

Figure 1: timing-pattern

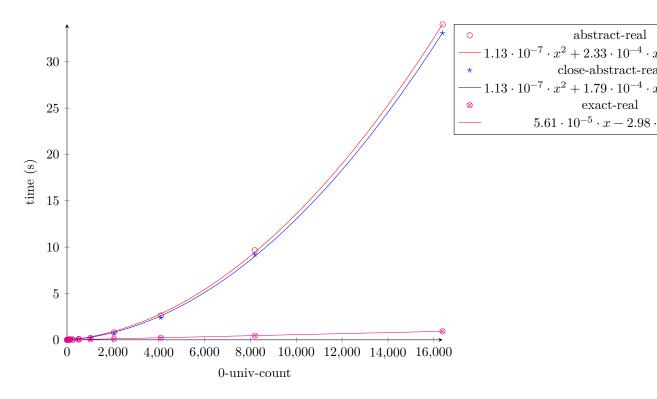
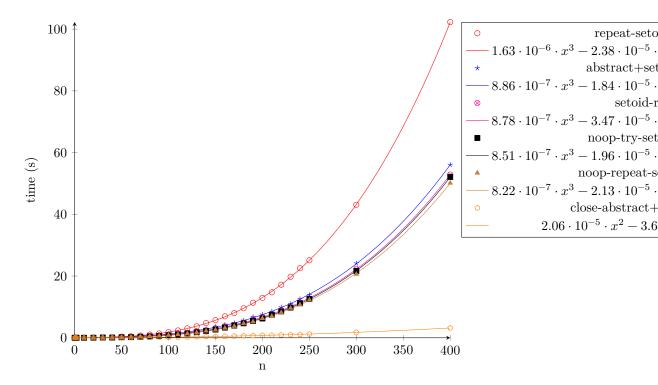


Figure 2: timing-n-polymorphic-universes param-1-n $\,0\,$



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

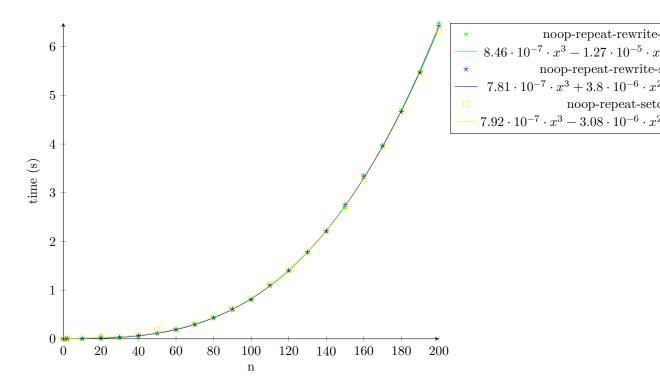
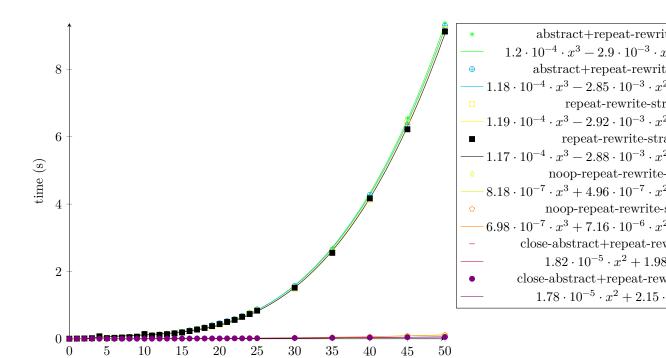
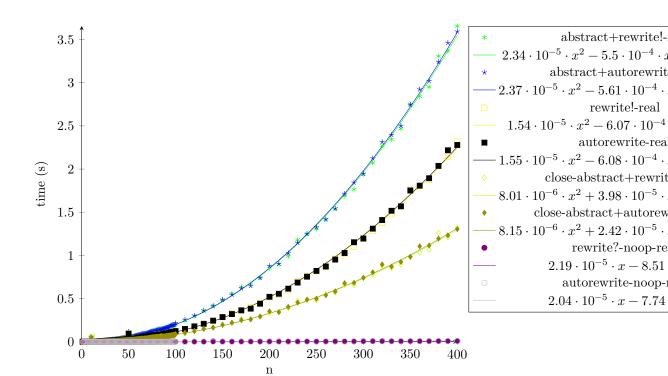


