

Figure 1: timing-pattern

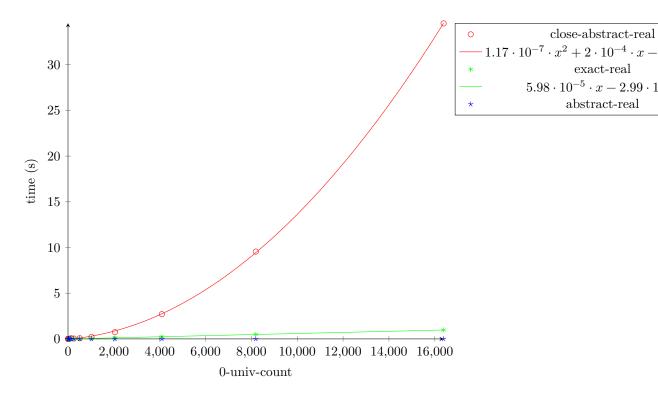
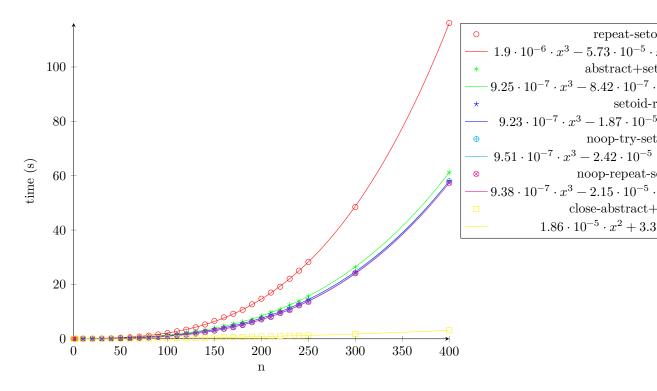


Figure 2: timing-n-polymorphic-universes param-1-n 0



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

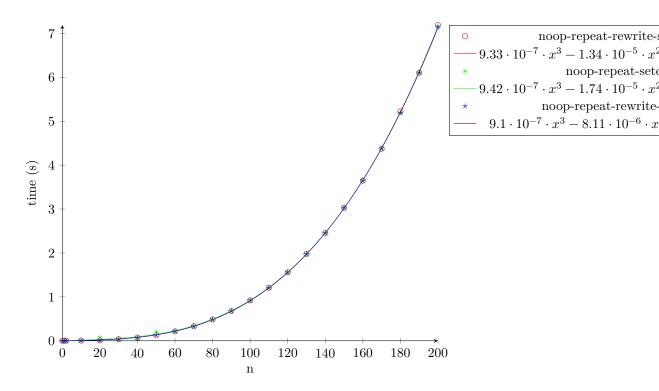
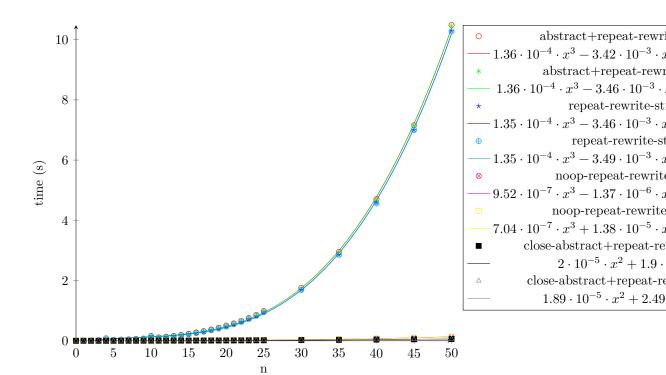
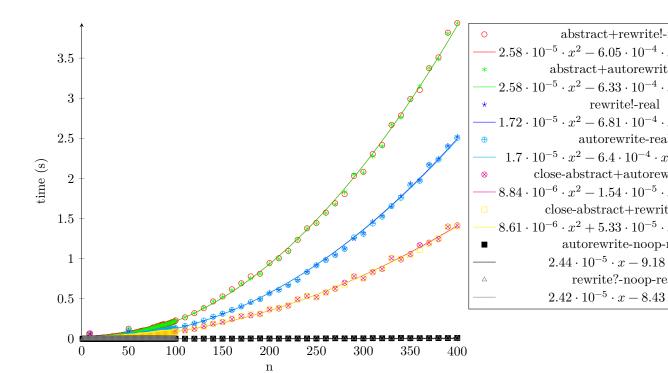


