

Figure 1: timing-pattern

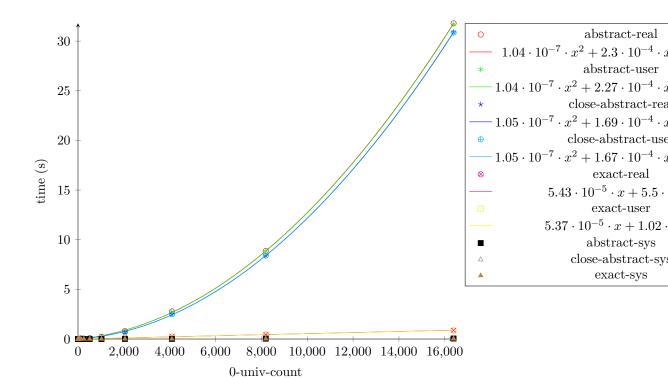


Figure 2: timing-n-polymorphic-universes param-1-n 0

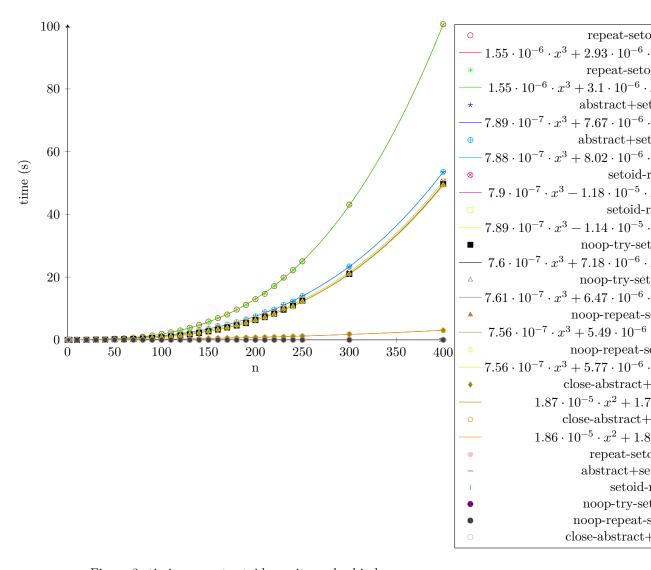


Figure 3: timing-repeat-setoid-rewrite-under-binders

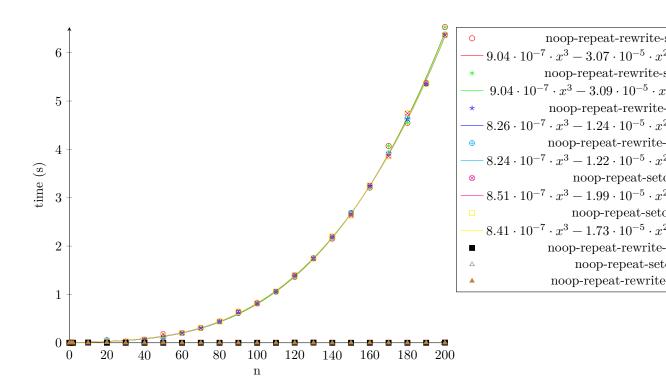


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

