

Figure 1: Timing of rewrite_strat and setoid_rewrite under binders

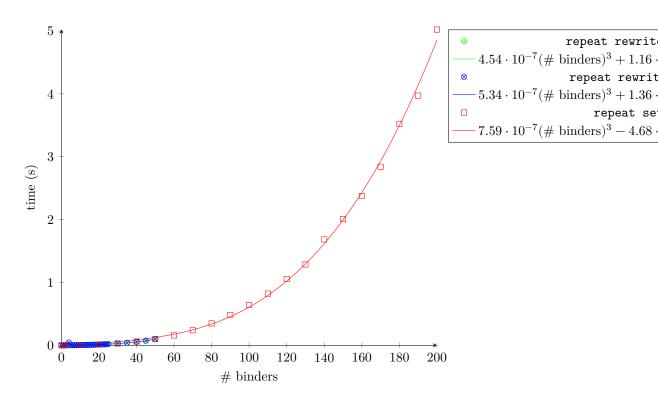
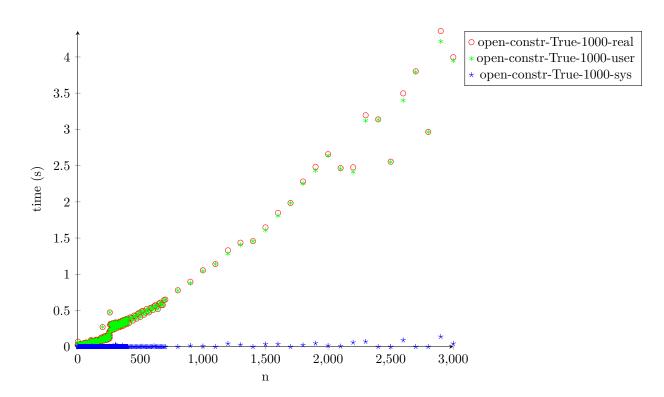
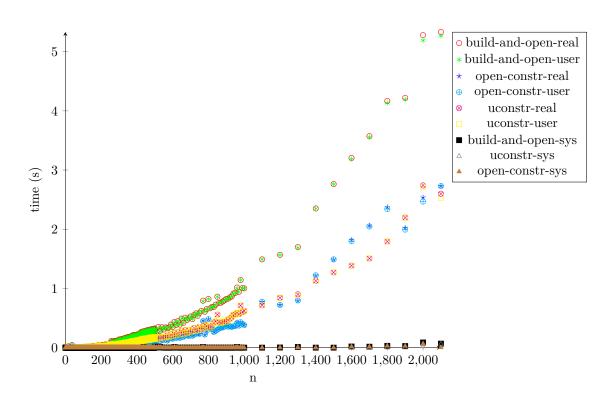


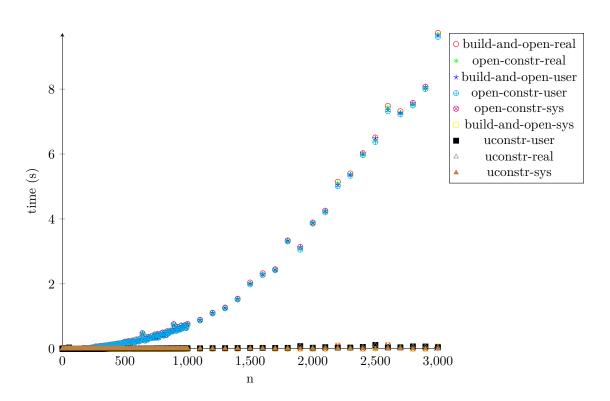
Figure 2: Timing of rewrite_strat and setoid_rewrite under binders



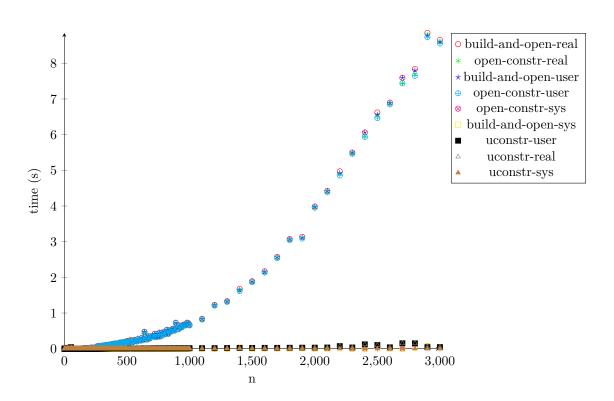
 $\label{eq:Figure 3: timing-do-n-open-constr-True} Figure \ 3: \ timing-do-n-open-constr-True$