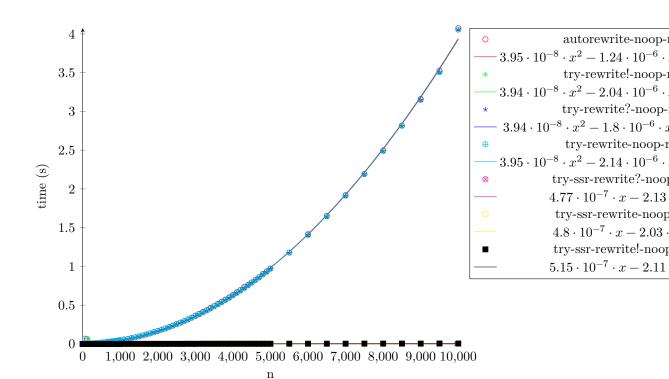
Figure 4: timing-repeat-setoid-rewrite-under-binders-noop



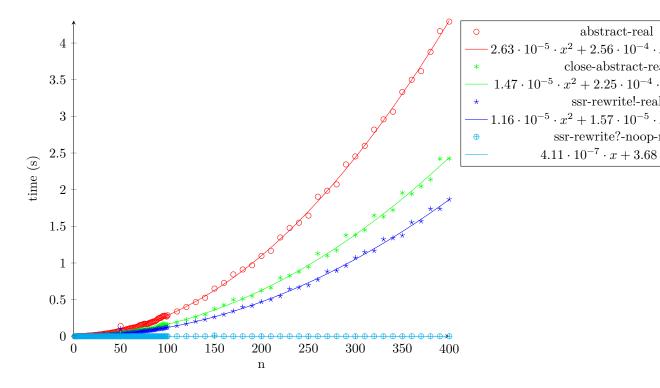
 $Figure\ 5:\ timing-rewrite-strat-under-binders$



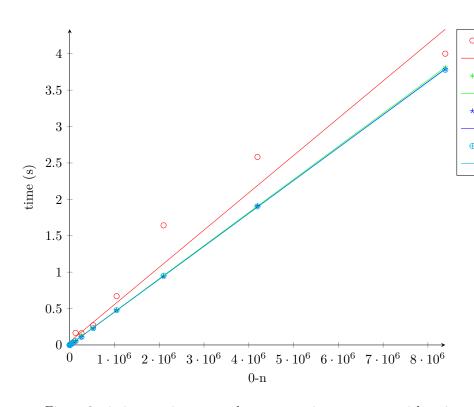
 $Figure \ 6: \ timing-rewrite-repeated-app-autorewrite \\$



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



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



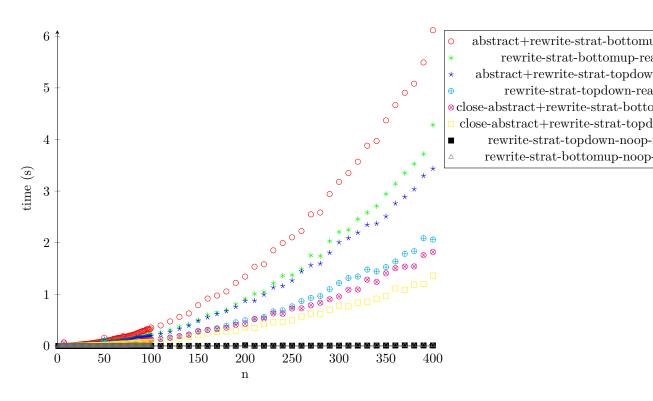
try-ssr-rewrite!-cold-noop-rea

 $5.12 \cdot 10^{-7} \cdot x + 4.35 \cdot 10^{-2}$ try-ssr-rewrite!-noop-real

 $\begin{aligned} &4.55\cdot 10^{-7}\cdot x + 1.2\cdot 10^{-3}\\ &\text{try-ssr-rewrite?-noop-real}\\ &4.52\cdot 10^{-7}\cdot x - 1.47\cdot 10^{-3} \end{aligned}$

