

Figure 1: timing-pattern

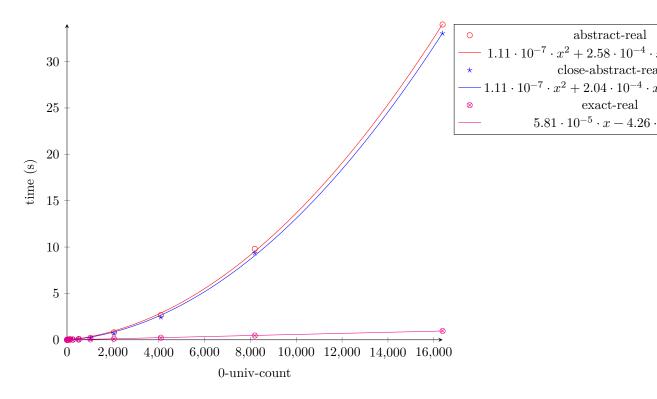
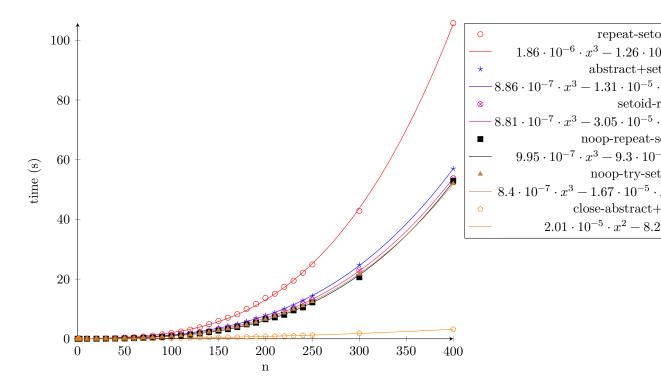
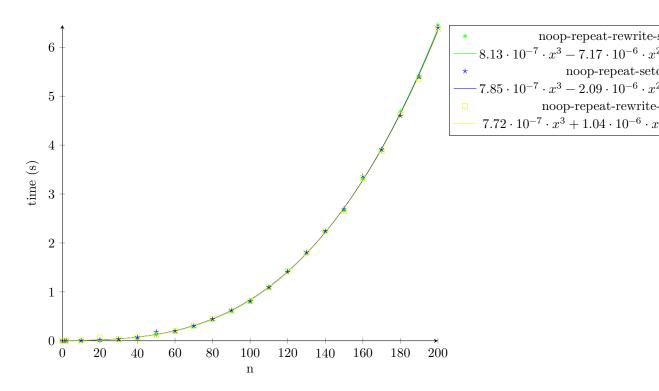


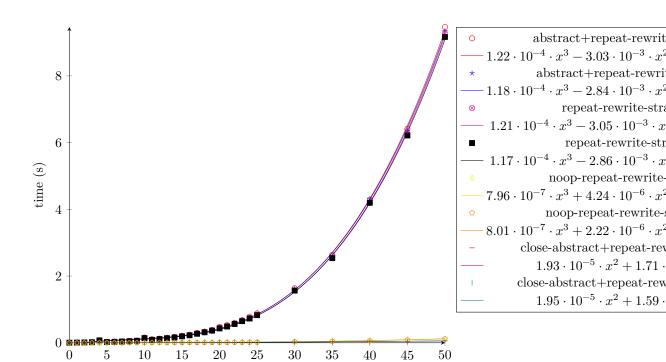
Figure 2: timing-n-polymorphic-universes param-1-n $\,0$