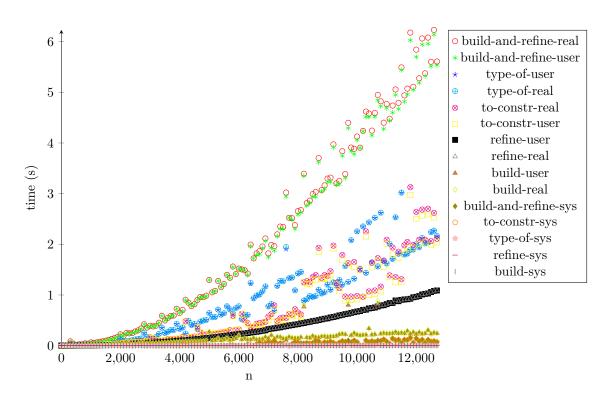
Figure~4:~timing-open-constr-n-lambda-no-types-different-names



Figure~5:~timing-open-constr-n-lambda-no-types-no-names



 $\label{prop:constr-n-lambda-no-types-same-names} Figure \ 6: \ timing-open-constr-n-lambda-no-types-same-names$



Figure~7:~timing-app-n-uconstr

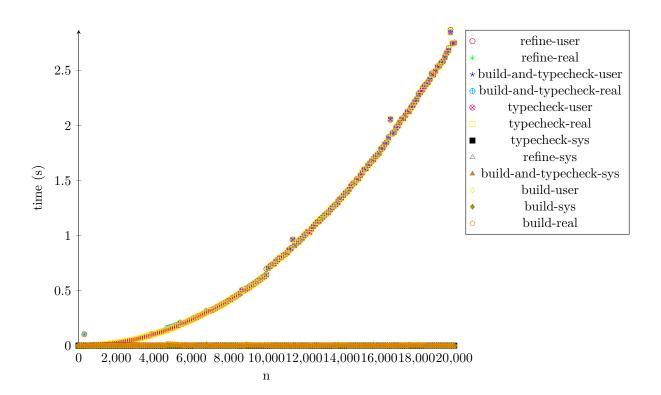


Figure 8: timing-app-n-ltac2 $\,$

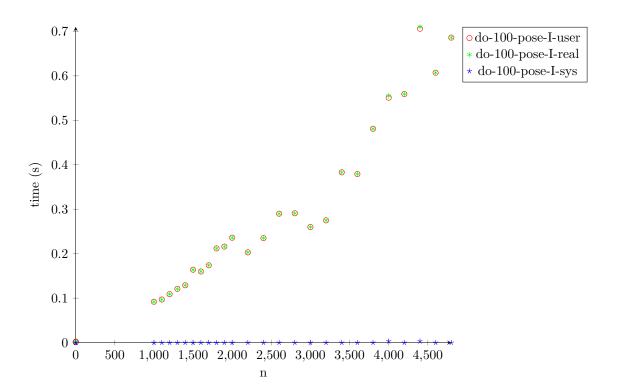


Figure 9: timing-do-n-pose

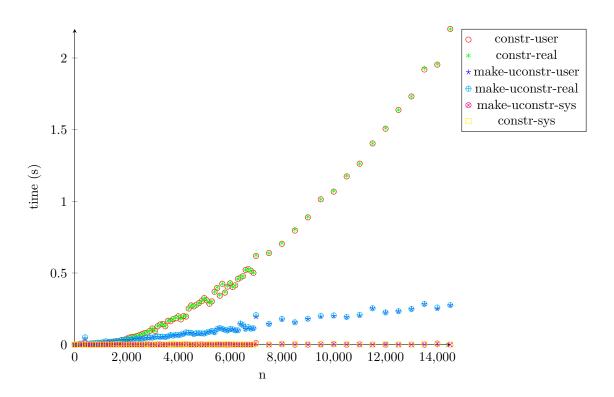


Figure 10: timing-let-n-uconstr

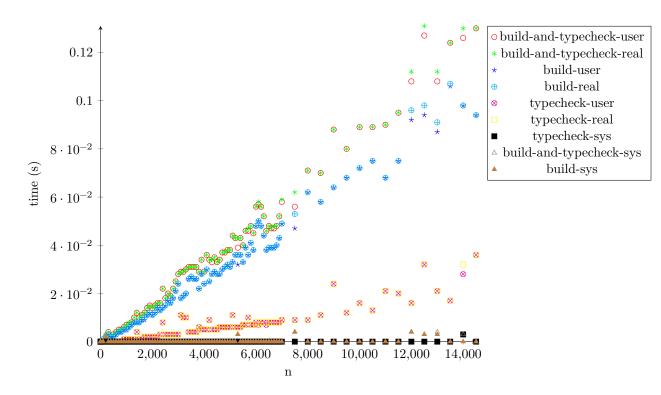
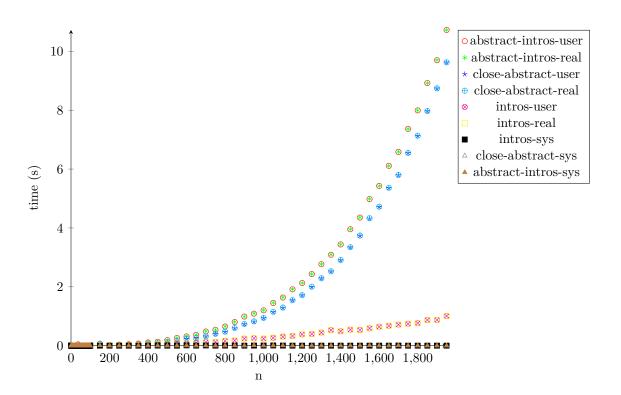


