

Figure 1: timing-pattern

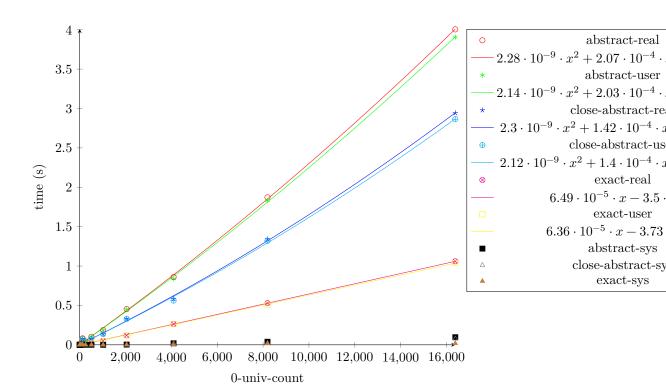


Figure 2: timing-n-polymorphic-universes param-1-n  $\,0\,$ 

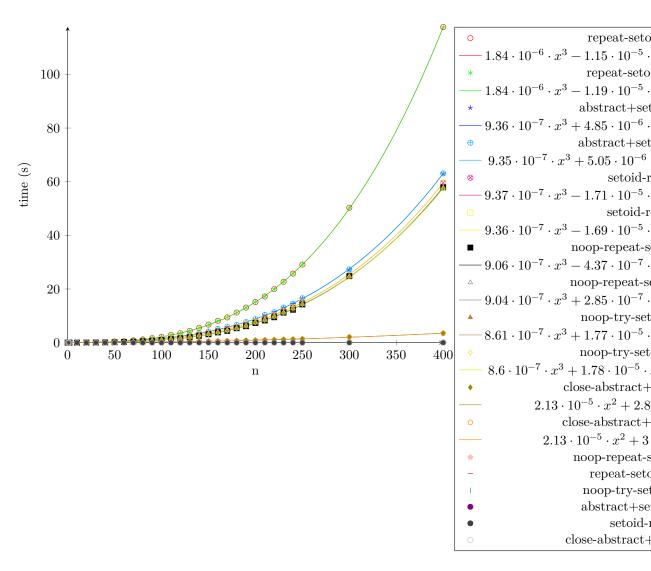


Figure 3: timing-repeat-setoid-rewrite-under-binders

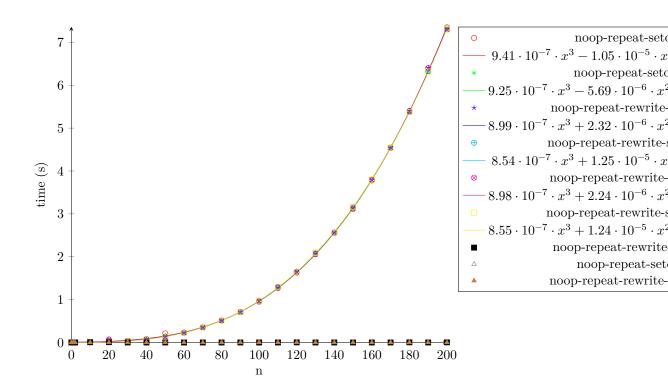


