

Figure 1: timing-pattern

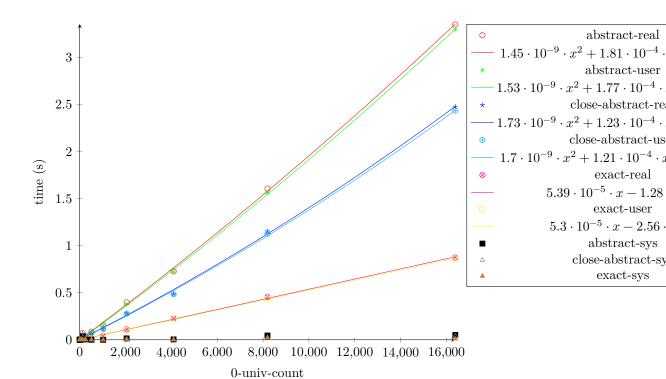


Figure 2: timing-n-polymorphic-universes param-1-n 0

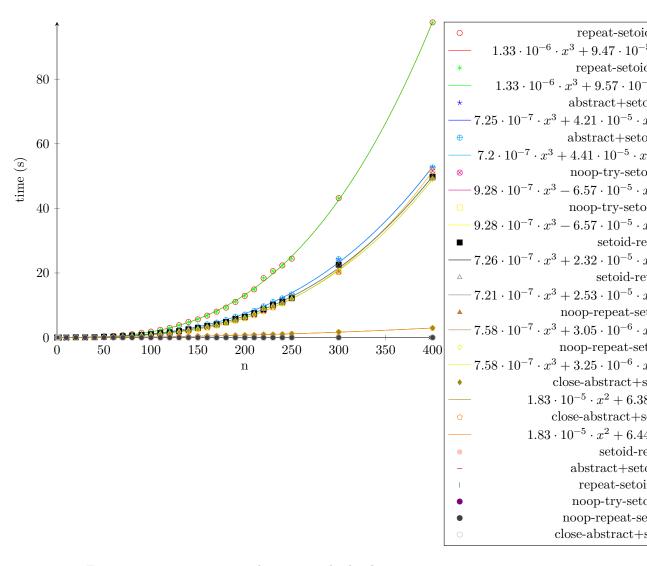
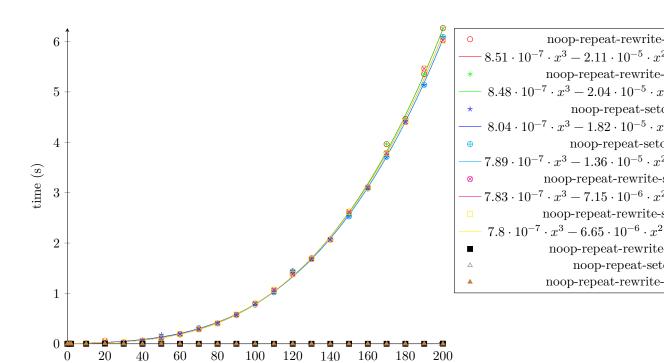