Figure 11: timing-let-n-ltac 2



Figure~12:~timing-intros-n-let

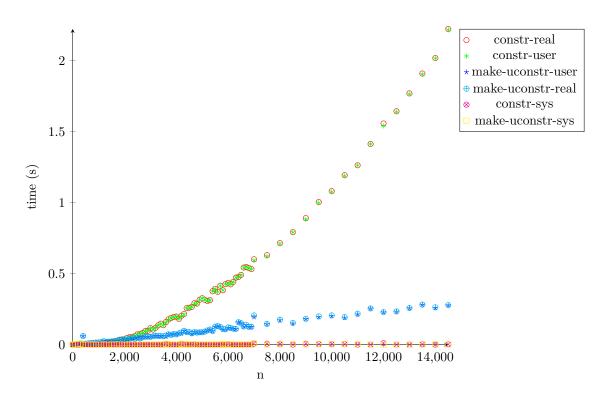


Figure 13: timing-fun-n-uconstr

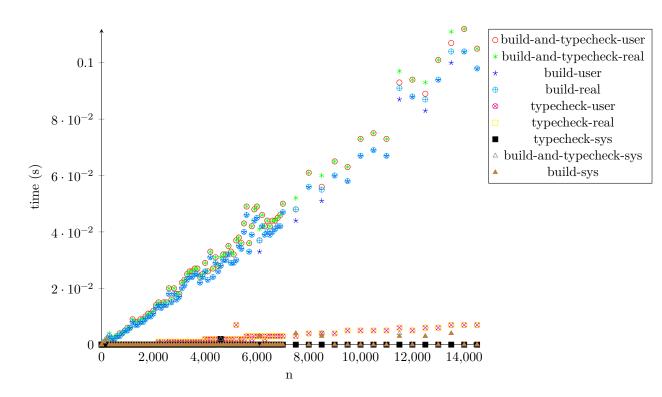


Figure 14: timing-fun-n-ltac2

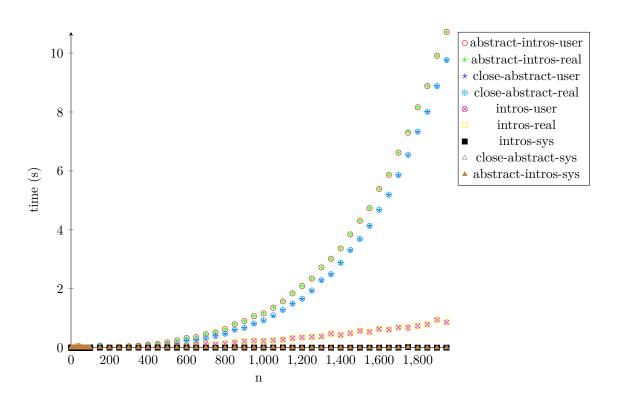
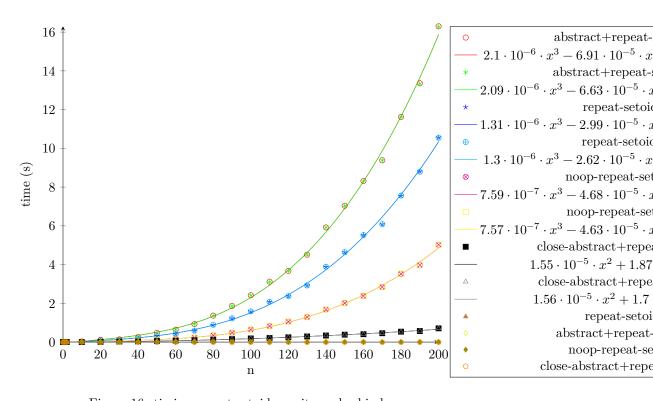
