

Figure 1: timing-pattern

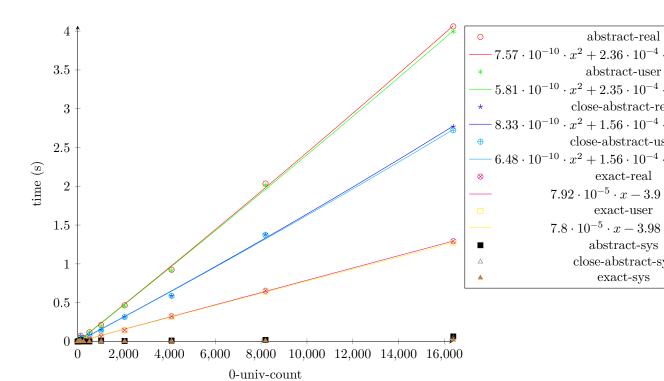


Figure 2: timing-n-polymorphic-universes param-1-n  $\,0\,$ 

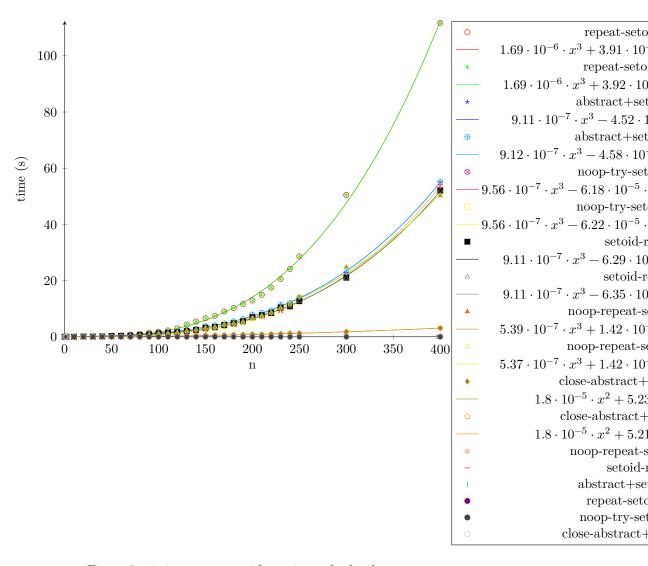


Figure 3: timing-repeat-setoid-rewrite-under-binders

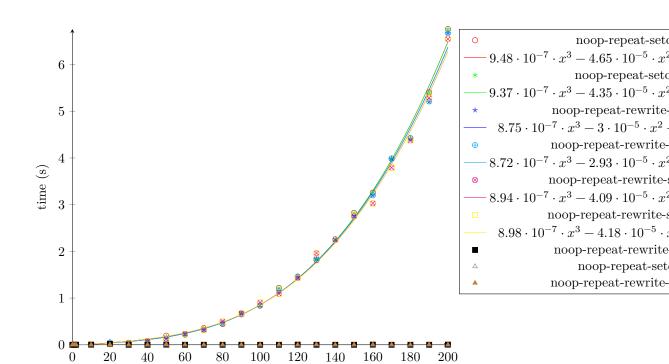


Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

n

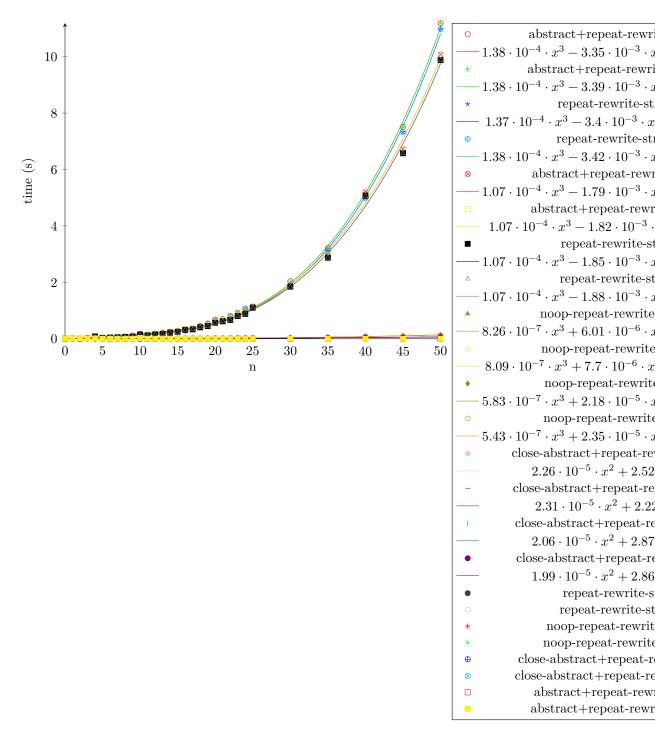


Figure 5: timing-rewrite-strat-under-binders

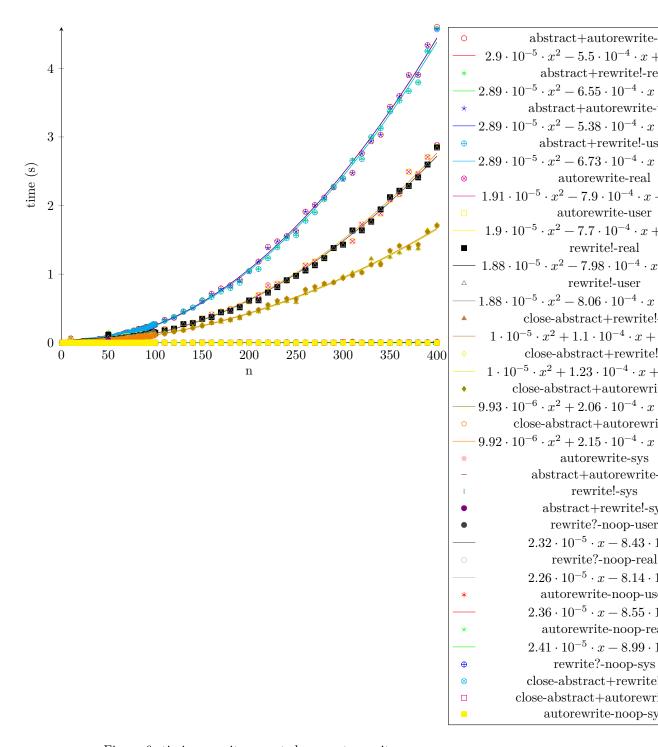


Figure 6: timing-rewrite-repeated-app-autorewrite

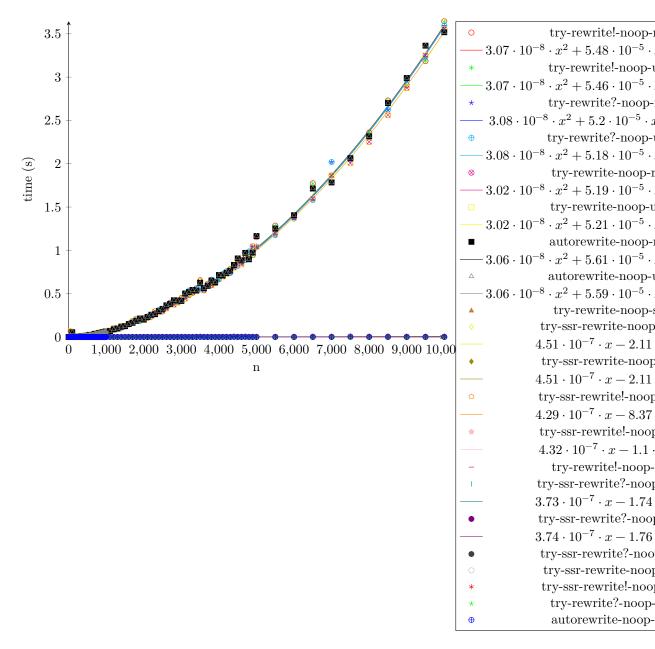
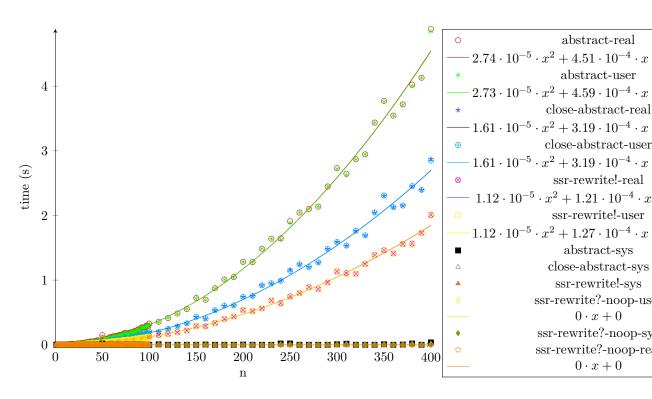


