

Figure 1: timing-pattern

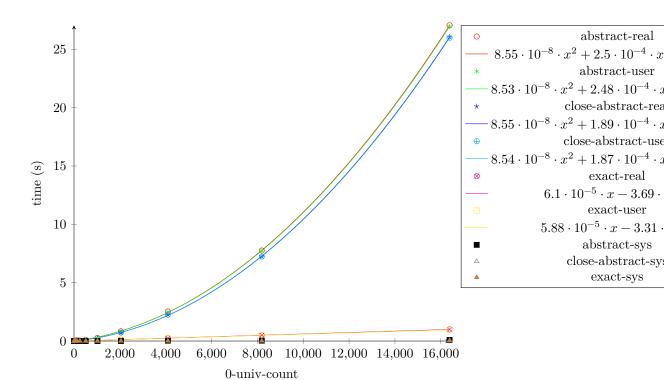


Figure 2: timing-n-polymorphic-universes param-1-n 0

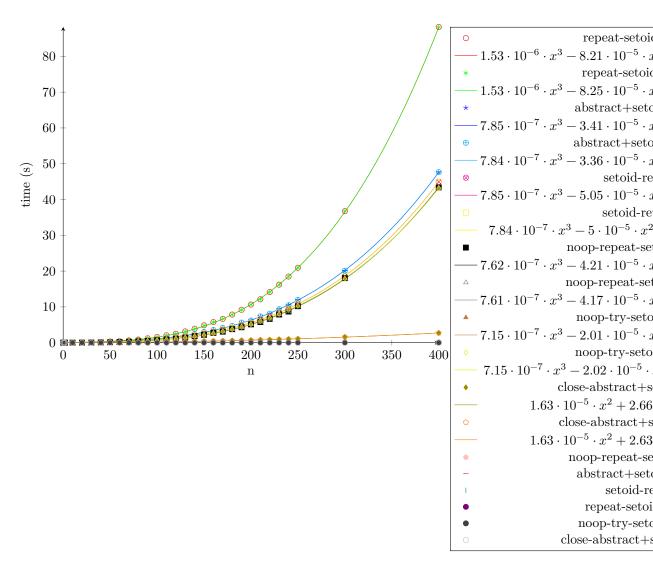
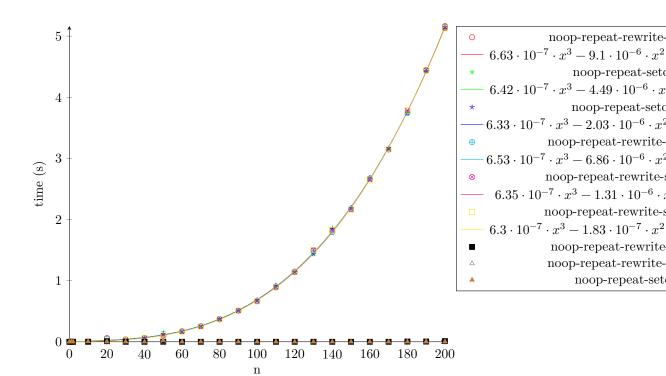