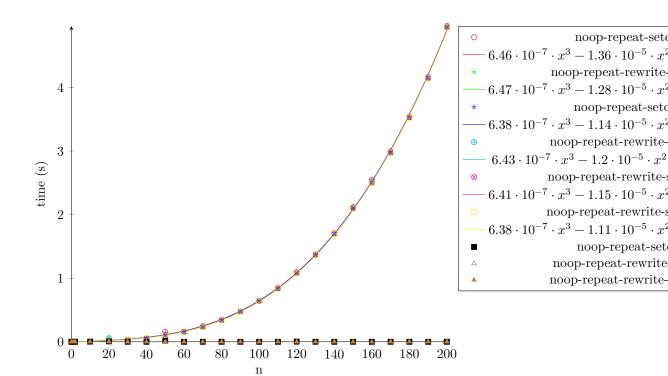


Figure 15: timing-intros-n-fun



 $Figure\ 16:\ timing-repeat-setoid-rewrite-under-binders$



 $Figure~17:~timing\mbox{-repeat-setoid-rewrite-under-binders-noop}$

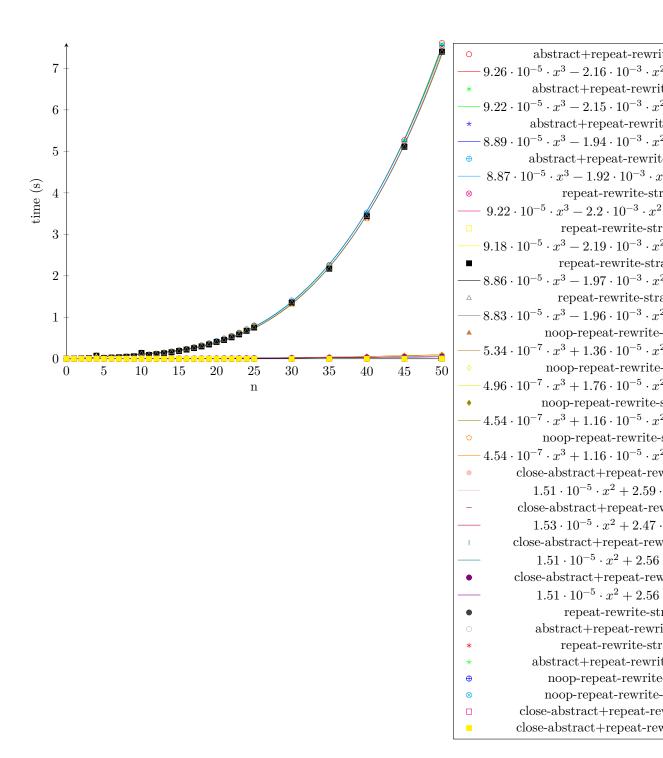
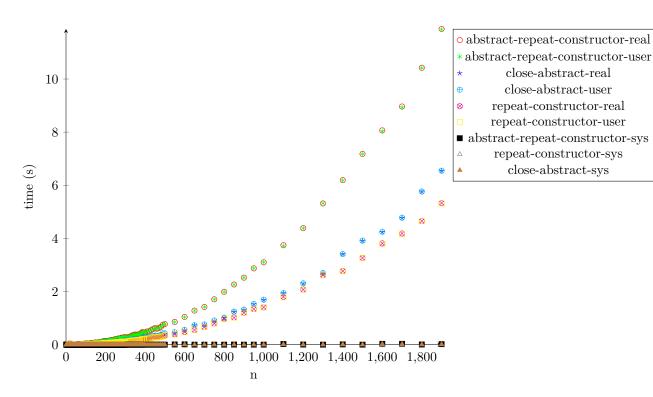