Figure 3: timing-repeat-setoid-rewrite-under-binders



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

n

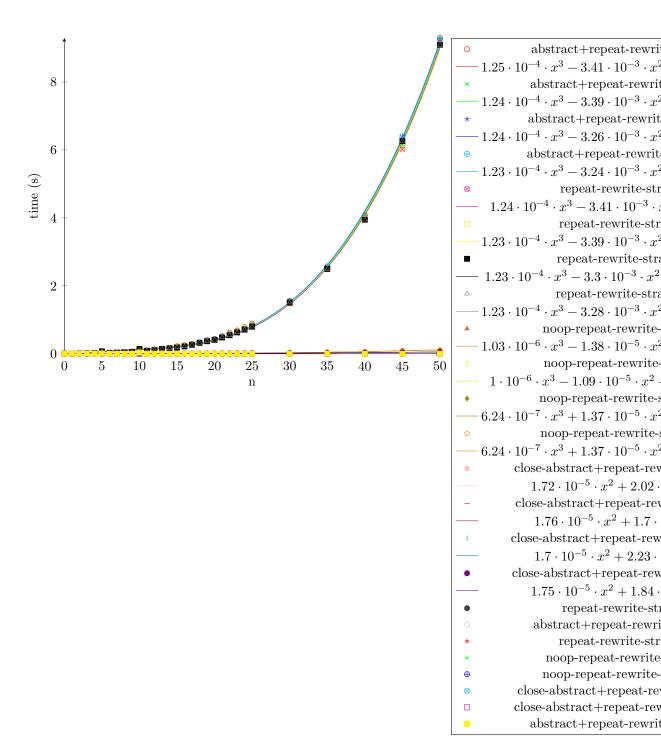
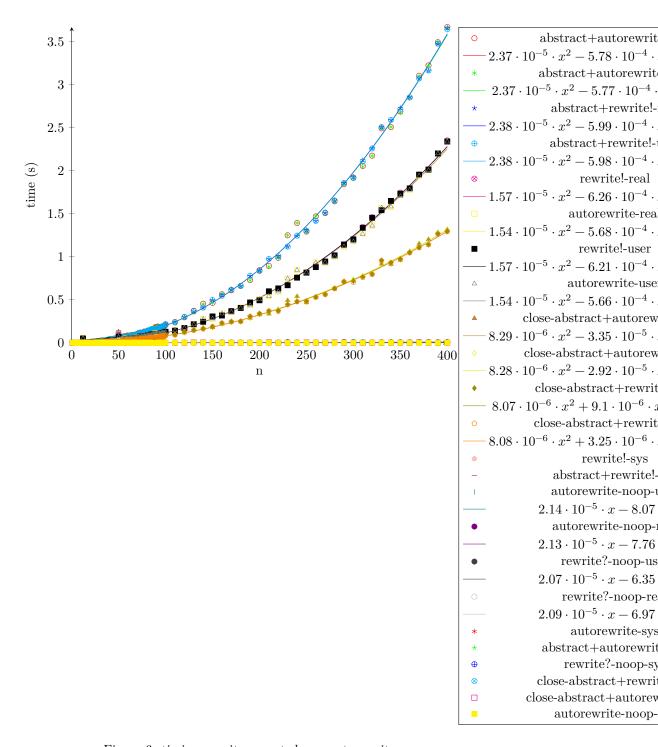