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

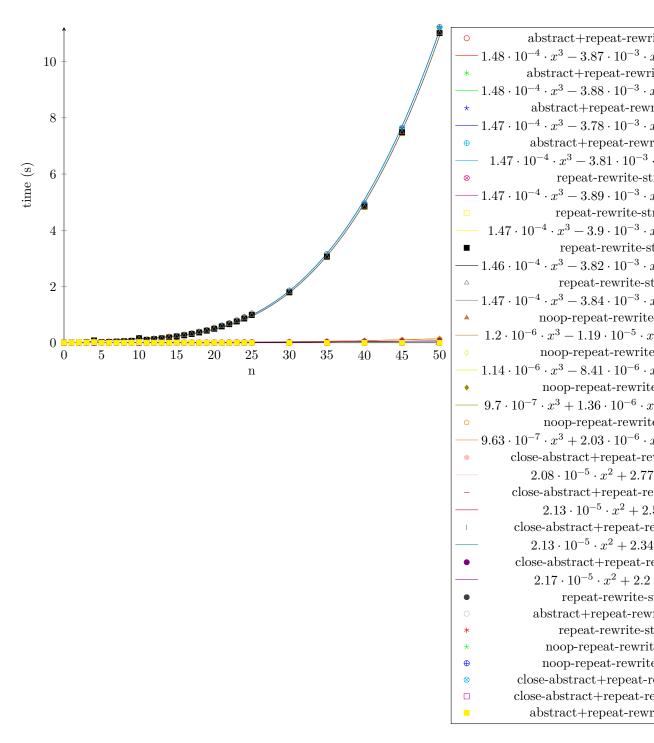
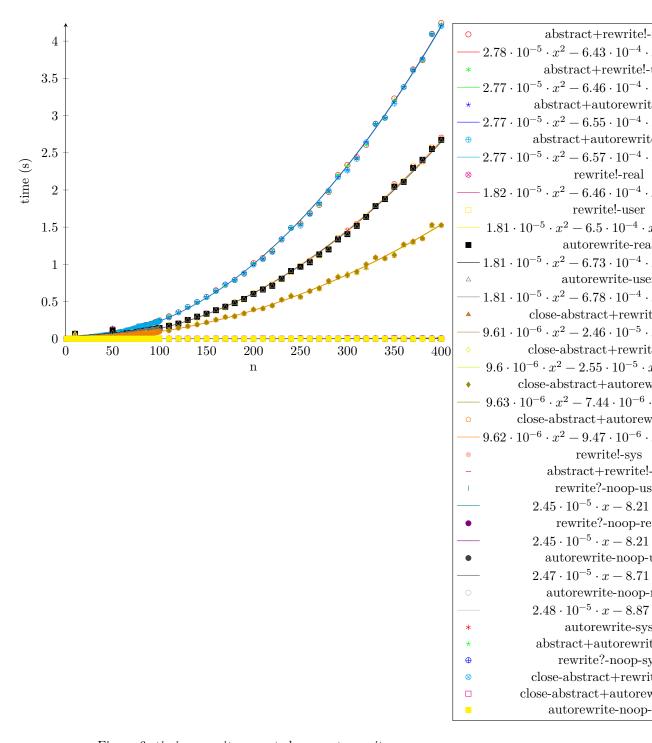


Figure 5: timing-rewrite-strat-under-binders



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

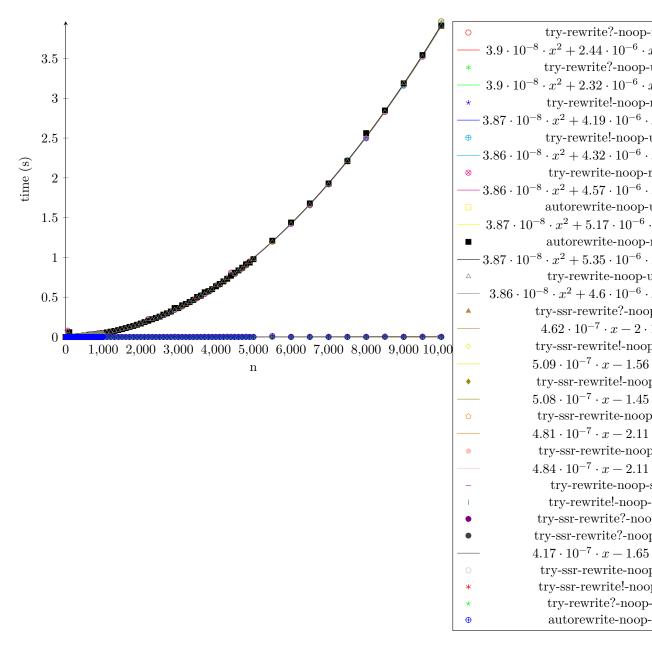
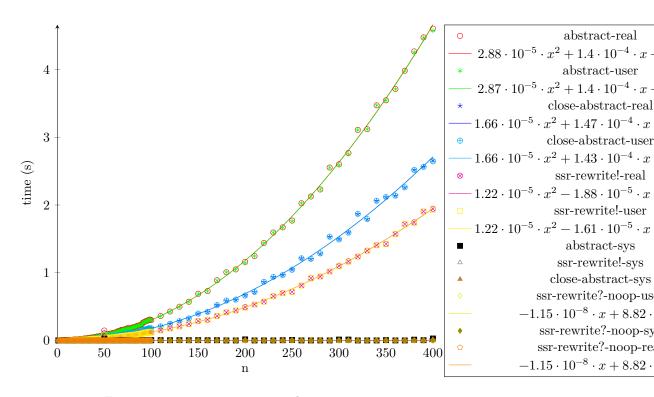