Figure 7: timing-rewrite-repeated-app-autorewrite-noop



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

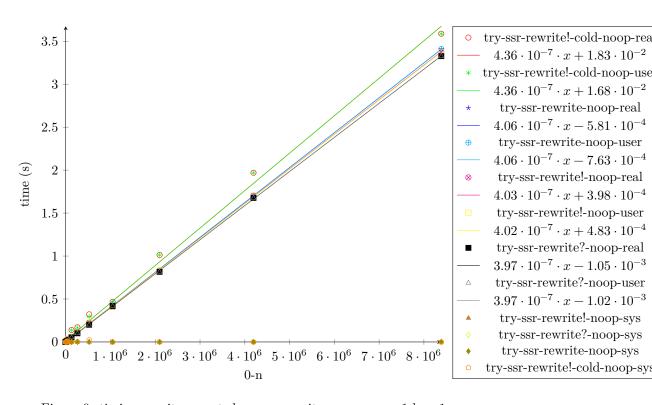


Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn  $\ 1$ 

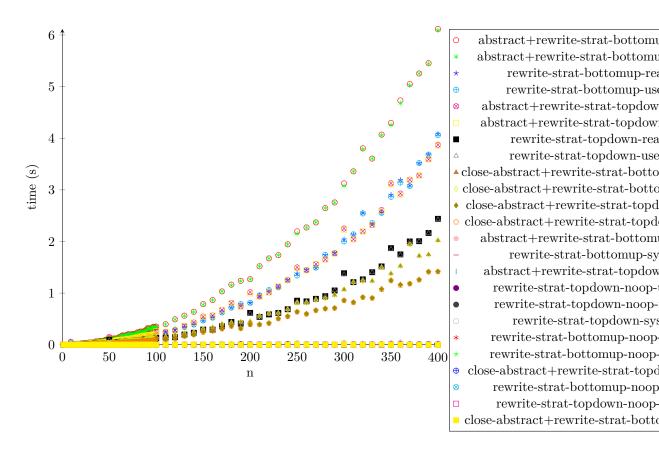


Figure 10: timing-rewrite-repeated-app-rewrite-strat

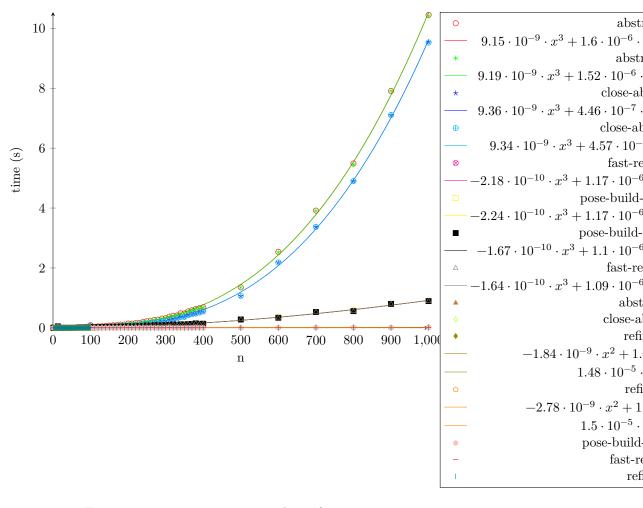