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

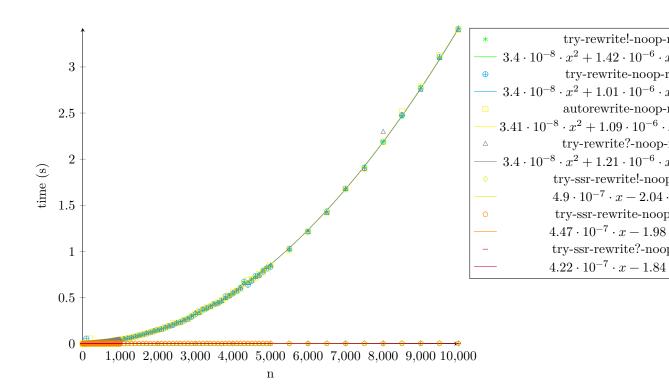


 $Figure\ 5:\ timing-rewrite-strat-under-binders$

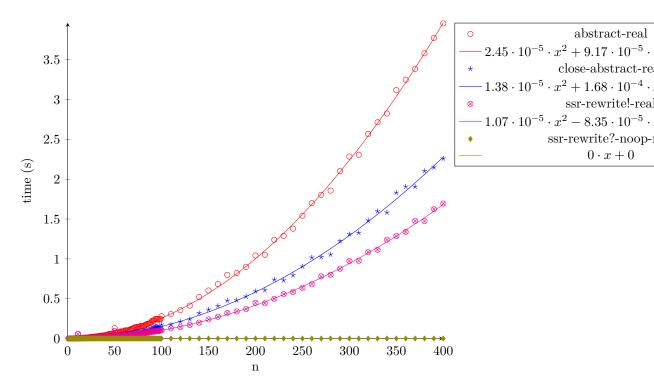
n



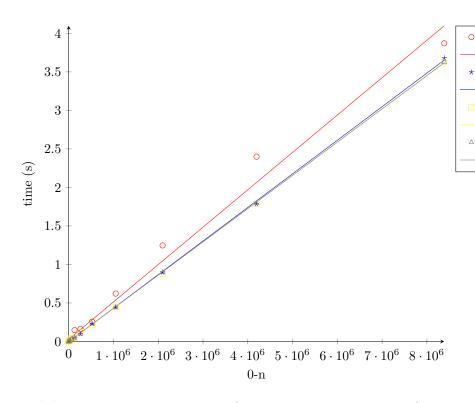
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$



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



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



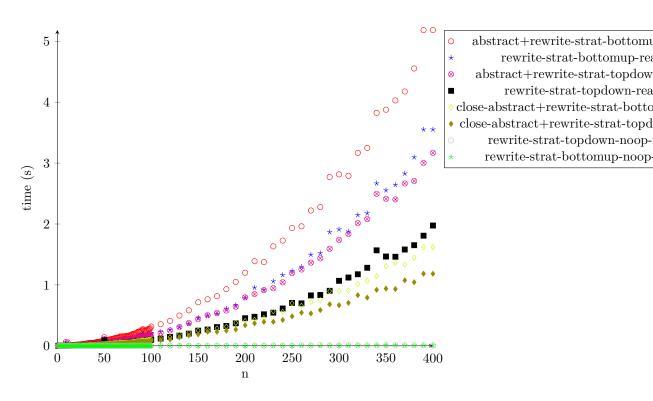
try-ssr-rewrite!-cold-noop-rea $4.85\cdot 10^{-7}\cdot x + 2.78\cdot 10^{-2}$ try-ssr-rewrite-noop-real

 $\begin{array}{l} 4.36\cdot 10^{-7}\cdot x - 3.89\cdot 10^{-3}\\ \text{try-ssr-rewrite!-noop-real} \end{array}$

 $\begin{array}{l} 4.31\cdot 10^{-7}\cdot x - 1.68\cdot 10^{-3}\\ \text{try-ssr-rewrite?-noop-real} \end{array}$

 $4.32\cdot 10^{-7}\cdot x - 2.17\cdot 10^{-3}$

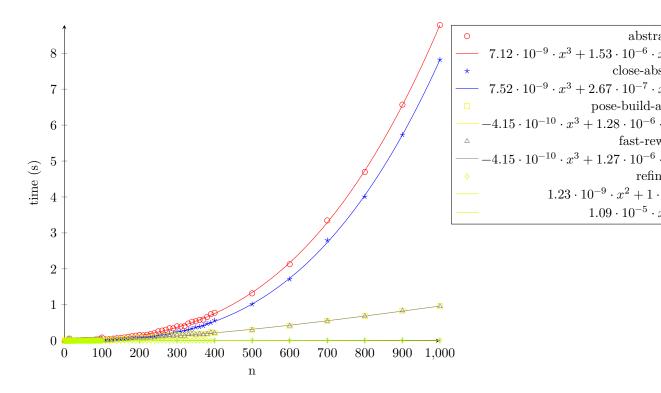
Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn $\ 1$