Figure 7: timing-rewrite-repeated-app-autorewrite-noop



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

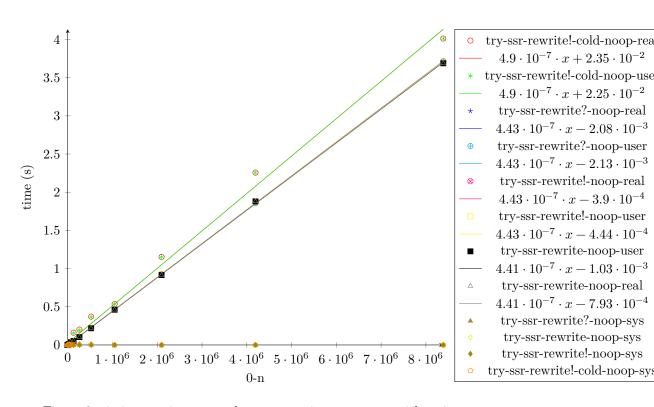


Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn  $\ 1$ 

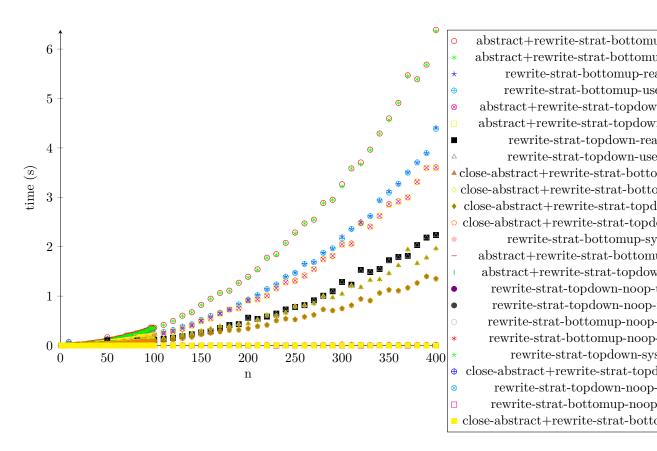


Figure 10: timing-rewrite-repeated-app-rewrite-strat

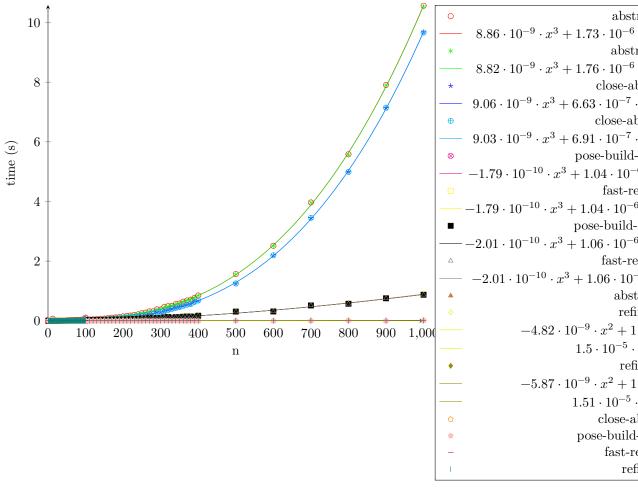