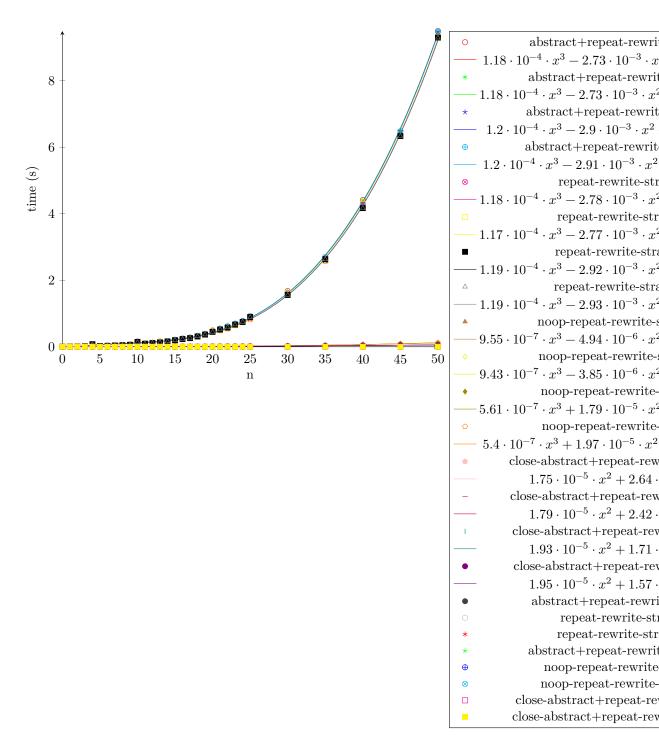
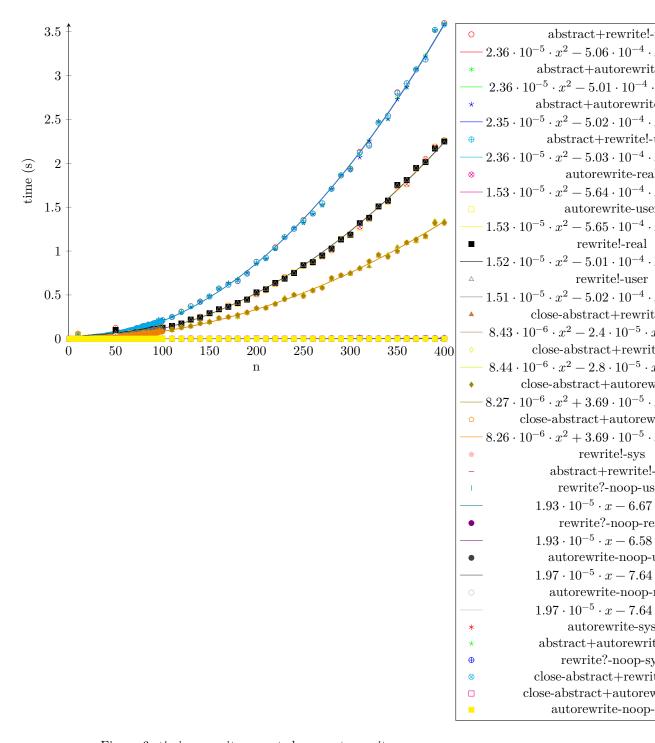


Figure 5: timing-rewrite-strat-under-binders



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

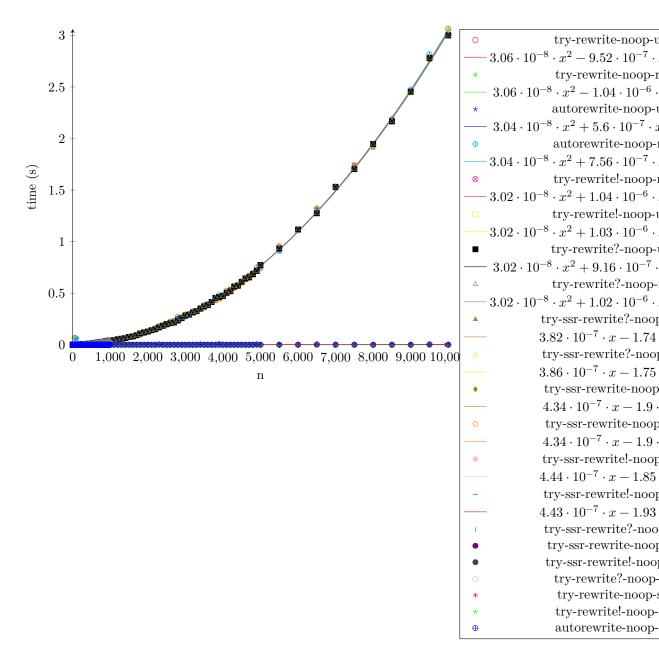
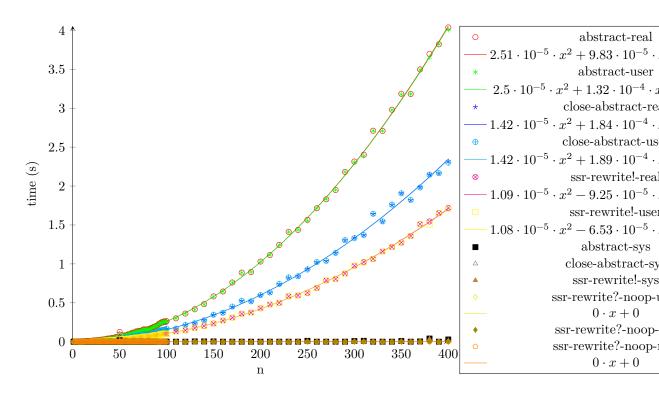


