

Figure 1: timing-pattern

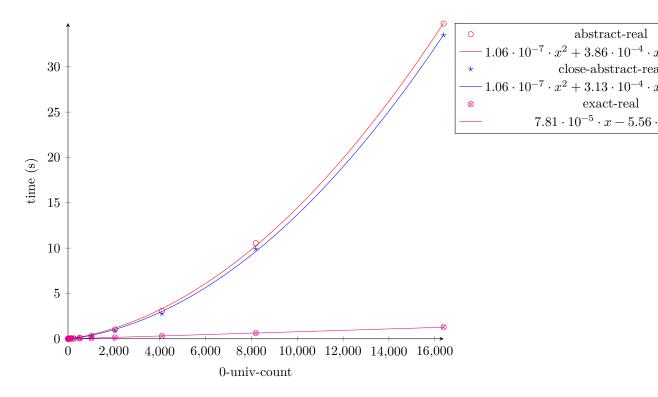
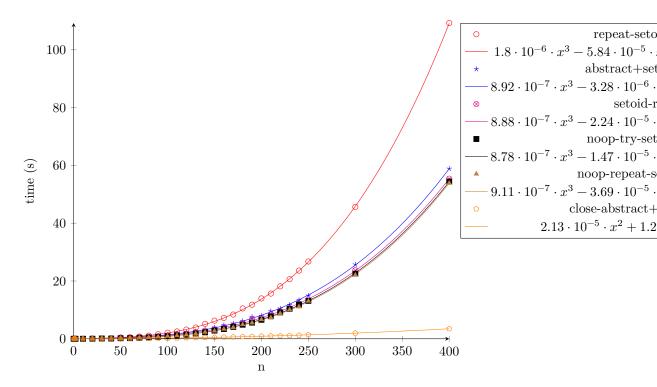


Figure 2: timing-n-polymorphic-universes param-1-n $\,0\,$



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

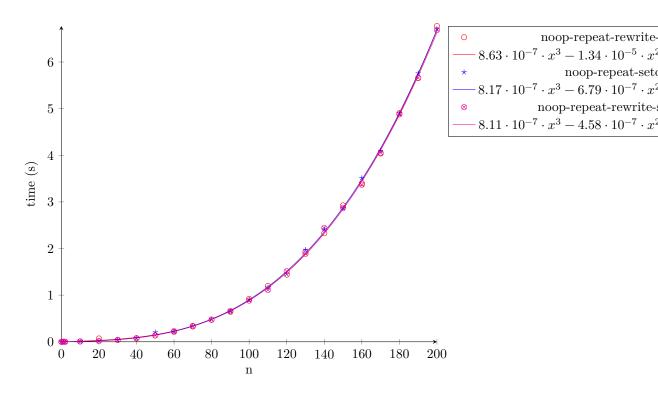
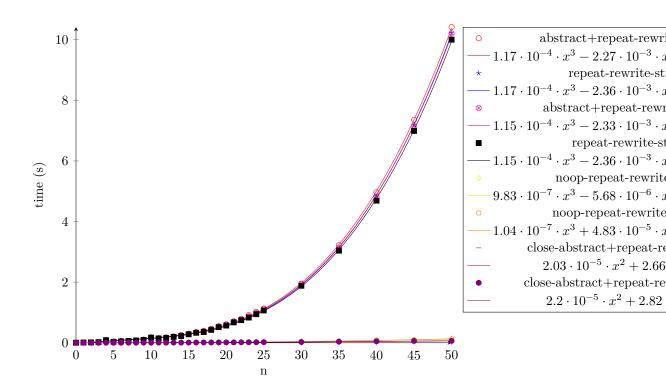
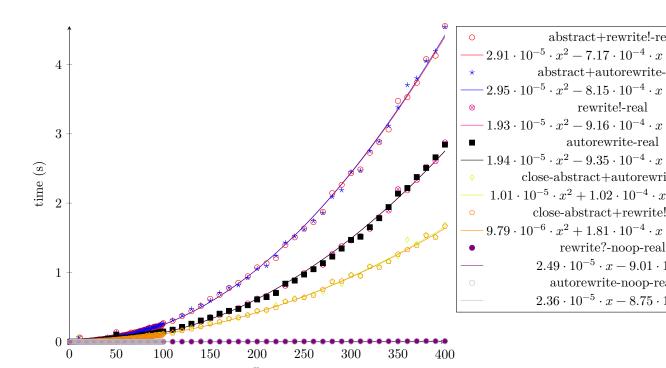