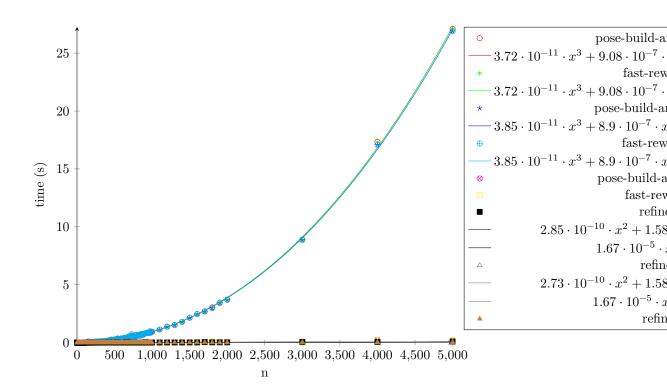


Figure 11: timing-rewrite-repeated-app-fast-rewrite



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

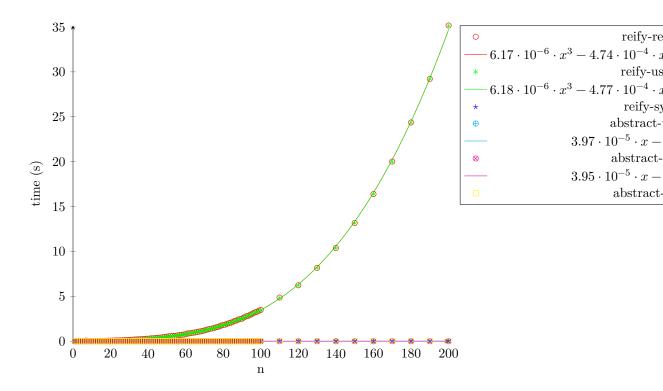


Figure 13: timing-typeclass-reification-let-in-HOAS

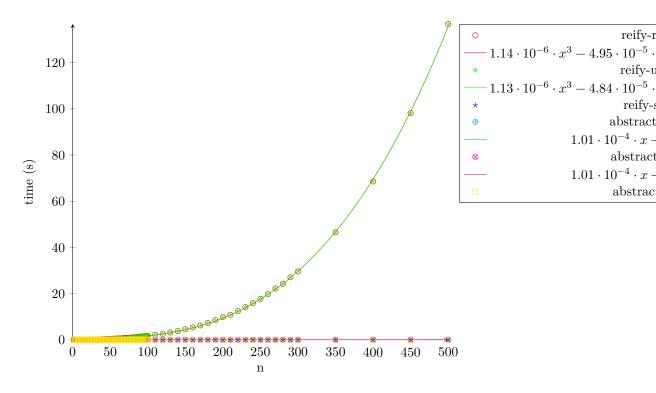
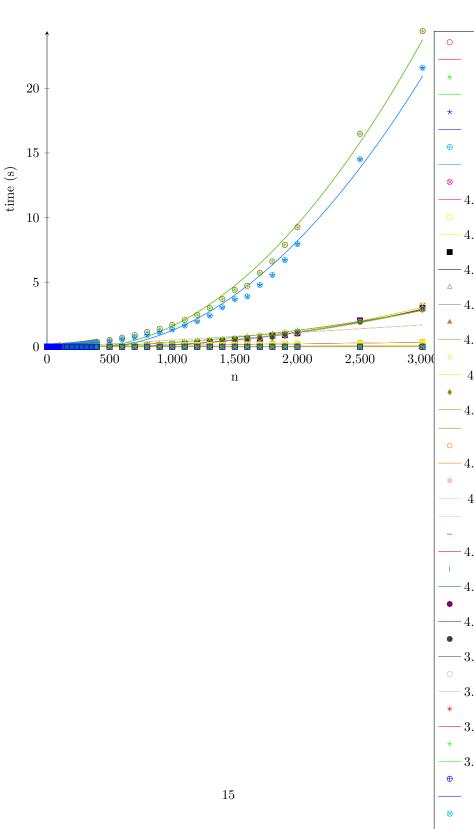