try-ssr-rewrite-noop-real $4.51\cdot 10^{-7}\cdot x - 5.98\cdot 10^{-4}$

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



rewrite-strat-bottomup-rea abstract + rewrite - strat - topdow

rewrite-strat-topdown-rea

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

 $Figure\ 10:\ timing-rewrite-repeated-app-rewrite-strat$

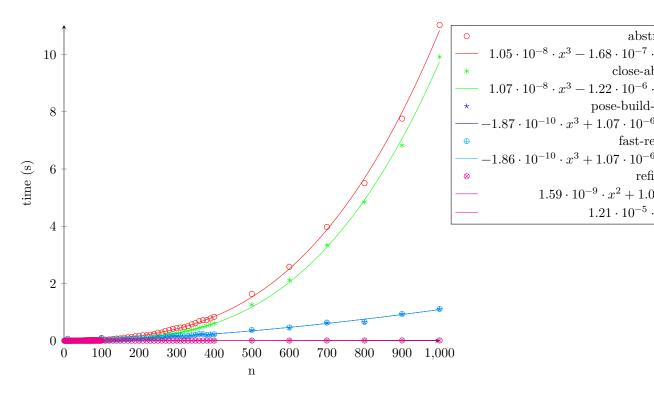
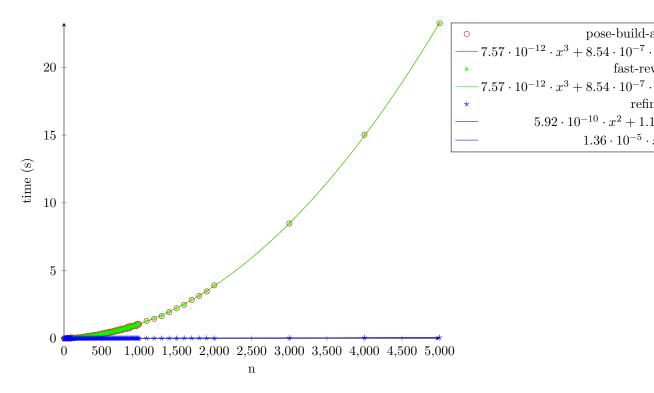