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

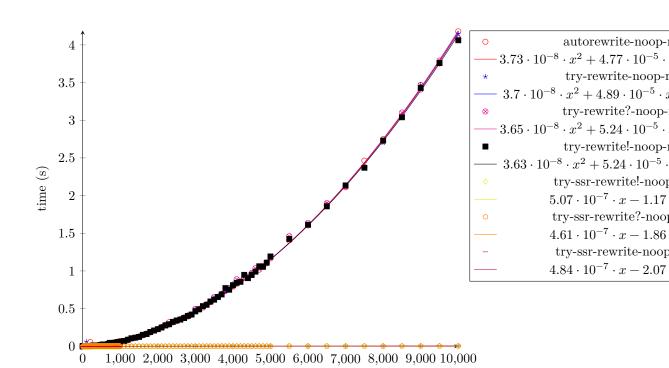


 $Figure\ 5:\ timing-rewrite-strat-under-binders$

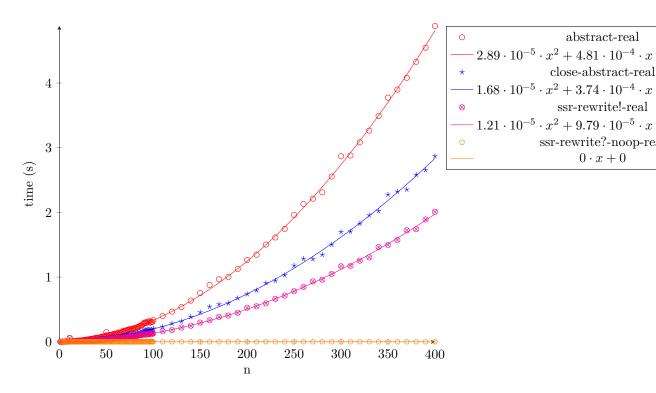


 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$

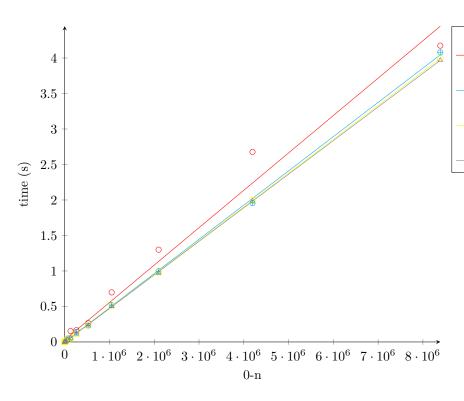
n



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



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



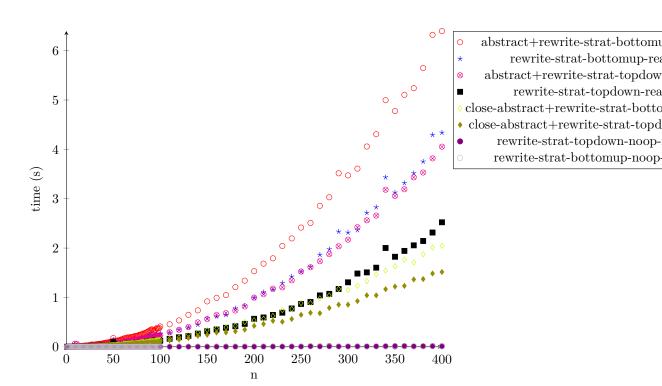
try-ssr-rewrite!-cold-noop-rea $5.27\cdot 10^{-7}\cdot x + 2.95\cdot 10^{-2}$

try-ssr-rewrite!-noop-real $4.82\cdot 10^{-7}\cdot x - 1.3\cdot 10^{-3}$

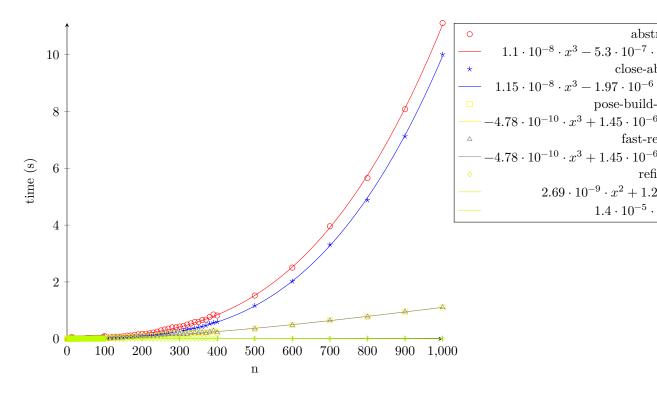
try-ssr-rewrite?-noop-real $4.76\cdot 10^{-7}\cdot x - 1.88\cdot 10^{-3}$

 $\begin{array}{l} \text{try-ssr-rewrite-noop-real} \\ 4.73 \cdot 10^{-7} \cdot x - 2.53 \cdot 10^{-3} \end{array}$