Figure 3: timing-repeat-setoid-rewrite-under-binders



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

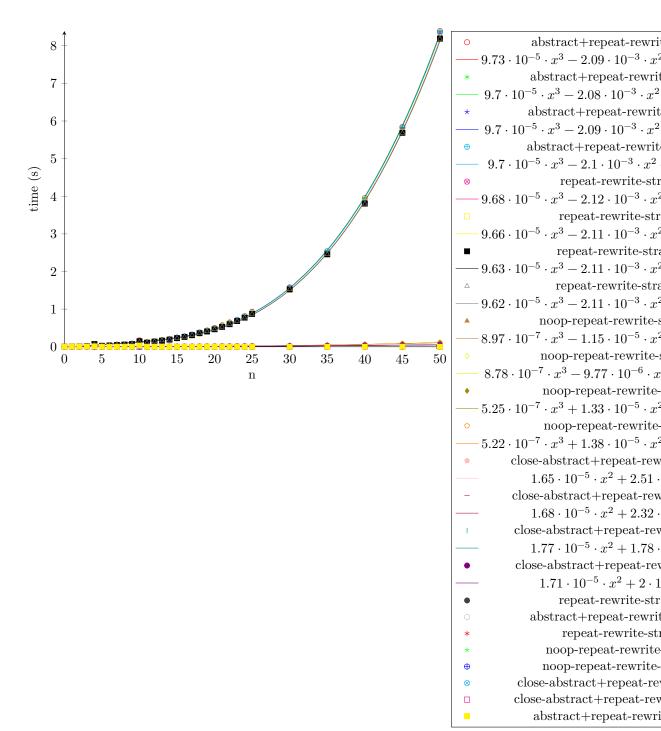
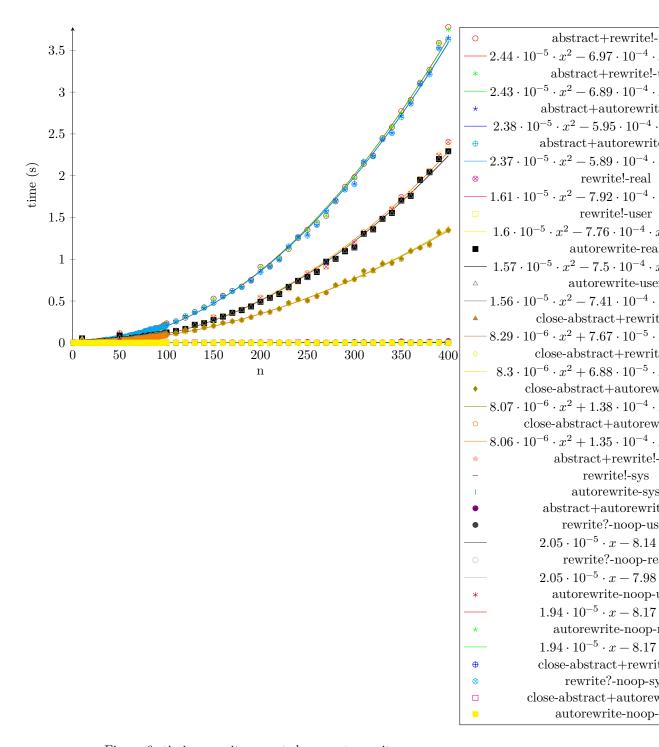


