

Figure 1: timing-pattern

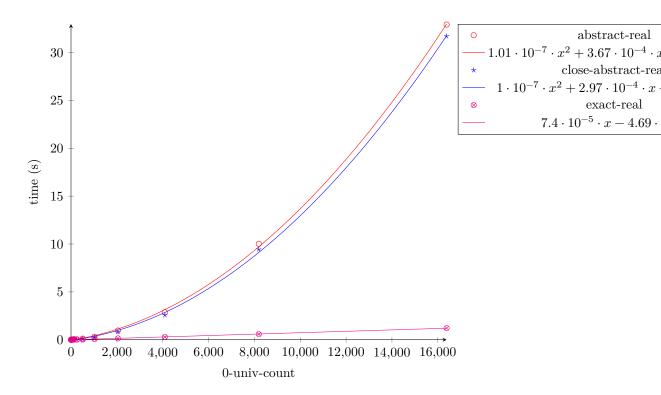


Figure 2: timing-n-polymorphic-universes param-1-n 0

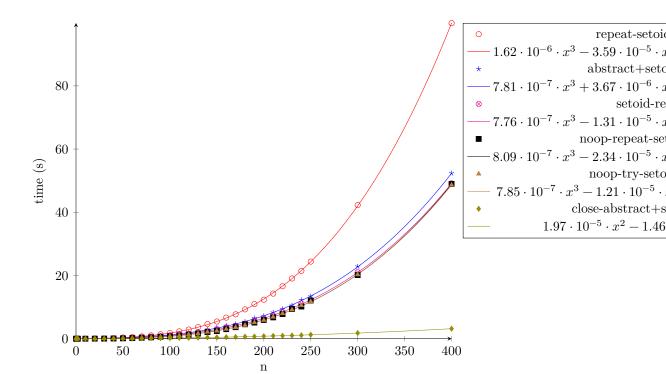
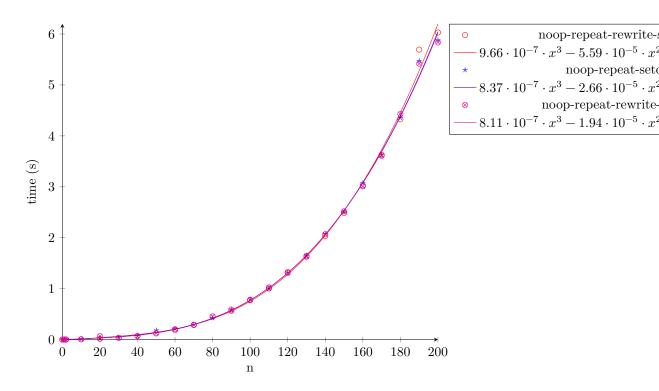
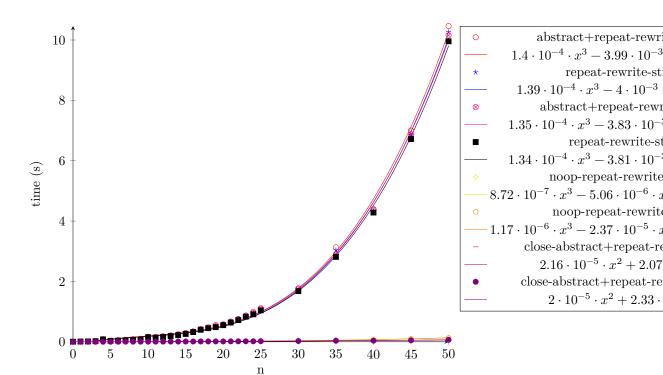


Figure 3: timing-repeat-setoid-rewrite-under-binders



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



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

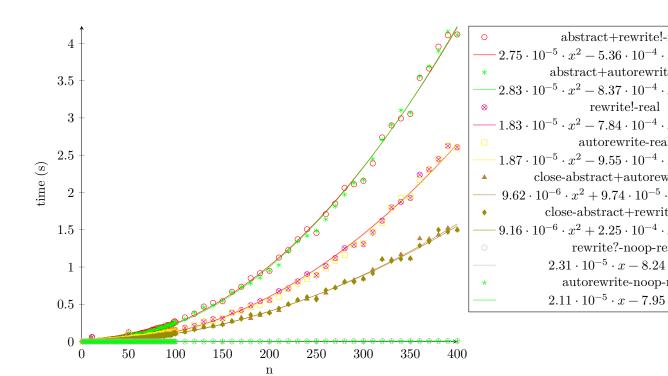
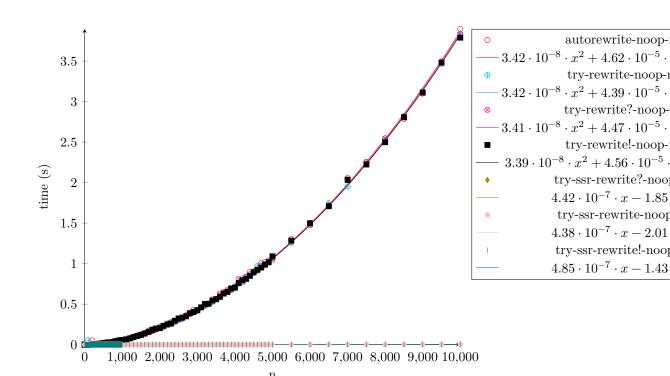