Figure 18: timing-rewrite-strat-under-binders



 ${\it close-abstract-real}$

close-abstract-user ${\bf repeat\text{-}constructor\text{-}real}$ $repeat\hbox{-}constructor\hbox{-}user$

repeat-constructor-sys

 ${\it close-abstract-sys}$

Figure 19: timing-conj-True-repeat-constructor

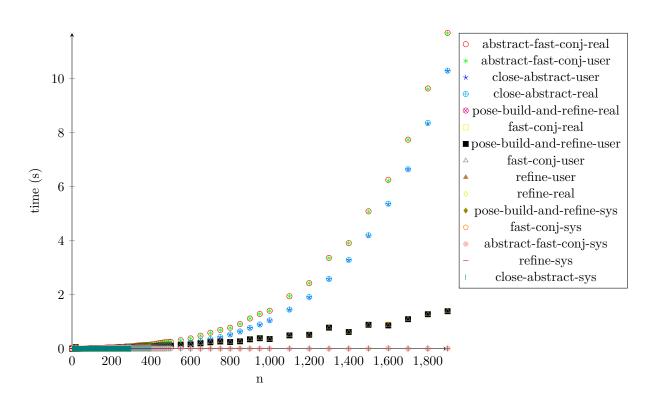


Figure 20: timing-conj-True-fast-conj