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

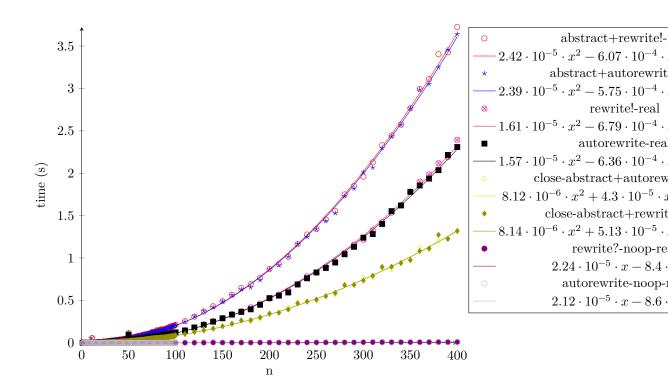


 $Figure\ 4:\ timing-repeat-setoid-rewrite-under-binders-noop$

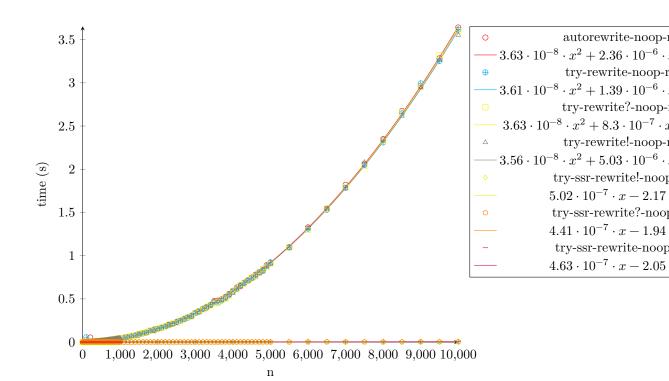


 $Figure\ 5:\ timing-rewrite-strat-under-binders$

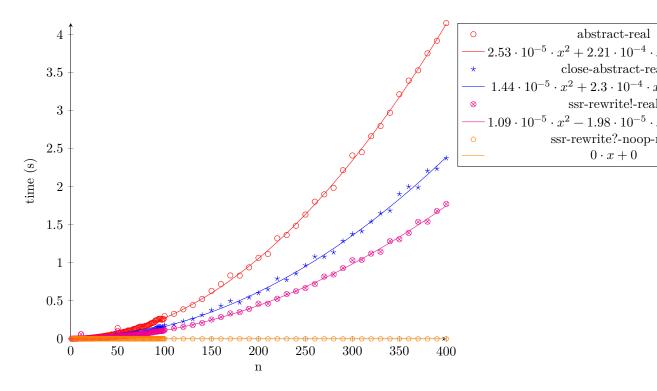
n



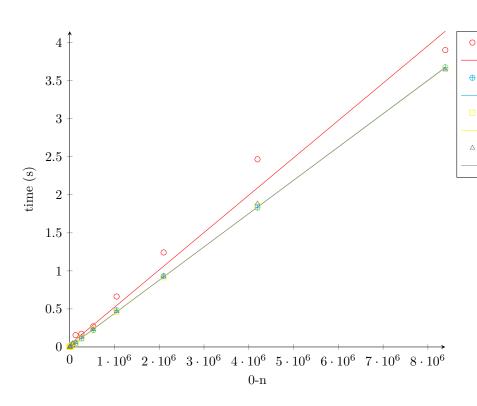
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$



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



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



try-ssr-rewrite!-cold-noop-rea

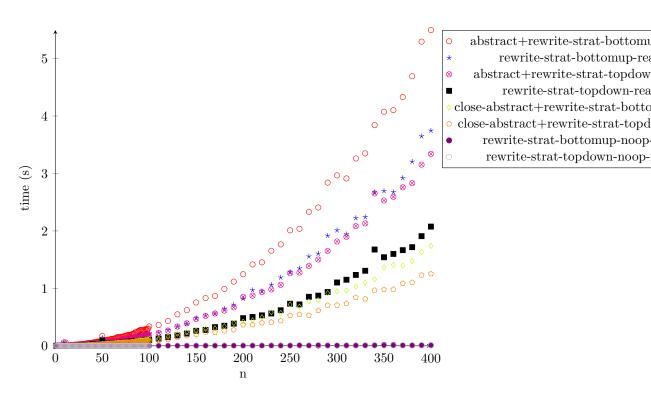
 $\begin{array}{l} 4.91\cdot 10^{-7}\cdot x + 3.12\cdot 10^{-2}\\ \text{try-ssr-rewrite?-noop-real} \end{array}$