Figure 6: timing-rewrite-repeated-app-autorewrite



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

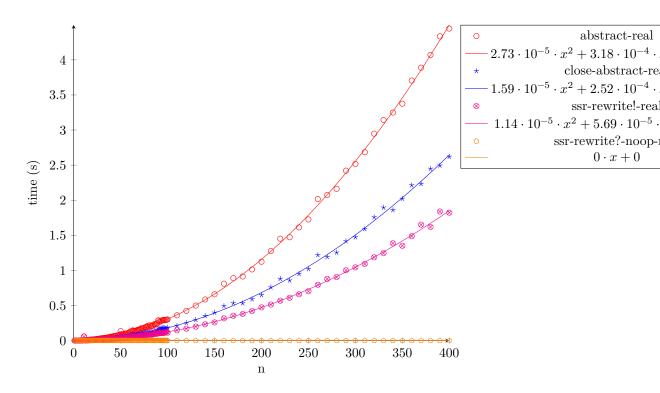
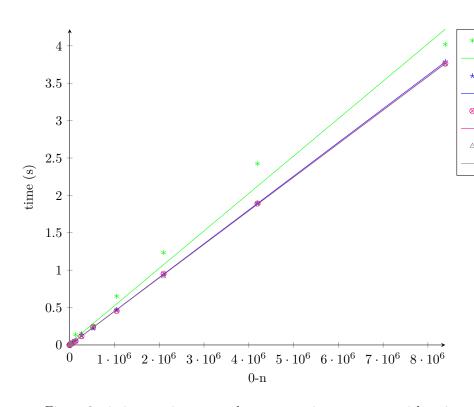


Figure 8: timing-rewrite-repeated-app-ssrrewrite



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

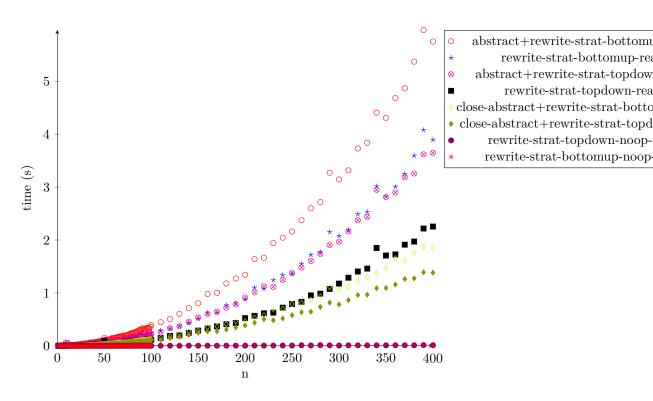
 $\begin{array}{l} 5\cdot 10^{-7}\cdot x + 2.44\cdot 10^{-2}\\ \text{try-ssr-rewrite!-noop-real} \end{array}$

 $\begin{array}{l} 4.51 \cdot 10^{-7} \cdot x - 7.08 \cdot 10^{-5} \\ \text{try-ssr-rewrite-noop-real} \end{array}$