Figure 5: timing-rewrite-strat-under-binders



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

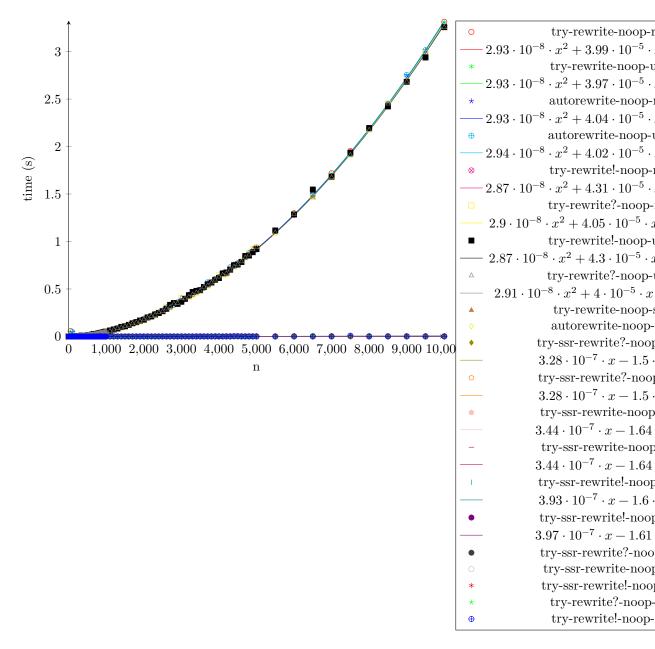


Figure 7: timing-rewrite-repeated-app-autorewrite-noop

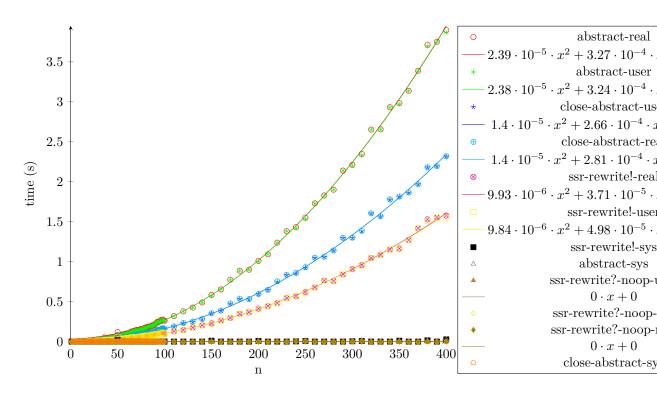


Figure 8: timing-rewrite-repeated-app-ssrrewrite

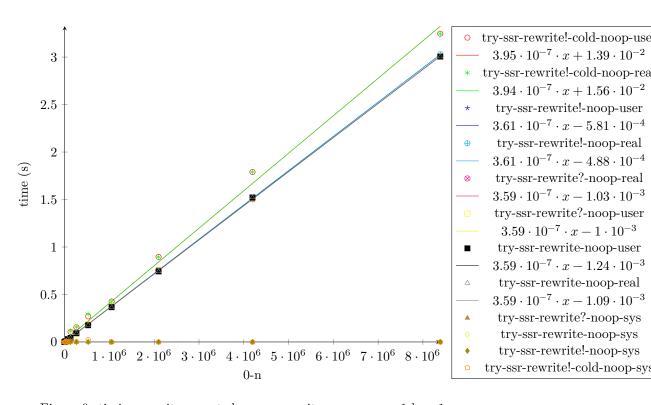


Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn  $\ 1$ 

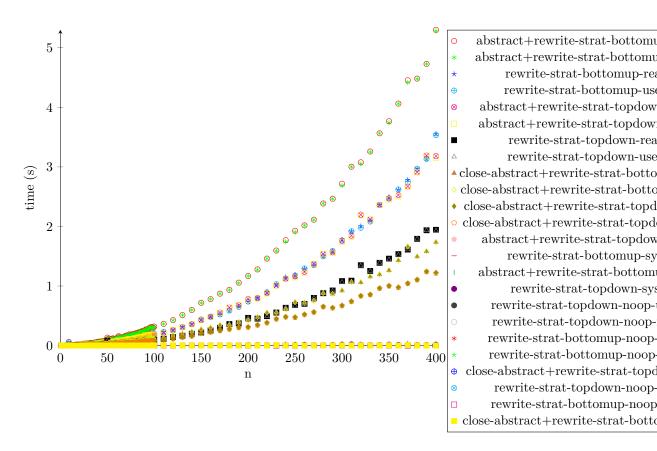