Figure 5: timing-rewrite-strat-under-binders



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

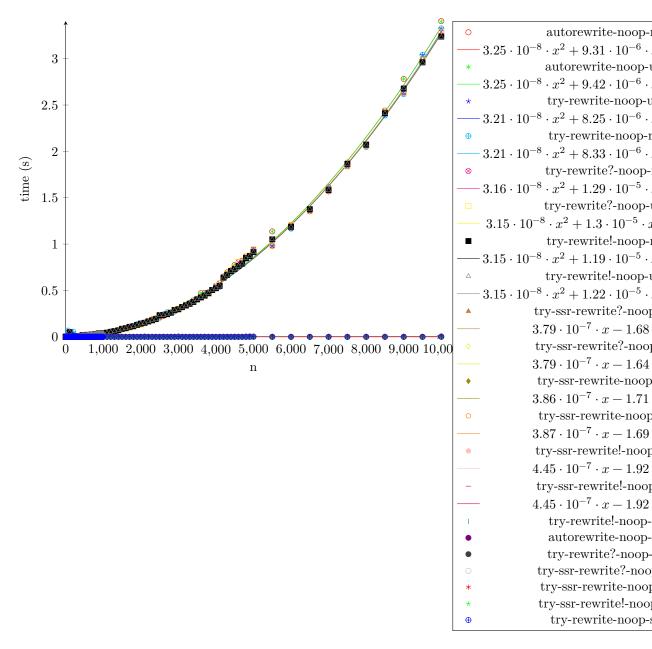


Figure 7: timing-rewrite-repeated-app-autorewrite-noop

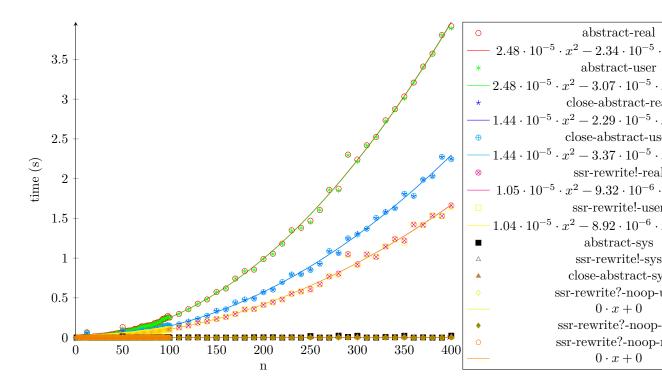


Figure 8: timing-rewrite-repeated-app-ssrrewrite

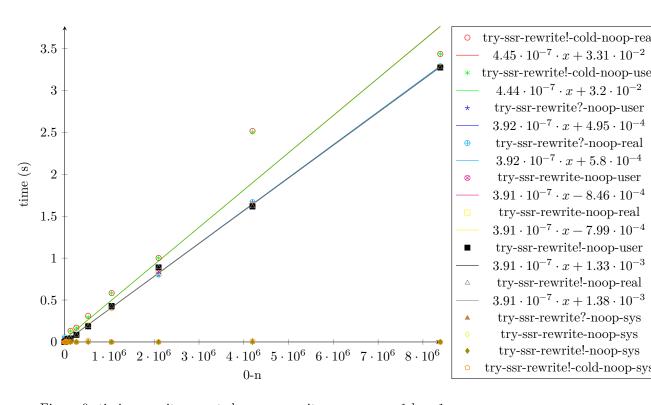


Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn  $\ 1$ 

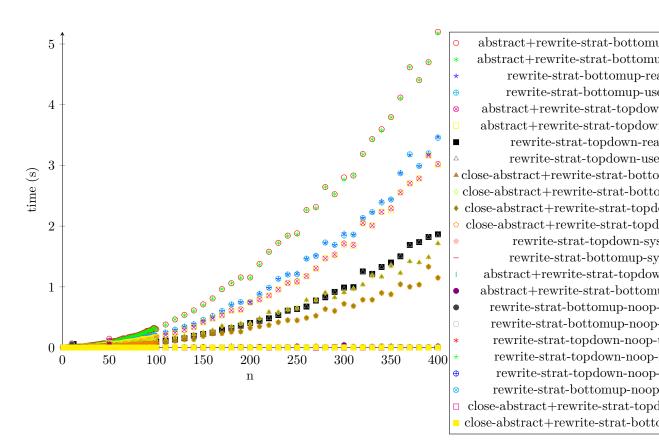


Figure 10: timing-rewrite-repeated-app-rewrite-strat

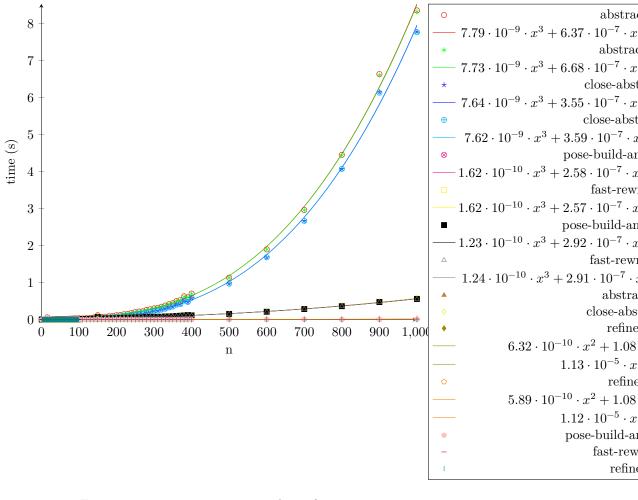
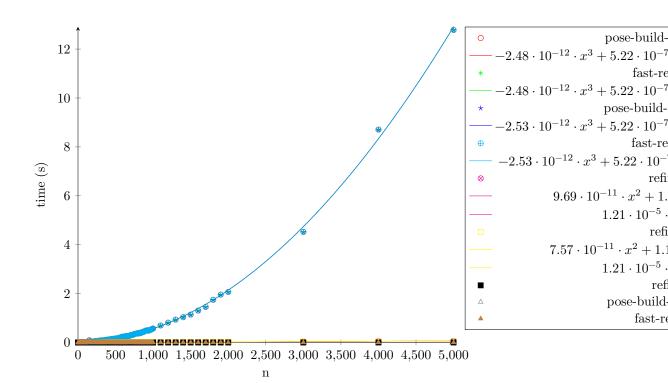
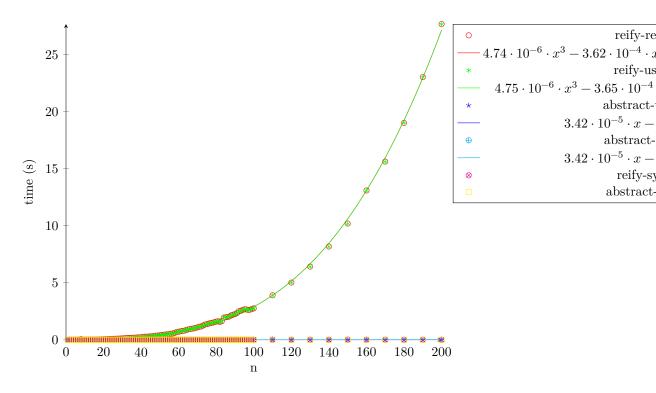