Figure 7: timing-rewrite-repeated-app-autorewrite-noop



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

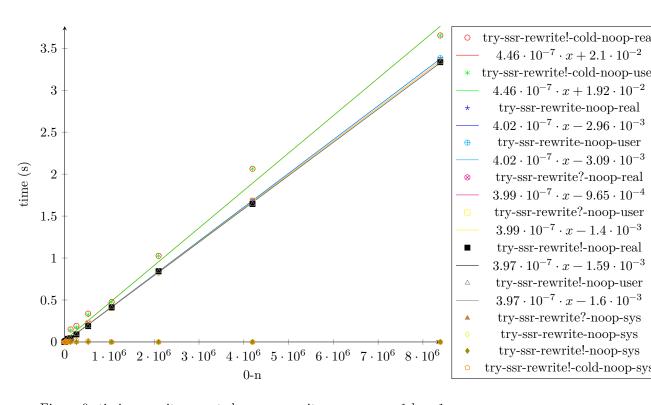


Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn  $\ 1$ 

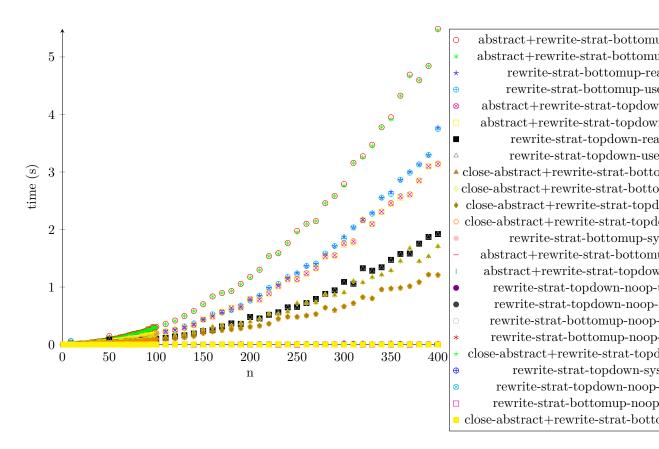


Figure 10: timing-rewrite-repeated-app-rewrite-strat

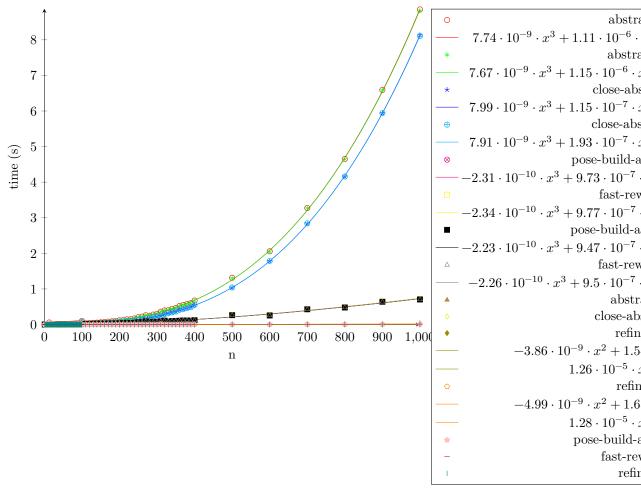