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



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



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

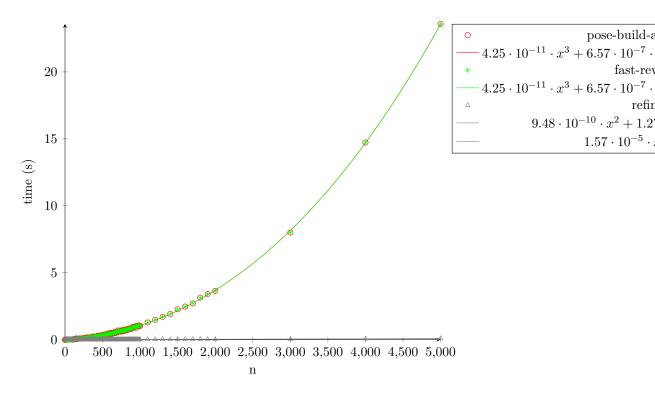


Figure 12: timing-rewrite-repeated-app-fast-rewrite-no-abstract

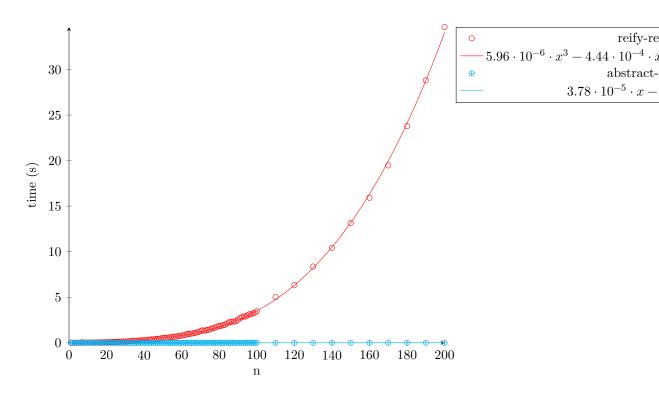


Figure 13: timing-typeclass-reification-let-in-HOAS

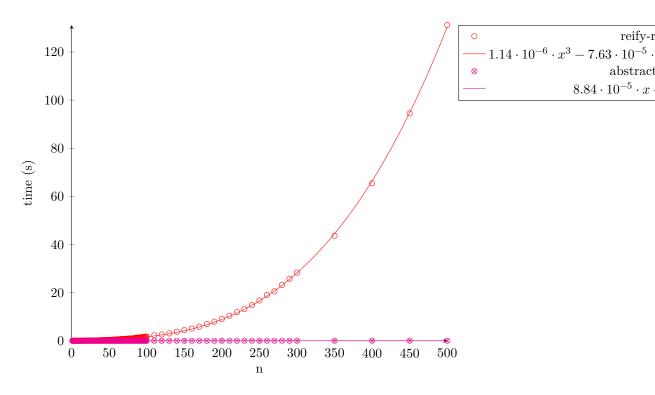
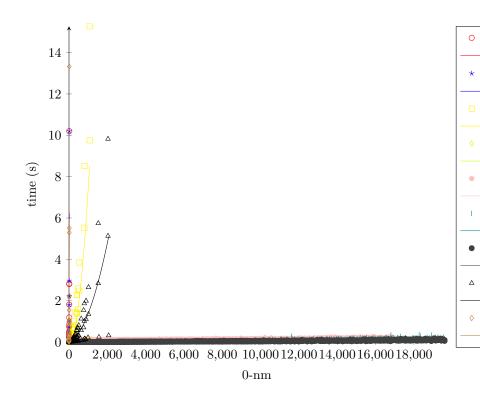


Figure 14: timing-typeclass-reification-let-in-PHOAS



rewrite-strat (top down-bot)

 $7.49 \cdot 10^{-6} \cdot x^2 - 1.49 \cdot 10^{-4} \cdot x^2 + 1.49 \cdot 10^{-4} \cdot x^2$

 $2.37 \cdot 10^{-10} \cdot x^2 + 5.2 \cdot 10^{-6} \cdot x^$

 $1.24 \cdot 10^{-10} \cdot x^2 + 5.1 \cdot 10^{-6} \cdot x^$

 $2.48 \cdot 10^{-10} \cdot x^2 + 4.15 \cdot 10^{-6} \cdot$

 $1.17 \cdot 10^{-10} \cdot x^2 + 3.26 \cdot 10^{-6} \cdot \\$

 $1.01 \cdot 10^{-6} \cdot x^2 + 3.78 \cdot 10^{-4} \cdot x^2$

 $-7.75 \cdot 10^{-3} \cdot x^3 + 0.25 \cdot x^2 -$

 $5.47\cdot 10^{-3}\exp{(0.47\cdot (}$ rewrite-strat (bottomup-bot $7.15\cdot 10^{-3}\exp{(0.45\cdot (}$