 $\begin{array}{l} 4.38 \cdot 10^{-7} \cdot x + 5.95 \cdot 10^{-4} \\ \text{try-ssr-rewrite-noop-real} \end{array}$

 $\begin{array}{l} 4.38 \cdot 10^{-7} \cdot x - 2.27 \cdot 10^{-4} \\ \text{try-ssr-rewrite!-noop-real} \end{array}$

 $4.37 \cdot 10^{-7} \cdot x + 4.19 \cdot 10^{-3}$

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

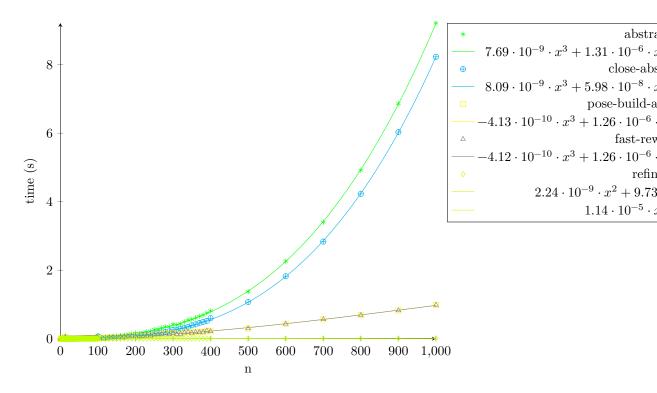


rewrite-strat-bottomup-real

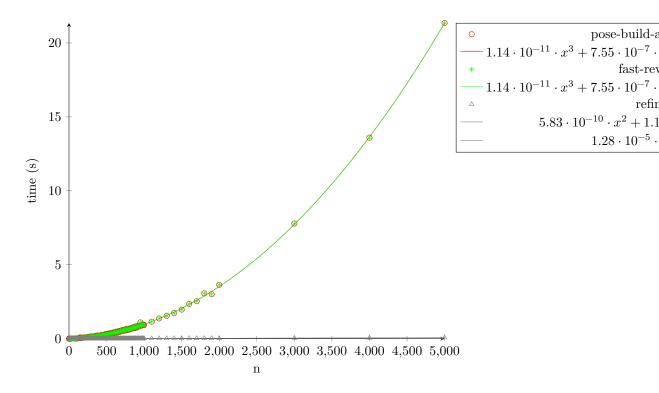
abstract + rewrite - strat - topdowrewrite-strat-topdown-rea