Figure 11: timing-rewrite-repeated-app-fast-rewrite



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

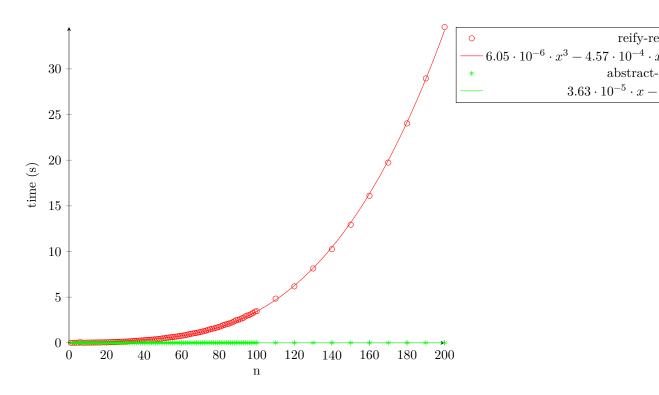


Figure 13: timing-typeclass-reification-let-in-HOAS

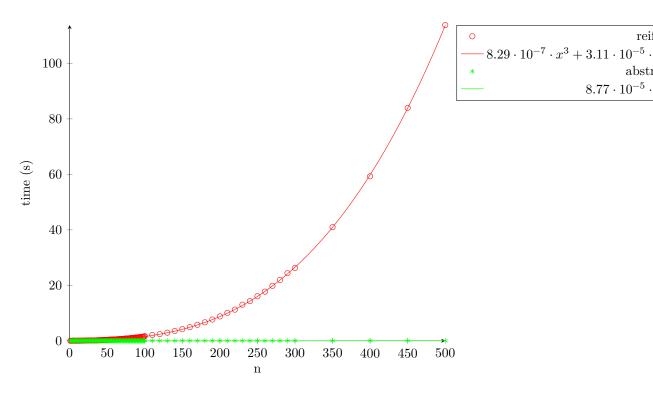


Figure 14: timing-typeclass-reification-let-in-PHOAS

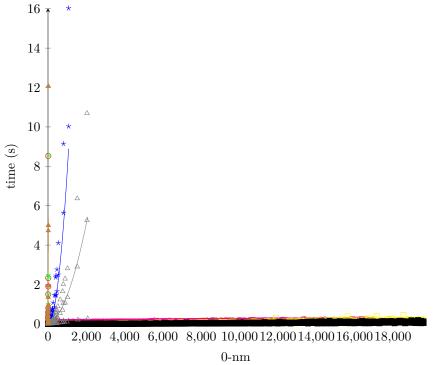


Figure 15: timing-rewrite-lift-lets-map param-1-n 1, param-2-m 1

```
rewrite-strat(bottomup-bot
                                                                                                                                 5.3 \cdot 10^{-3} \exp{(0.46 \cdot (0.46 \cdot (0.4
                                                   rewrite\text{-}strat (top down\text{-}bot
                                                                                                                       3.48 \cdot 10^{-3} exp (0.49 \cdot (
                                                                                                                                                                                                                                           cps+cbn-real
          7.78 \cdot 10^{-6} \cdot x^2 - 1.15 \cdot 10^{-4} \cdot .
                                                                                                                                                                           cps+vm-compute-
  1.24\cdot 10^{-10}\cdot x^2 + 5.45\cdot 10^{-6}\cdot \\
                                                                                                                                                   cps+native-compute
       4.27 \cdot 10^{-11} \cdot x^2 + 5.91 \cdot 10^{-6}
                                                                                                                                                                                                                                         cps+lazy-real
  2.12 \cdot 10^{-10} \cdot x^2 + 4.89 \cdot 10^{-6} \cdot
                                                                                                                                                                                                                                              cps+cbv-real
1.07 \cdot 10^{-10} \cdot x^2 + 3.62 \cdot 10^{-6} \cdot 
                                                                                                                                                                                                                                 cps+simpl-real
       1.09 \cdot 10^{-6} \cdot x^2 + 3.81 \cdot 10^{-4} \cdot x^2
                                                                                                                                                                                                       setoid-rewrite-re
          -7.01 \cdot 10^{-3} \cdot x^3 + 0.22 \cdot x^2 -
```

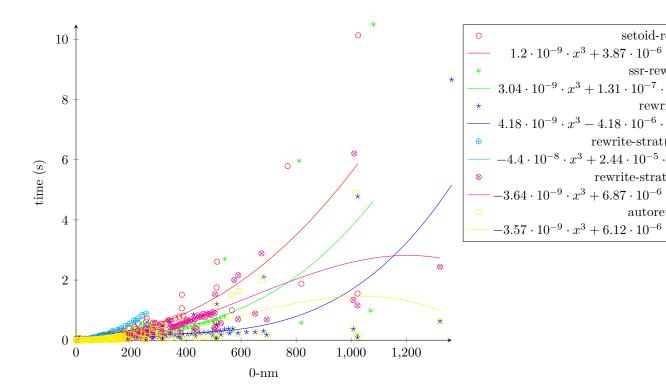
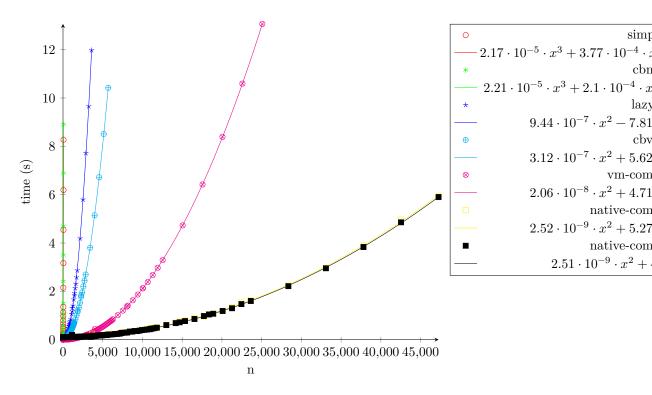


Figure 16: timing-rewrite-plus-0-tree param-1-n 0, param-2-m 1, param-3-input-size 5, param-4-output-size 3, param-5-num-rewrites 1



simp

lazy

vm-com

native-com

native-com $2.51 \cdot 10^{-9} \cdot x^2 + 4$

 $2.21 \cdot 10^{-5} \cdot x^3 + 2.1 \cdot 10^{-4} \cdot x$

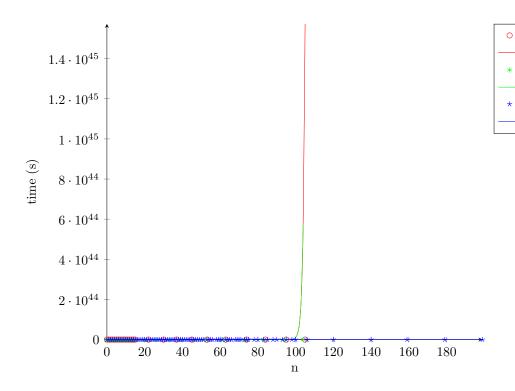
 $9.44 \cdot 10^{-7} \cdot x^2 - 7.81$

 $3.12 \cdot 10^{-7} \cdot x^2 + 5.62$

 $2.06 \cdot 10^{-8} \cdot x^2 + 4.71$

 $2.52 \cdot 10^{-9} \cdot x^2 + 5.27$

Figure 17: timing-sieve-of-eratosthenes



rewrite-

rewrite-s

 $-1.56 \cdot 10^{-6} \cdot x^3 + 2.85 \cdot 1$

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