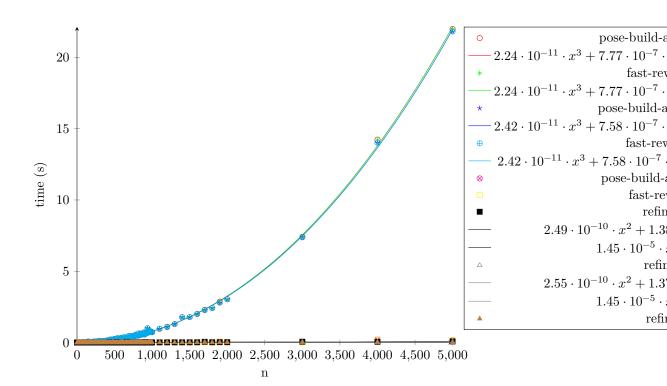
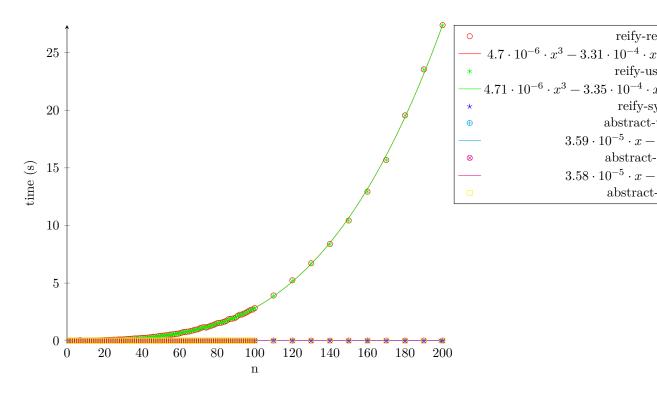


Figure 11: timing-rewrite-repeated-app-fast-rewrite



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



 ${\bf Figure~13:~timing-type class-reification-let-in-HOAS}$ 

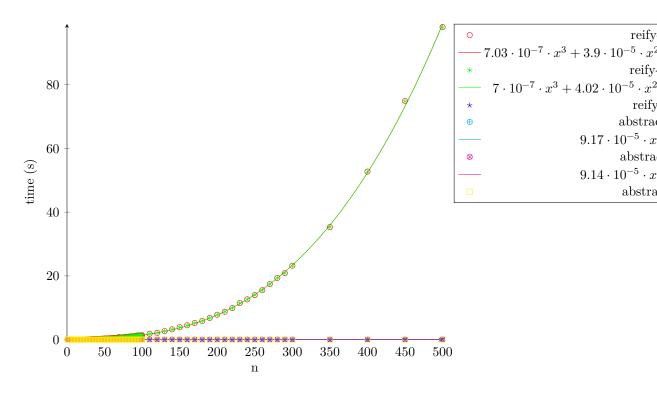
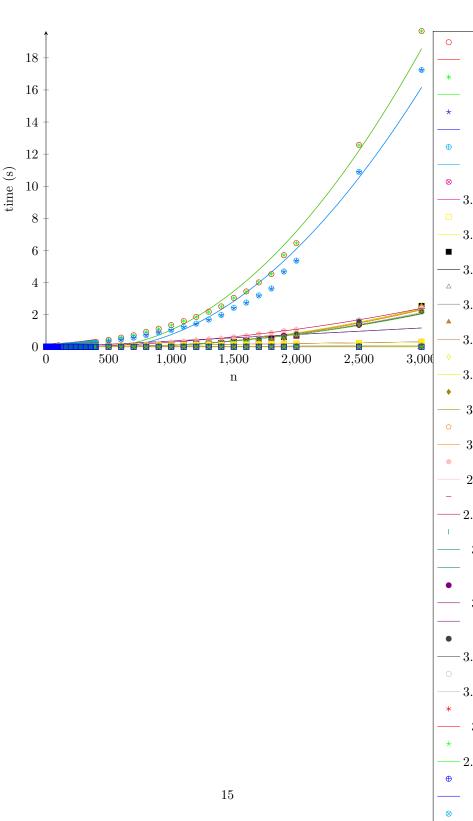