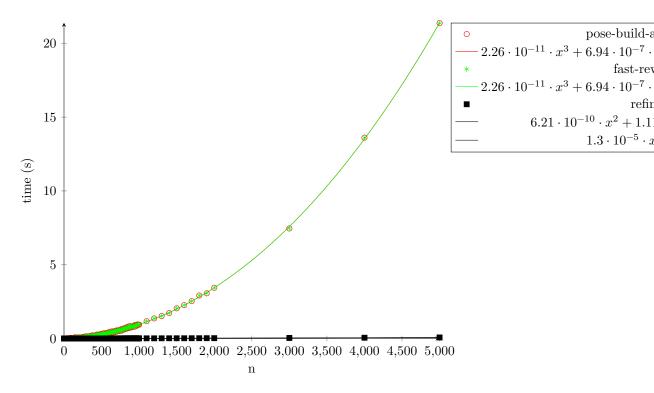
rewrite-strat-bottomup-rea abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

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

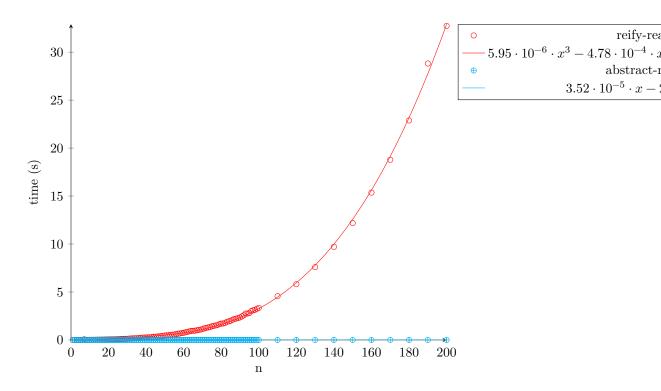
 $Figure~10:~timing\mbox{-rewrite-repeated-app-rewrite-strat}$



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



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



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

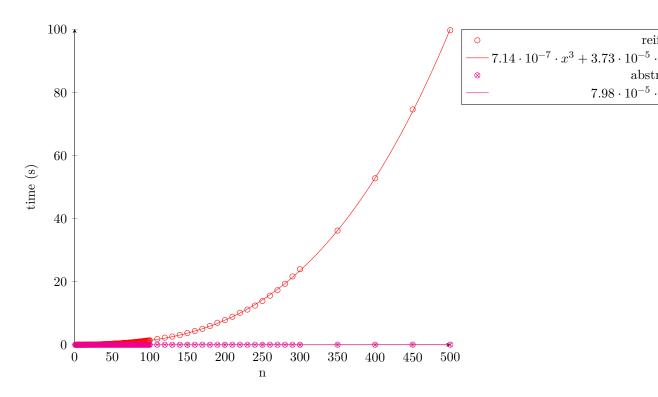
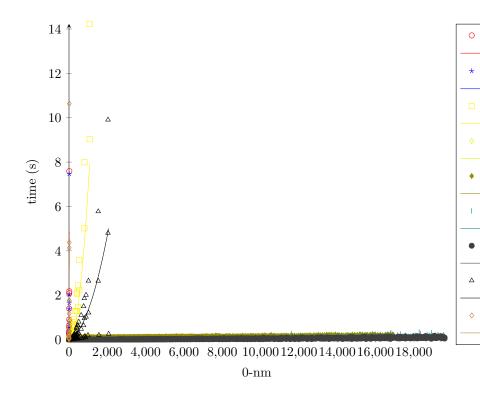


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat (topdown-bot $5.52\cdot 10^{-3} \exp{(0.45\cdot ($ rewrite-strat (bottomup-bot