Figure 14: timing-typeclass-reification-let-in-PHOAS



 $3.21 \cdot 10^{-6} \cdot x^2 - 1.78 \cdot 10^{-6}$  $3.21 \cdot 10^{-6} \cdot x^2 - 1.78 \cdot 10^{-6}$  $2.91 \cdot 10^{-6} \cdot x^2 - 1.81 \cdot 10^{-6}$  $2.91 \cdot 10^{-6} \cdot x^2 - 1.81 \cdot 10^{-6}$  $4.41 \cdot 10^{-7} \cdot x^2 - 3.14 \cdot 10^{-4} \cdot x^2$  $4.41 \cdot 10^{-7} \cdot x^2 - 3.13 \cdot 10^{-4} \cdot x^2$  $4.18 \cdot 10^{-7} \cdot x^2 - 2.95 \cdot 10^{-4} \cdot x^2$  $4.18 \cdot 10^{-7} \cdot x^2 - 2.95 \cdot 10^{-4} \cdot x^2$  $4.07 \cdot 10^{-7} \cdot x^2 - 2.87 \cdot 10^{-4} \cdot x^2 = 2.87 \cdot 10^{-4} \cdot x^2 + 2.87 \cdot 10^{-4} \cdot x^2$  $4.07 \cdot 10^{-7} \cdot x^2 - 2.87 \cdot 10^{-4}$  $4.07 \cdot 10^{-7} \cdot x^2 - 2.58 \cdot 10^{-4} \cdot x^2$  $4.24 \cdot 10^{-7} \cdot x^2 - 3.07 \cdot 10^{-4} \cdot x^2 = 3.07 \cdot 10^{-4} \cdot x^2 + 3.07 \cdot 10^{-4} \cdot x^2$  $4.07 \cdot 10^{-7} \cdot x^2 - 2.6 \cdot 10^{-4} \cdot x$  $4.24 \cdot 10^{-7} \cdot x^2 - 3.07 \cdot 10^{-4} \cdot x^2$  $4.11 \cdot 10^{-7} \cdot x^2 - 2.78 \cdot 10^{-4} \cdot x^2$  $4.11 \cdot 10^{-7} \cdot x^2 - 2.78 \cdot 10^{-4} \cdot x^2$  $3.99 \cdot 10^{-7} \cdot x^2 - 2.54 \cdot 10^{-4} \cdot x^2$  $3.98 \cdot 10^{-7} \cdot x^2 - 2.53 \cdot 10^{-4} \cdot x^2$  $3.02 \cdot 10^{-7} \cdot x^2 + 3.46 \cdot 10^{-5} \cdot x^2$  $3.02 \cdot 10^{-7} \cdot x^2 + 3.35 \cdot 10^{-5} \cdot x^2$ 

abstract-real

abstract-user

fast-rewrite-real

fast-rewrite-user

type-pf-cast-real

type-pf-cast-user

type-admit-cast-us

type-admit-cast-re

check-pf-cast-rea

check-pf-cast-use

 $5.87 \cdot 10^{-4} \cdot x - 7.01 \cdot$ type-admit-real

 $5.86 \cdot 10^{-4} \cdot x - 7.01 \cdot$ type-admit-user

refine-real

refine-user

check-admit-user

check-admit-real

check-admit-cast-r

check-admit-cast-u

close-abstract-rea

close-abstract-use

build-eval-thunk-u

 $1.15 \cdot 10^{-4} \cdot x - 6.85$ build-eval-thunk-re  $1.16 \cdot 10^{-4} \cdot x - 6.26 \cdot$ build-thunk-user  $1.15 \cdot 10^{-4} \cdot x - 7.92 \cdot$ build-thunk-real  $1.15 \cdot 10^{-4} \cdot x - 7.32 \cdot$ ob ools I sages