Figure 10: timing-rewrite-repeated-app-rewrite-strat

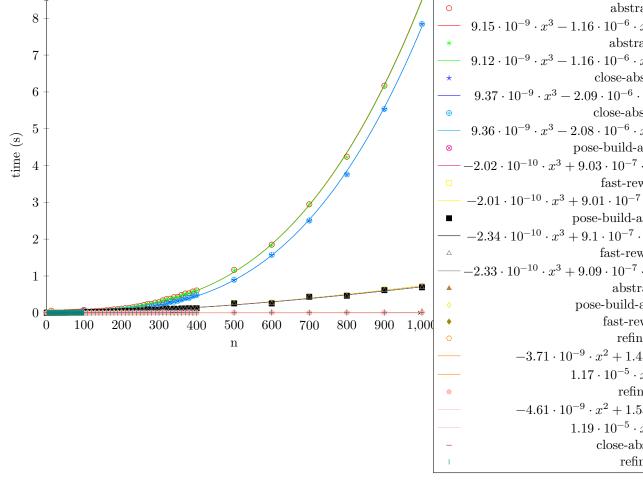
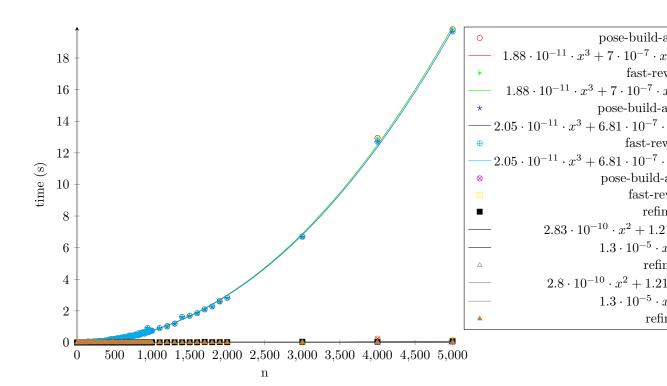
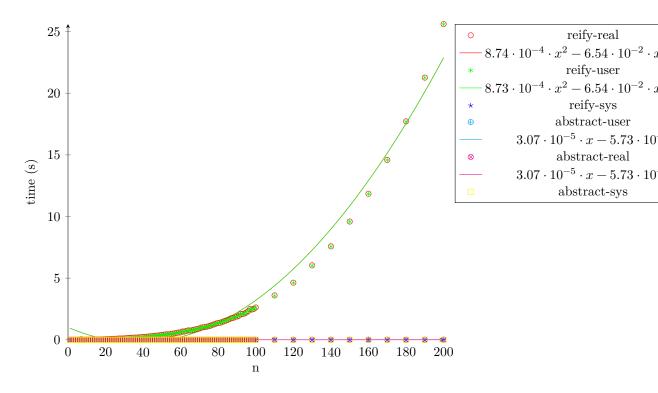


Figure 11: timing-rewrite-repeated-app-fast-rewrite



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



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

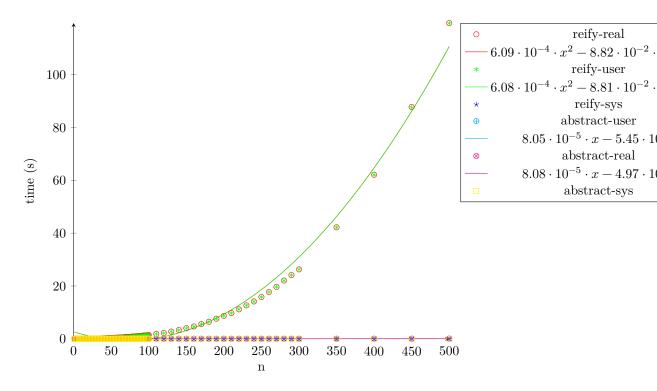
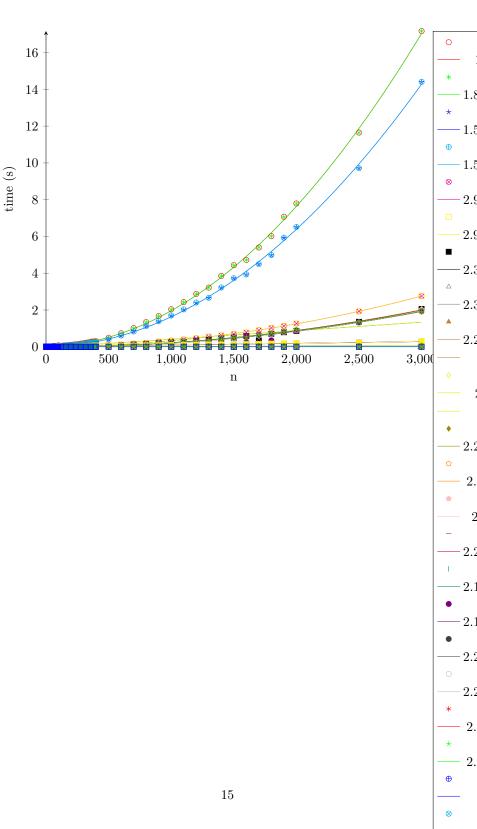