 $7 \cdot 10^{-6} \cdot x^2 - 1.85 \cdot 10^{-4} \cdot x$

 $2\cdot 10^{-10}\cdot x^2 + 4.93\cdot 10^{-6}\cdot x$

 $1.14 \cdot 10^{-11} \cdot x^2 + 6.35 \cdot 10^{-6}$

 $2.4 \cdot 10^{-10} \cdot x^2 + 3.7 \cdot 10^{-6} \cdot x$

 $8.95\cdot 10^{-11}\cdot x^2 + 3.28\cdot 10^{-6}\cdot \\$

 $1.01 \cdot 10^{-6} \cdot x^2 + 3.3 \cdot 10^{-4} \cdot x^2$

 $-6.13 \cdot 10^{-3} \cdot x^3 + 0.2 \cdot x^2 - \\$

 $5.06 \cdot 10^{-3} exp(0.45 \cdot ($

cps+cbn-real

cps+lazy-real

cps+cbv-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

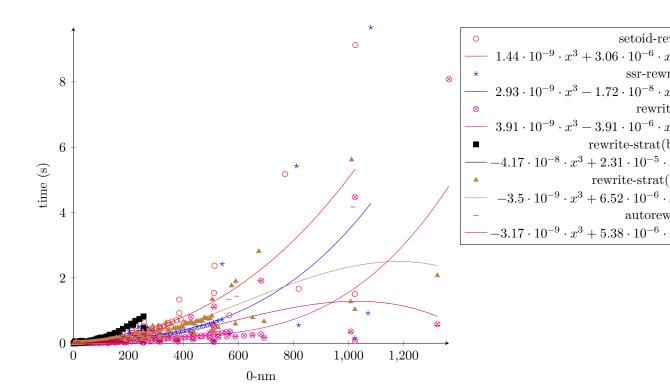
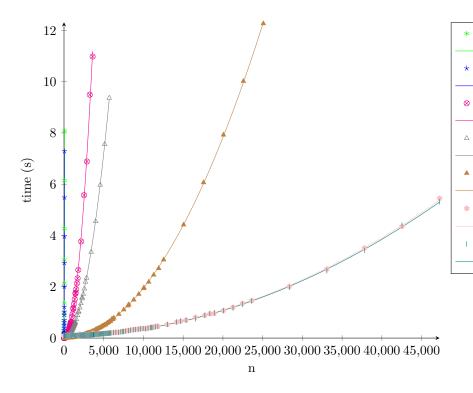


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



cbn-

simp

vm-com

native-comp

native-comp

 $2.13 \cdot 10^{-5} \cdot x^3 + 7.23 \cdot 10^{-5} \cdot x^3$

 $1.61 \cdot 10^{-5} \cdot x^3 + 5.88 \cdot 10^{-4} \cdot x^3$

 $8.88 \cdot 10^{-7} \cdot x^2 - 9.57$

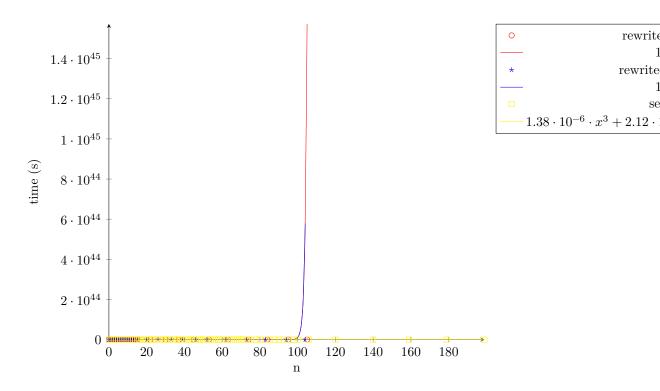
 $2.82 \cdot 10^{-7} \cdot x^2 + 3.15$

 $1.96 \cdot 10^{-8} \cdot x^2 - 1.58$

 $2.27 \cdot 10^{-9} \cdot x^2 + 4.73$

 $2.25 \cdot 10^{-9} \cdot x^2 + 4.02$

Figure 17: timing-sieve-of-eratosthenes



rewrite

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

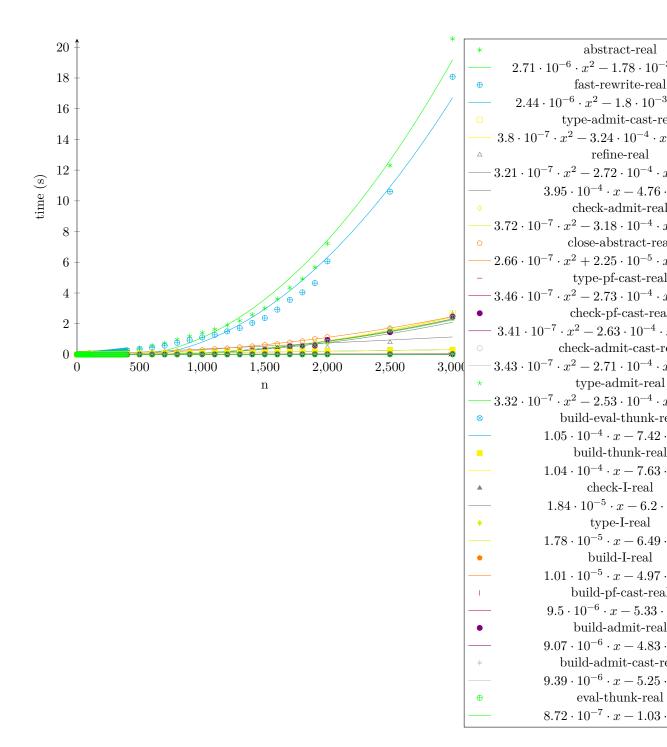


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2