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

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



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



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

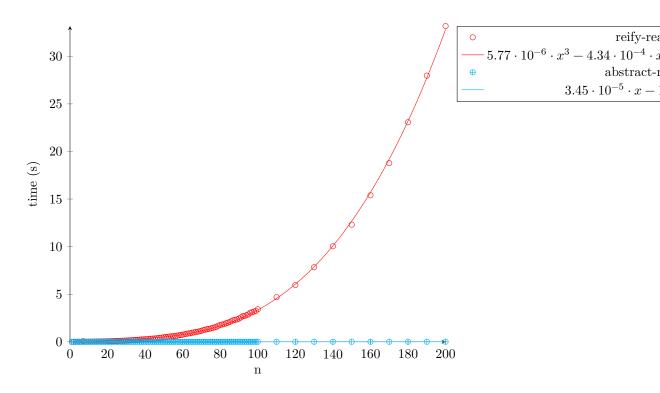


Figure 13: timing-typeclass-reification-let-in-HOAS

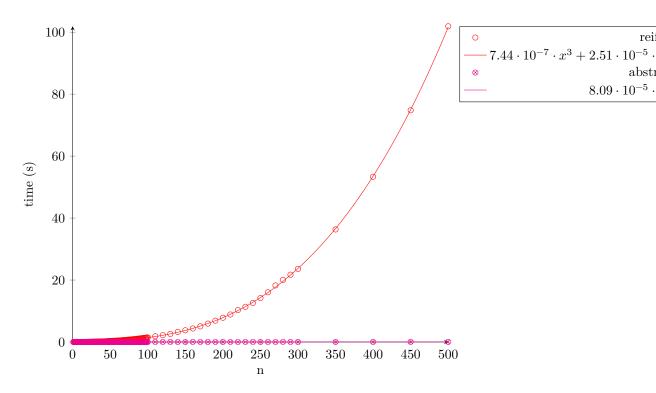


Figure 14: timing-typeclass-reification-let-in-PHOAS

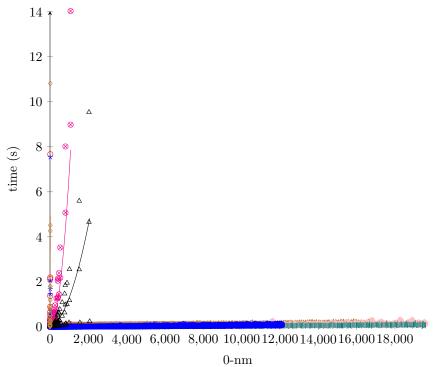


Figure 15: timing-rewrite-lift-lets-map param-1-n 1, param-2-m 1

```
rewrite-strat(topdown-bot
                                                                                                            5.35 \cdot 10^{-3} exp (0.45 \cdot (
                                       rewrite-strat(bottomup-bot
                                                                                                            5.53 \cdot 10^{-3} exp (0.45 \cdot (
                                                                                                                                                                                                                            cps+cbn-real
    6.92 \cdot 10^{-6} \cdot x^2 - 1.54 \cdot 10^{-4} \cdot x^2
                                                                                                                                           cps+native-compute
       6.57 \cdot 10^{-11} \cdot x^2 + 5.52 \cdot 10^{-6}
                                                                                                                                                                                                                        cps+lazy-real
       2.2 \cdot 10^{-10} \cdot x^2 + 3.98 \cdot 10^{-6} \cdot x^2
                                                                                                                                                                                                                            _{\rm cps+cbv\text{-}real}
1.01 \cdot 10^{-10} \cdot x^2 + 3.16 \cdot 10^{-6}
                                                                                                                                                               cps+vm-compute-
  1.26 \cdot 10^{-10} \cdot x^2 + 5.8 \cdot 10^{-6} \cdot x^2
                                                                                                                                                                                                                   cps+simpl-real
  9.61 \cdot 10^{-7} \cdot x^2 + 3.51 \cdot 10^{-4} \cdot x^2
                                                                                                                                                                                          setoid-rewrite-re
            -6.29 \cdot 10^{-3} \cdot x^3 + 0.2 \cdot x^2 -
```

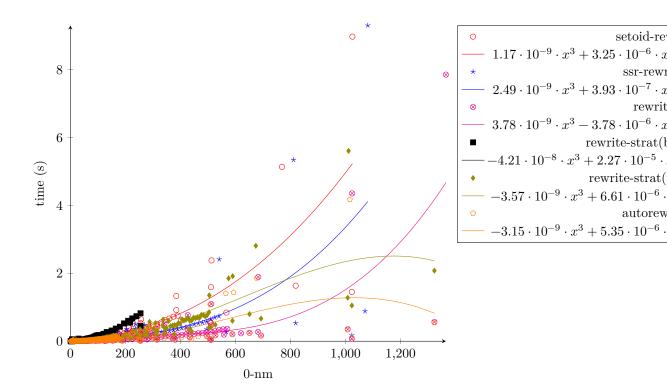
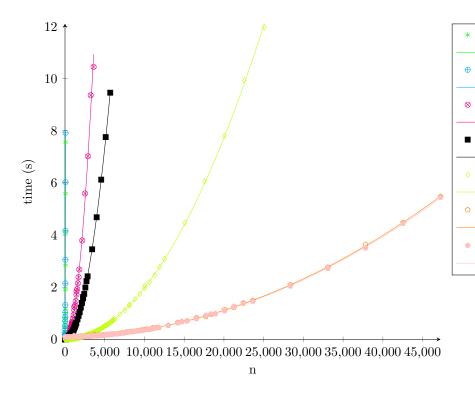