Figure 14: timing-typeclass-reification-let-in-PHOAS



 $1.86 \cdot 10^{-6} \cdot x^2 + 9 \cdot 10^{-5} \cdot x$  $1.86 \cdot 10^{-6} \cdot x^2 + 8.56 \cdot 10^{-5} \cdot x^2$  $1.57 \cdot 10^{-6} \cdot x^2 + 5.66 \cdot 10^{-5} \cdot x^2$  $1.57 \cdot 10^{-6} \cdot x^2 + 5.12 \cdot 10^{-5} \cdot x^2$  $2.96 \cdot 10^{-7} \cdot x^2 + 3.23 \cdot 10^{-5} \cdot x^2$  $2.95 \cdot 10^{-7} \cdot x^2 + 3.27 \cdot 10^{-5} \cdot x^2$  $2.35 \cdot 10^{-7} \cdot x^2 - 3.65 \cdot 10^{-5} \cdot x^2$  $2.34 \cdot 10^{-7} \cdot x^2 - 3.63 \cdot 10^{-5} \cdot x^2$  $2.27 \cdot 10^{-7} \cdot x^2 - 9.68 \cdot 10^{-6} \cdot x^2$  $2.27 \cdot 10^{-7} \cdot x^2 - 1 \cdot 10^{-5} \cdot x$  $2.26 \cdot 10^{-7} \cdot x^2 - 1.01 \cdot 10^{-5} \cdot x^2$  $2.26\cdot 10^{-7}\cdot x^2 - 1.01\cdot 10^{-5}\cdot \\$  $2.21 \cdot 10^{-7} \cdot x^2 + 4.06 \cdot 10^{-6}$  $2.21 \cdot 10^{-7} \cdot x^2 + 4.95 \cdot 10^{-6} \cdot x^2$  $2.18 \cdot 10^{-7} \cdot x^2 - 1.37 \cdot 10^{-5} \cdot x^2$  $2.18 \cdot 10^{-7} \cdot x^2 - 1.37 \cdot 10^{-5} \cdot x^2$  $2.28 \cdot 10^{-7} \cdot x^2 - 4.13 \cdot 10^{-5} \cdot x^2 = 0.00 \cdot 10^{-5} \cdot x^2$  $2.28 \cdot 10^{-7} \cdot x^2 - 4.09 \cdot 10^{-5} \cdot x^2 = 4.09 \cdot 10^{-5} \cdot x^2 + 4.09 \cdot 10^{-5} \cdot x^2$  $2.1 \cdot 10^{-7} \cdot x^2 + 1.64 \cdot 10^{-5} \cdot x$  $2.1 \cdot 10^{-7} \cdot x^2 + 1.65 \cdot 10^{-5} \cdot x$ 

abstract-real

abstract-user

fast-rewrite-real

fast-rewrite-user

close-abstract-rea

close-abstract-use

type-admit-cast-re

type-admit-cast-us

 $4.63 \cdot 10^{-4} \cdot x - 5.07$ 

 $4.62 \cdot 10^{-4} \cdot x - 5.07 \cdot$ check-admit-user

refine-real

refine-user

check-admit-real

type-pf-cast-user

type-pf-cast-real

check-pf-cast-use

check-pf-cast-rea

type-admit-user

type-admit-real

check-admit-cast-u

check-admit-cast-r

build-eval-thunk-u

 $9.43 \cdot 10^{-5} \cdot x - 6.87$ build-eval-thunk-re  $9.48 \cdot 10^{-5} \cdot x - 4.84 \cdot$ build-thunk-user  $9.35 \cdot 10^{-5} \cdot x - 7.08 \cdot$ build-thunk-real  $9.41 \cdot 10^{-5} \cdot x - 5.22 \cdot$ oboole I ...