Figure 14: timing-typeclass-reification-let-in-PHOAS



 $2.63 \cdot 10^{-6} \cdot x^2 - 1.74 \cdot 10^{-6}$  $2.62 \cdot 10^{-6} \cdot x^2 - 1.74 \cdot 10^{-6}$  $2.37 \cdot 10^{-6} \cdot x^2 - 1.78 \cdot 10^{-6}$  $2.37 \cdot 10^{-6} \cdot x^2 - 1.78 \cdot 10^{-6}$  $3.67 \cdot 10^{-7} \cdot x^2 - 3.13 \cdot 10^{-4} \cdot x^2$  $3.67 \cdot 10^{-7} \cdot x^2 - 3.13 \cdot 10^{-4} \cdot x^2$  $3.62 \cdot 10^{-7} \cdot x^2 - 3.14 \cdot 10^{-4} \cdot x^2$  $3.61 \cdot 10^{-7} \cdot x^2 - 3.12 \cdot 10^{-4} \cdot x^2$  $3.57 \cdot 10^{-7} \cdot x^2 - 2.98 \cdot 10^{-4} \cdot x^2$  $3.57 \cdot 10^{-7} \cdot x^2 - 2.99 \cdot 10^{-4} \cdot x^2$  $3.59 \cdot 10^{-7} \cdot x^2 - 3.19 \cdot 10^{-4}$  $3.59 \cdot 10^{-7} \cdot x^2 - 3.19 \cdot 10^{-4}$  $2.56 \cdot 10^{-7} \cdot x^2 + 3.4 \cdot 10^{-5} \cdot x$  $2.56 \cdot 10^{-7} \cdot x^2 + 3.34 \cdot 10^{-5} \cdot x^2$  $3 \cdot 10^{-7} \cdot x^2 - 2.16 \cdot 10^{-4} \cdot x$  $3 \cdot 10^{-7} \cdot x^2 - 2.16 \cdot 10^{-4} \cdot x$  $3.16 \cdot 10^{-7} \cdot x^2 - 2.41 \cdot 10^{-4} \cdot x^2$  $3.16 \cdot 10^{-7} \cdot x^2 - 2.42 \cdot 10^{-4} \cdot x^2$  $3 \cdot 10^{-7} \cdot x^2 - 2.24 \cdot 10^{-4} \cdot x$  $2.99 \cdot 10^{-7} \cdot x^2 - 2.23 \cdot 10^{-4} \cdot x^2$ 

abstract-real

abstract-user

fast-rewrite-real

fast-rewrite-user

type-admit-cast-re

type-admit-cast-us

check-admit-real

check-admit-user

type-pf-cast-user

type-pf-cast-real

type-admit-real

type-admit-user

close-abstract-rea

close-abstract-use

refine-real

 $4.07 \cdot 10^{-4} \cdot x - 4.88 \cdot$ refine-user

 $4.07 \cdot 10^{-4} \cdot x - 4.88 \cdot$ check-pf-cast-rea

check-pf-cast-use

check-admit-cast-r

check-admit-cast-u

build-eval-thunk-re

 $1.01 \cdot 10^{-4} \cdot x - 8.56 \cdot$ build-eval-thunk-u  $1.01 \cdot 10^{-4} \cdot x - 9.38 \cdot$ build-thunk-user  $1 \cdot 10^{-4} \cdot x - 1.02 \cdot 1$ build-thunk-real  $1 \cdot 10^{-4} \cdot x - 9.28 \cdot 1$