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

vm-com

native-com

native-com

 $2.2 \cdot 10^{-5} \cdot x^3 + 1.46 \cdot 10^{-4} \cdot x^3$

 $2.04 \cdot 10^{-5} \cdot x^3 + 1.03 \cdot 10^{-4} \cdot x^3$

 $8.48 \cdot 10^{-7} \cdot x^2 - 1.64$

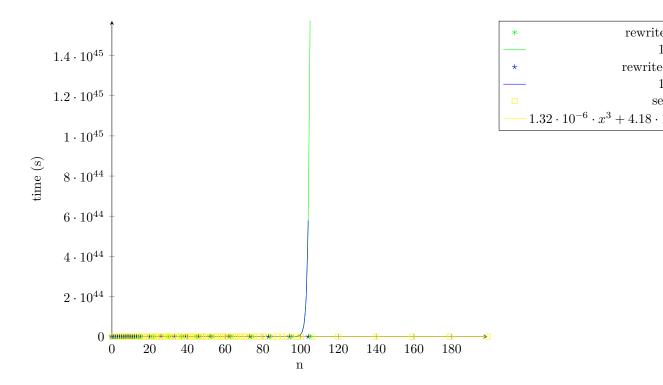
 $2.85 \cdot 10^{-7} \cdot x^2 + 4.52$

 $1.89 \cdot 10^{-8} \cdot x^2 + 9.01$

 $2.3 \cdot 10^{-9} \cdot x^2 + 5.42$

 $2.29 \cdot 10^{-9} \cdot x^2 + 4.54$

Figure 17: timing-sieve-of-eratosthenes



rewrite

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

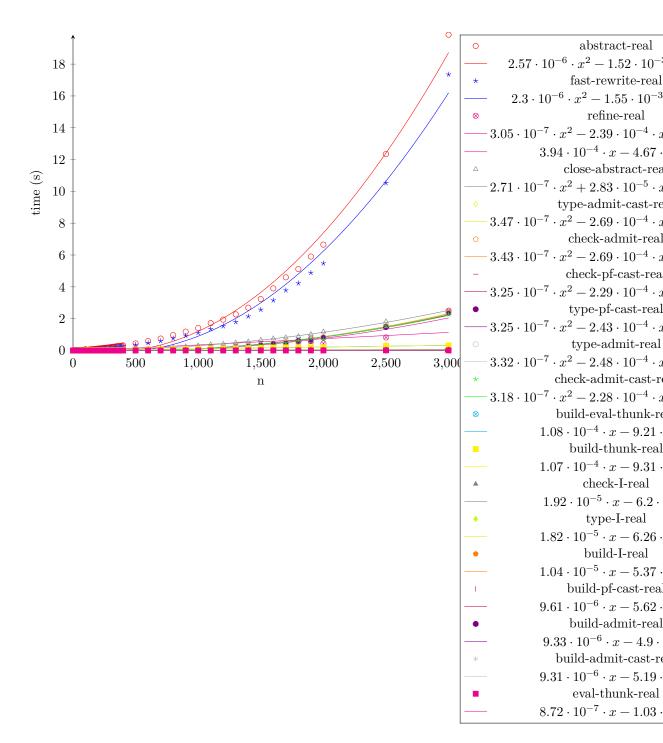


Figure 19: timing-rewrite-repeated-app-fast-rewrite-ltac2