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

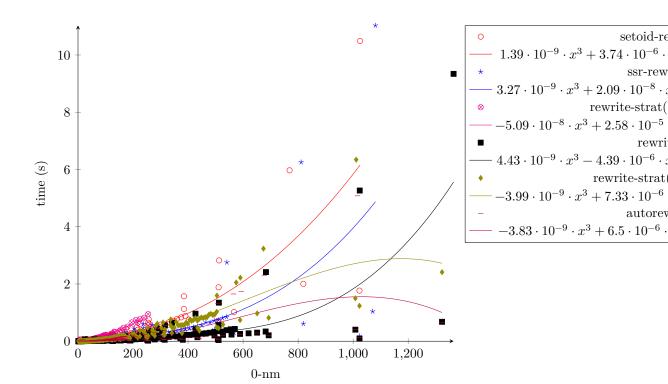
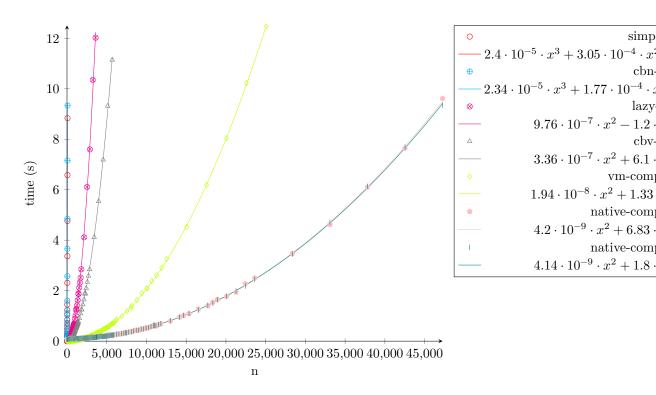


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-comp

native-comp

 $9.76 \cdot 10^{-7} \cdot x^2 - 1.2 \cdot$

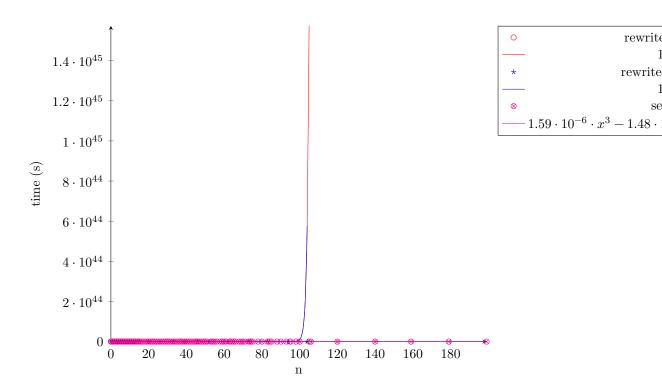
 $3.36 \cdot 10^{-7} \cdot x^2 + 6.1 \cdot$

 $1.94 \cdot 10^{-8} \cdot x^2 + 1.33$

 $4.2 \cdot 10^{-9} \cdot x^2 + 6.83 \cdot$

 $4.14 \cdot 10^{-9} \cdot x^2 + 1.8 \cdot$

Figure 17: timing-sieve-of-eratosthenes



rewrite

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

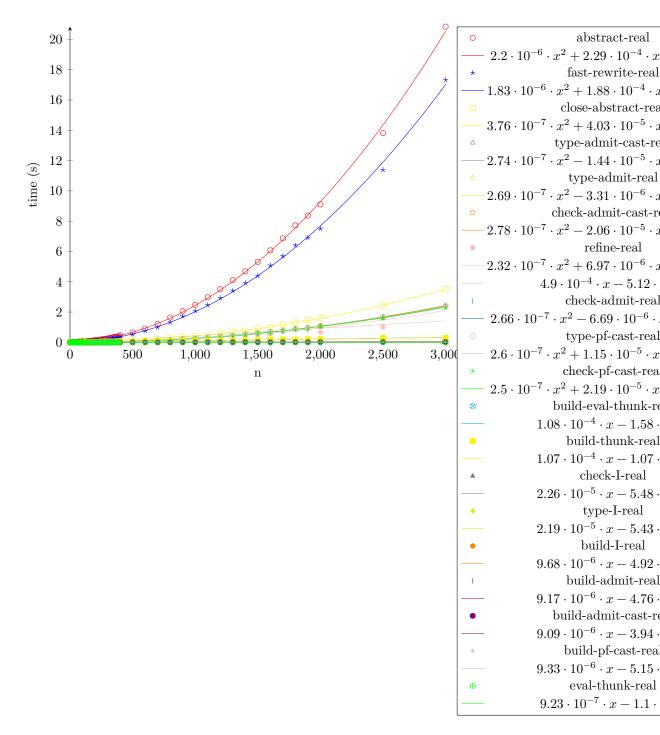


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2