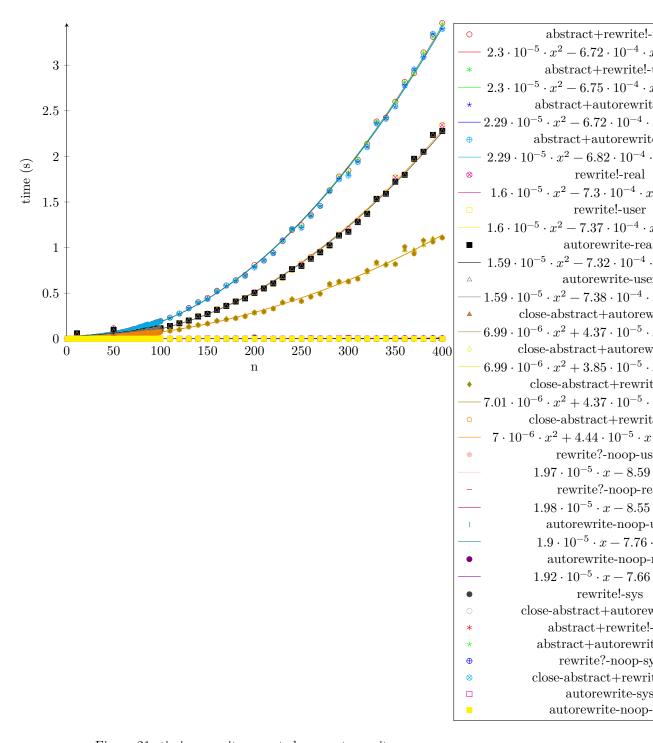


Figure 21: timing-rewrite-repeated-app-autorewrite

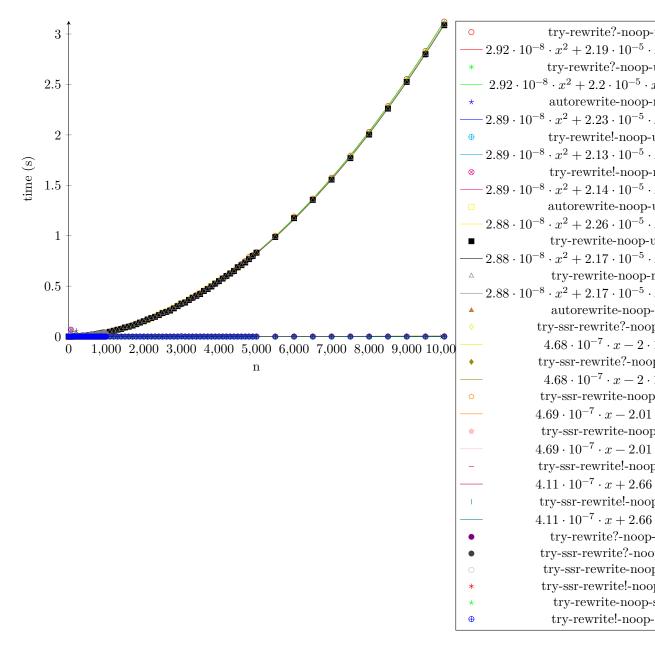


Figure 22: timing-rewrite-repeated-app-autorewrite-noop

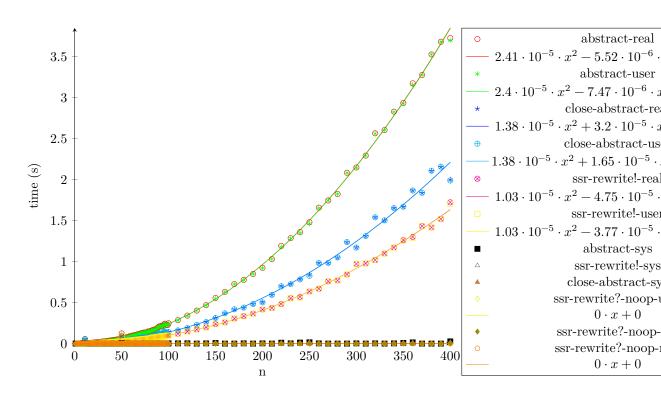


Figure 23: timing-rewrite-repeated-app-ssrrewrite

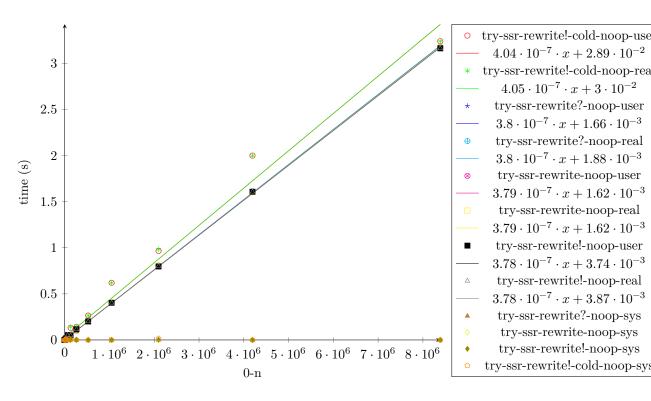
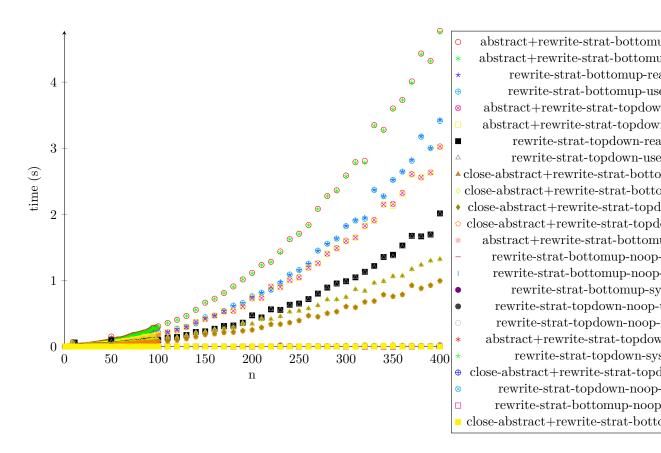