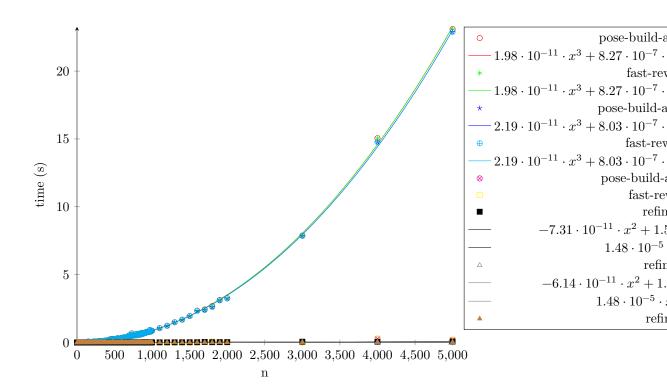
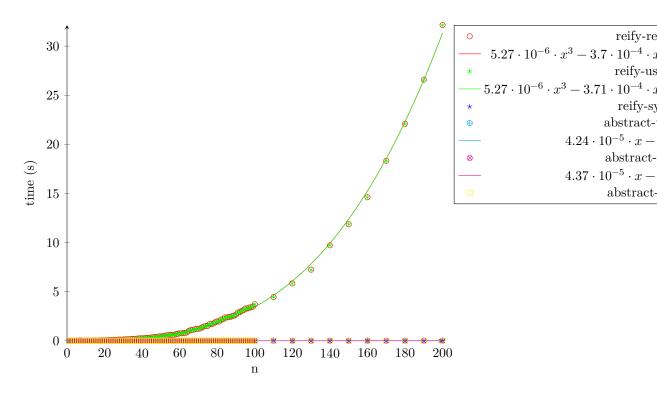


Figure 11: timing-rewrite-repeated-app-fast-rewrite



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



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

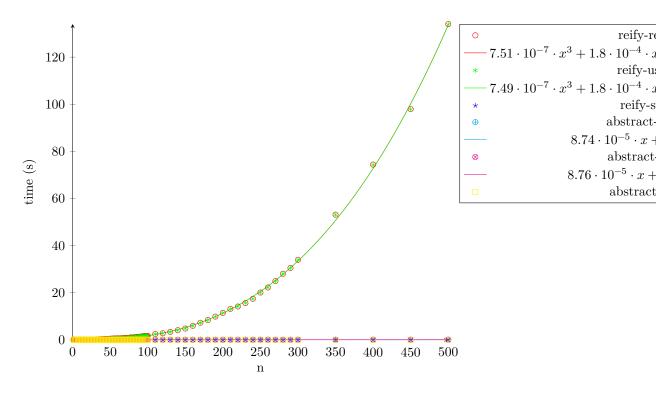
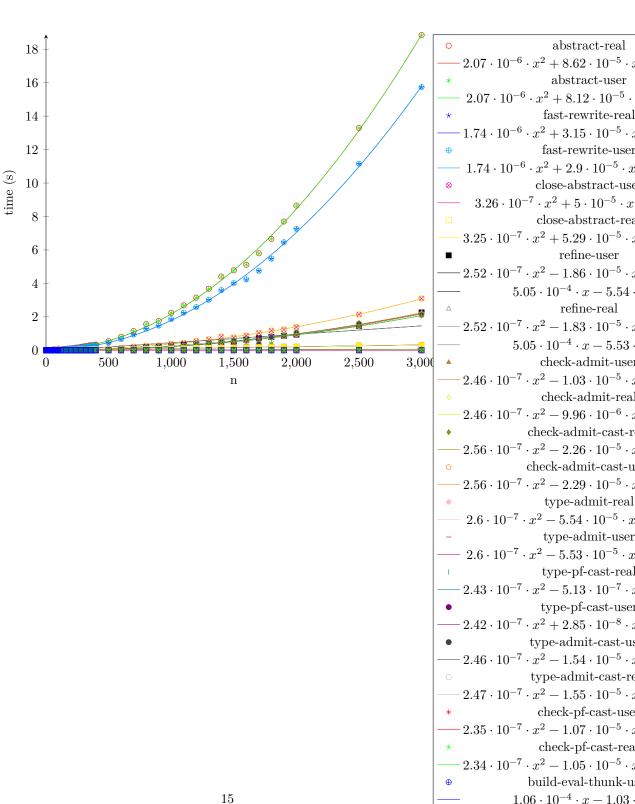


