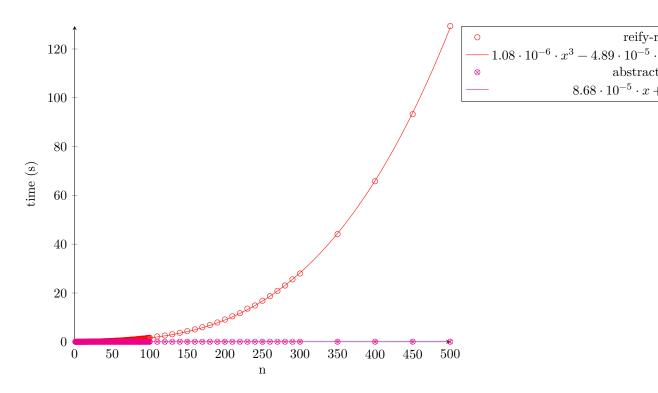
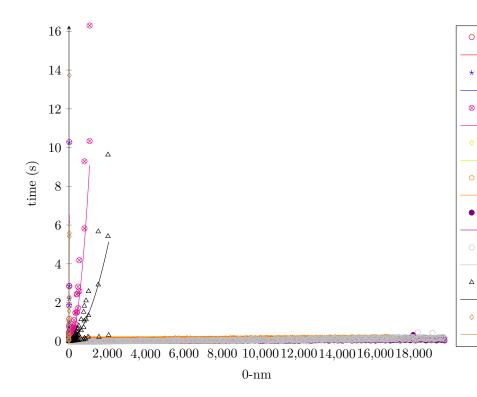


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat(topdown-bot) $7.1 \cdot 10^{-3} exp(0.46 \cdot (0.46 \cdot$

rewrite-strat(bottomup-bot $6.93 \cdot 10^{-3} exp(0.45 \cdot ($

 $7.97 \cdot 10^{-6} \cdot x^2 - 1.43 \cdot 10^{-4} \cdot .$

 $1.6 \cdot 10^{-10} \cdot x^2 + 5.04 \cdot 10^{-6} \cdot x^2$

 $8.09 \cdot 10^{-11} \cdot x^2 + 5.47 \cdot 10^{-6} \cdot$

 $1.15 \cdot 10^{-10} \cdot x^2 + 3.65 \cdot 10^{-6} \cdot$

 $2.37 \cdot 10^{-10} \cdot x^2 + 4.58 \cdot 10^{-6} \cdot \\$

 $1.02 \cdot 10^{-6} \cdot x^2 + 3.63 \cdot 10^{-4} \cdot x^2 + 3.63 \cdot 10^{-4}$

 $-7.98 \cdot 10^{-3} \cdot x^3 + 0.25 \cdot x^2 -$

cps+cbn-real

cps+vm-compute-

cps+native-compute

cps+cbv-real

cps+lazy-real

cps+simpl-real

setoid-rewrite-re

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

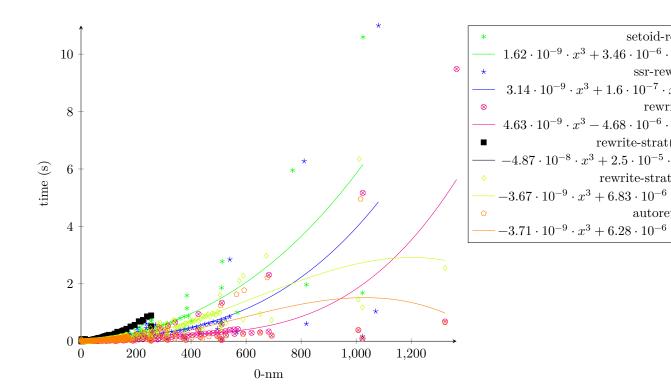
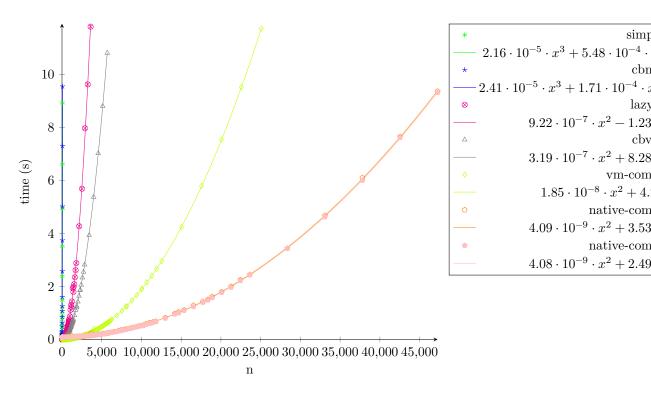


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

lazy

vm-com

native-com

native-com

 $9.22 \cdot 10^{-7} \cdot x^2 - 1.23$

 $3.19 \cdot 10^{-7} \cdot x^2 + 8.28$

 $1.85 \cdot 10^{-8} \cdot x^2 + 4.5$

 $4.09 \cdot 10^{-9} \cdot x^2 + 3.53$

 $4.08 \cdot 10^{-9} \cdot x^2 + 2.49$

 $Figure~17:~timing\mbox{-sieve-of-eratos} thenes$

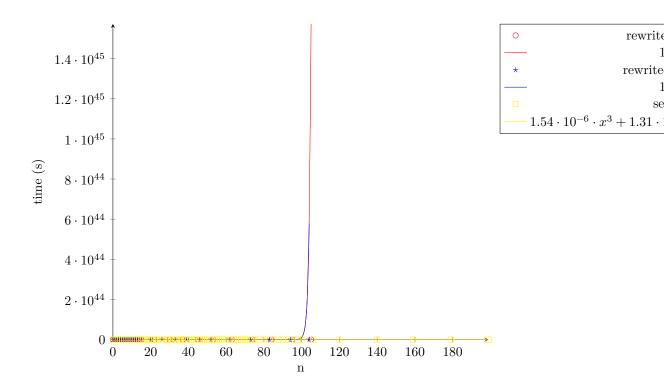


Figure 18: timing-rewrite-under-lets-plus-0 $\,$