 $4.49\cdot 10^{-7}\cdot x - 7.43\cdot 10^{-4}$ try-ssr-rewrite?-noop-real

 $4.48\cdot 10^{-7}\cdot x - 1.97\cdot 10^{-3}$

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

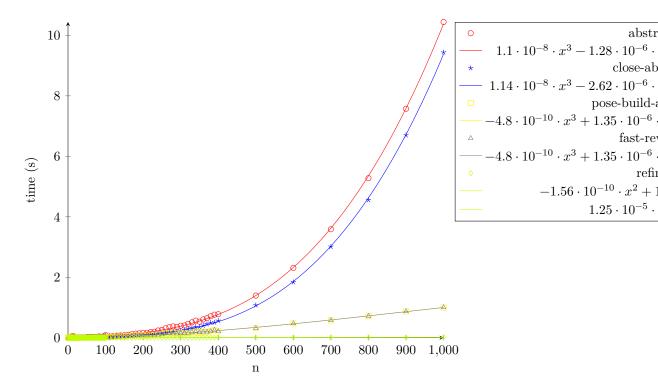


rewrite-strat-bottomup-rea

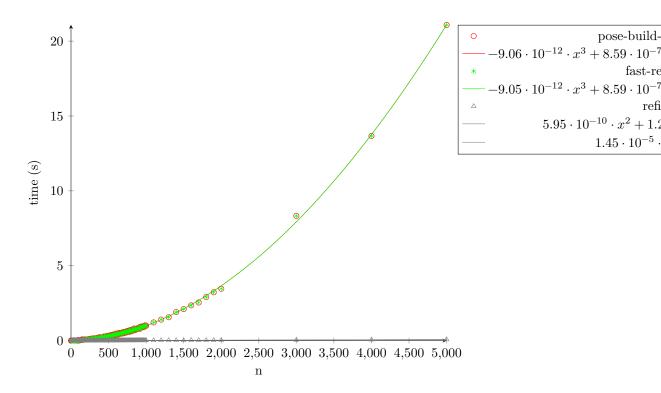
rewrite-strat-topdown-rea

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

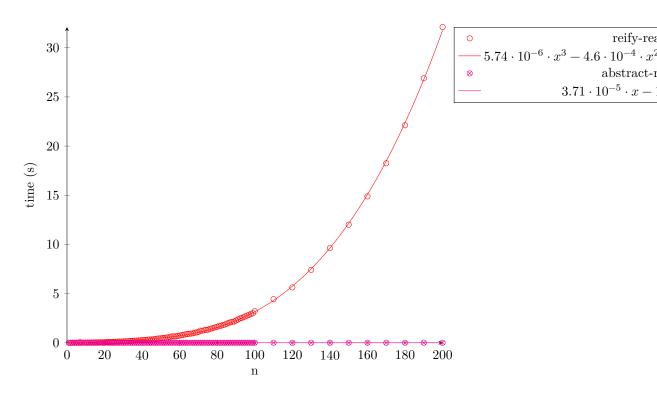


Figure 13: timing-typeclass-reification-let-in-HOAS

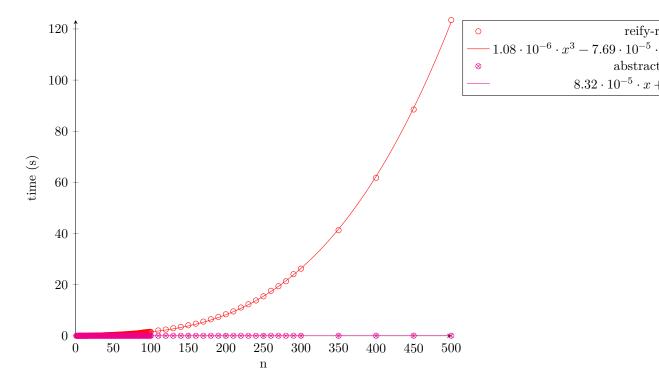


Figure 14: timing-typeclass-reification-let-in-PHOAS

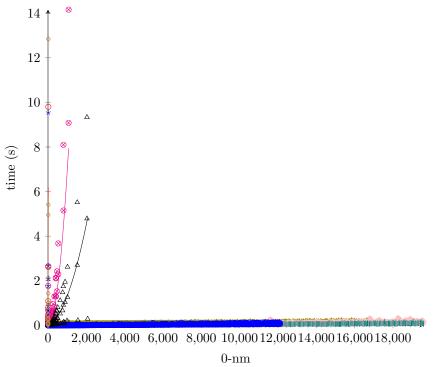


Figure 15: timing-rewrite-lift-lets-map param-1-n 1, param-2-m 1

```
rewrite\text{-}strat(topdown\text{-}bot
                                                                                                                         6.6 \cdot 10^{-3} exp(0.46 \cdot (0.46))
                                          rewrite-strat(bottomup-bot
                                                                                                                    4.48 \cdot 10^{-3} exp(0.48 \cdot (
                                                                                                                                                                                                                                    cps+cbn-real
         6.91 \cdot 10^{-6} \cdot x^2 - 7.05 \cdot 10^{-5} \cdot x^2
                                                                                                                                                cps+native-compute
                      9.73 \cdot 10^{-11} \cdot x^2 + 4.87 \cdot 10^{-6}
                                                                                                                                                                                                                               cps+lazy-real
    2.27 \cdot 10^{-10} \cdot x^2 + 4.04 \cdot 10^{-6} \cdot 
                                                                                                                                                                                                                                    \operatorname{cps+cbv-real}
1.09 \cdot 10^{-10} \cdot x^2 + 3.14 \cdot 10^{-6} \cdot 
                                                                                                                                                                   cps+vm-compute-
                      2 \cdot 10^{-10} \cdot x^2 + 5.12 \cdot 10^{-6} \cdot x
                                                                                                                                                                                                                        cps+simpl-real
       9.43 \cdot 10^{-7} \cdot x^2 + 3.89 \cdot 10^{-4} \cdot x^2
                                                                                                                                                                                               setoid-rewrite-re
         -7.45 \cdot 10^{-3} \cdot x^3 + 0.24 \cdot x^2 -
```