Figure 14: timing-typeclass-reification-let-in-PHOAS



 $2.52 \cdot 10^{-7} \cdot x^2 - 1.83 \cdot 10^{-5} \cdot x^2$  $2.46 \cdot 10^{-7} \cdot x^2 - 1.03 \cdot 10^{-5} \cdot x^2$  $2.46 \cdot 10^{-7} \cdot x^2 - 9.96 \cdot 10^{-6} \cdot x^2$  $2.56 \cdot 10^{-7} \cdot x^2 - 2.26 \cdot 10^{-5} \cdot x^2 = 2.26 \cdot 10^{-5} \cdot x^2 + 2.26 \cdot 10^{-5} \cdot x^2$  $2.56 \cdot 10^{-7} \cdot x^2 - 2.29 \cdot 10^{-5} \cdot x^2 = 2.29 \cdot 10^{-5} \cdot x^2 + 2.29 \cdot 10^{-5} \cdot x^2$  $2.6 \cdot 10^{-7} \cdot x^2 - 5.54 \cdot 10^{-5} \cdot x$  $2.6 \cdot 10^{-7} \cdot x^2 - 5.53 \cdot 10^{-5} \cdot x$  $2.43 \cdot 10^{-7} \cdot x^2 - 5.13 \cdot 10^{-7} \cdot x^2 = 5.13 \cdot 10^{-7} \cdot x^2 + 5.13 \cdot 10^{-7} \cdot x^2$  $2.42 \cdot 10^{-7} \cdot x^2 + 2.85 \cdot 10^{-8} \cdot x^2$  $2.46 \cdot 10^{-7} \cdot x^2 - 1.54 \cdot 10^{-5} \cdot x^2 = 1.54 \cdot 10^{-5} \cdot x^2 + 1.54 \cdot 10^{-5} \cdot x^2$  $2.47 \cdot 10^{-7} \cdot x^2 - 1.55 \cdot 10^{-5} \cdot x^2 = 1.55 \cdot 10^{-5} \cdot x^2 + 1.55 \cdot 10^{-5} \cdot x^2 = 1.55 \cdot 10^{-5} \cdot x^2$  $2.35 \cdot 10^{-7} \cdot x^2 - 1.07 \cdot 10^{-5} \cdot x^2$  $2.34 \cdot 10^{-7} \cdot x^2 - 1.05 \cdot 10^{-5} \cdot x^2$ 

abstract-real

abstract-user

fast-rewrite-real

fast-rewrite-user

close-abstract-use

close-abstract-rea

refine-user

 $5.05 \cdot 10^{-4} \cdot x - 5.54$ refine-real

 $5.05 \cdot 10^{-4} \cdot x - 5.53$ 

check-admit-user

check-admit-real

check-admit-cast-r

check-admit-cast-u

type-admit-real

type-admit-user

type-pf-cast-real

type-pf-cast-user

type-admit-cast-us

type-admit-cast-re

check-pf-cast-use

check-pf-cast-rea

build-eval-thunk-us

 $1.06 \cdot 10^{-4} \cdot x - 1.03 \cdot$ build-eval-thunk-re  $1.07 \cdot 10^{-4} \cdot x - 9.49 \cdot$ build-thunk-user  $1.06 \cdot 10^{-4} \cdot x - 1.12 \cdot$ build-thunk-real  $1.06 \cdot 10^{-4} \cdot x - 1.05 \cdot$ aboalt I ugon