Figure 11: timing-rewrite-repeated-app-fast-rewrite



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



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

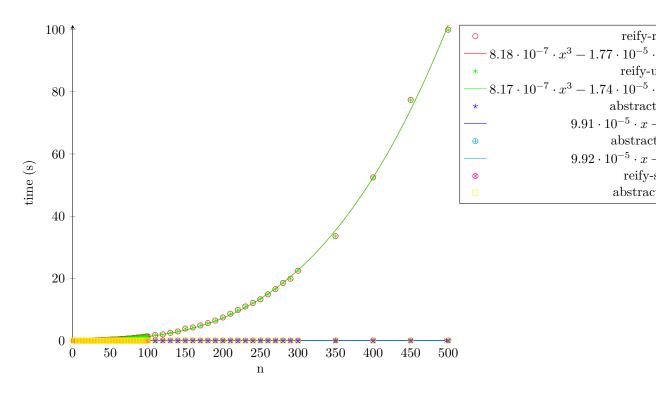
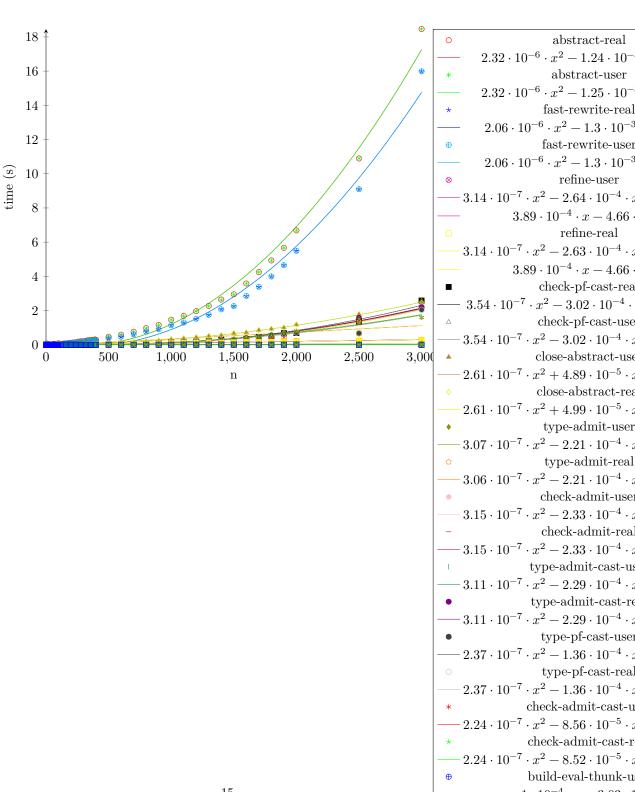


Figure 14: timing-typeclass-reification-let-in-PHOAS



abstract-real

abstract-user

fast-rewrite-real

fast-rewrite-user

refine-user

 $2.32 \cdot 10^{-6} \cdot x^2 - 1.24 \cdot 10^{-6}$ 

 $2.32 \cdot 10^{-6} \cdot x^2 - 1.25 \cdot 10^{-6}$ 

 $2.06 \cdot 10^{-6} \cdot x^2 - 1.3 \cdot 10^{-3}$ 

 $2.06 \cdot 10^{-6} \cdot x^2 - 1.3 \cdot 10^{-3}$ 

 $3.89 \cdot 10^{-4} \cdot x - 4.66 \cdot$ refine-real

 $3.89 \cdot 10^{-4} \cdot x - 4.66 \cdot$ 

check-pf-cast-rea

check-pf-cast-use

close-abstract-use

close-abstract-rea

type-admit-user

type-admit-real

check-admit-user

check-admit-real

type-admit-cast-us

type-admit-cast-re

type-pf-cast-user

type-pf-cast-real

check-admit-cast-u

check-admit-cast-r

build-eval-thunk-u

 $1 \cdot 10^{-4} \cdot x - 3.03 \cdot 1$ build-eval-thunk-re  $1.01 \cdot 10^{-4} \cdot x - 1.89$ build-thunk-user  $9.96 \cdot 10^{-5} \cdot x - 3.67 \cdot$ build-thunk-real  $9.99 \cdot 10^{-5} \cdot x - 2.68 \cdot$