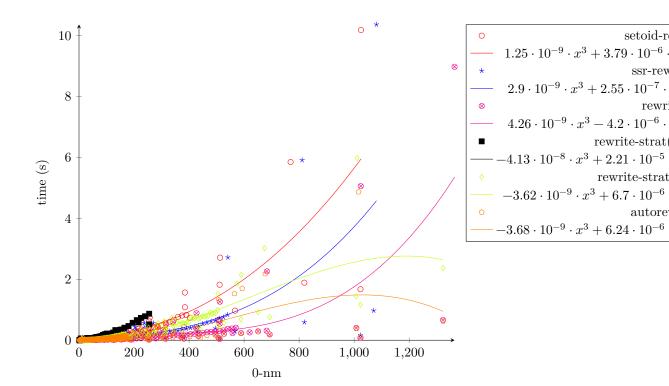
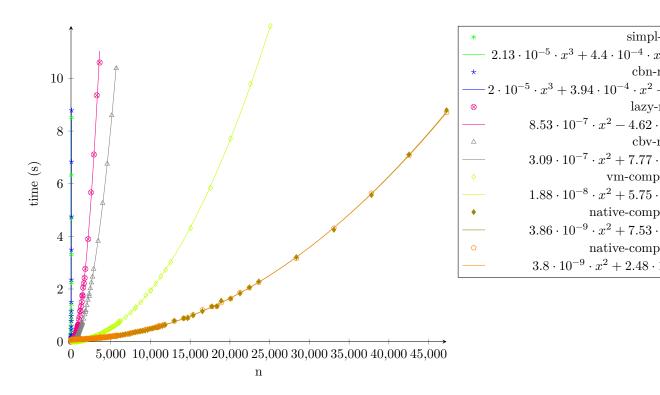


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



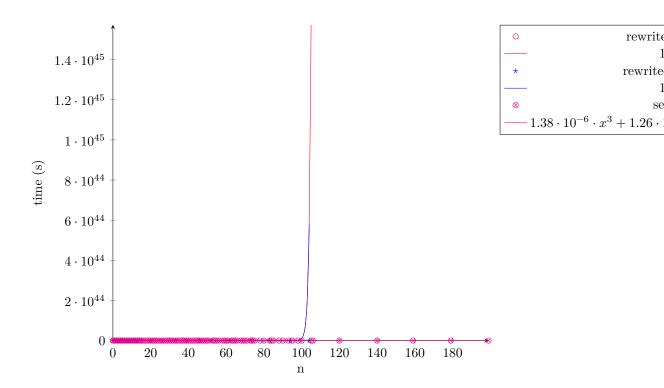
simpl-

vm-comp

native-comp

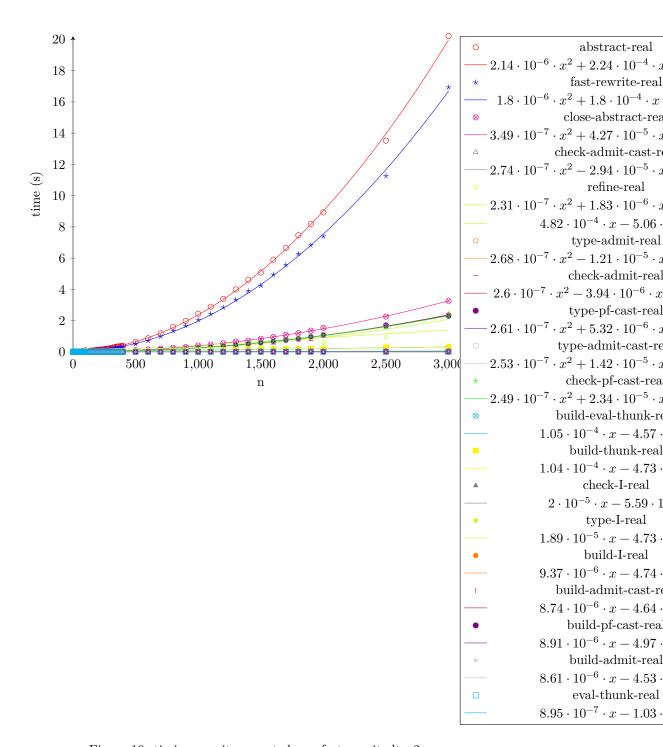
 $\begin{array}{c} \text{native-comp} \\ 3.8 \cdot 10^{-9} \cdot x^2 + 2.48 \cdot 1 \end{array}$

Figure 17: timing-sieve-of-eratosthenes



rewrite

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



Figure~19:~timing-rewrite-repeated-app-fast-rewrite-ltac 2