Figure 24: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn $\ 1$



 $Figure\ 25:\ timing-rewrite-repeated-app-rewrite-strat$

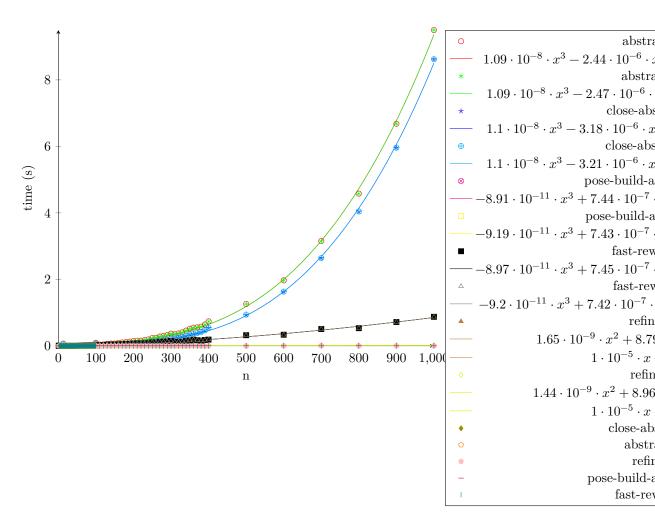
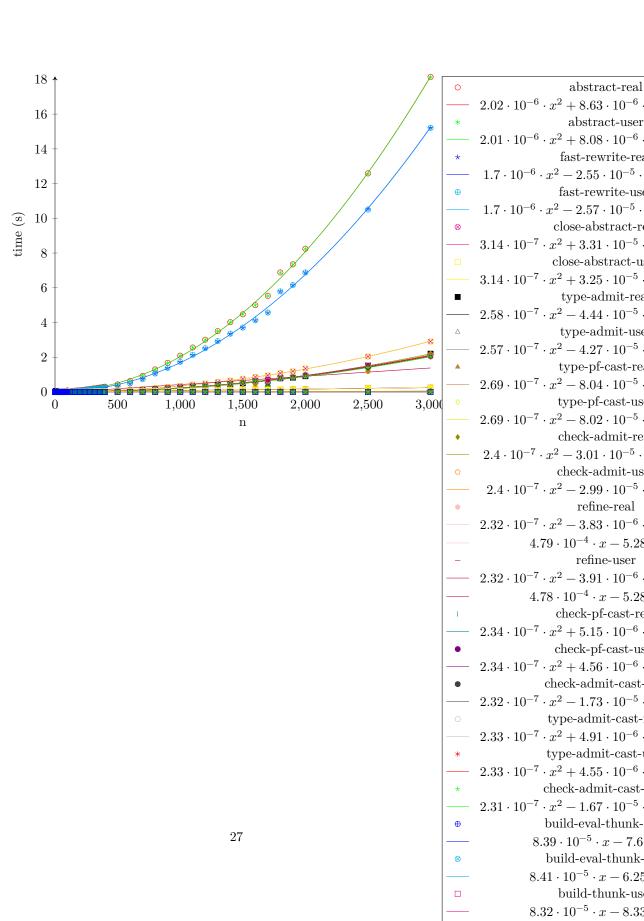


Figure 26: timing-rewrite-repeated-app-fast-rewrite



abstract-real

abstract-user

fast-rewrite-rea

fast-rewrite-use

close-abstract-re

close-abstract-u

type-admit-rea

type-admit-use

type-pf-cast-rea

type-pf-cast-us

check-admit-re

check-admit-us

 $4.79 \cdot 10^{-4} \cdot x - 5.28$

 $4.78 \cdot 10^{-4} \cdot x - 5.28$ check-pf-cast-re

check-pf-cast-us

check-admit-cast-

type-admit-cast-

type-admit-cast-

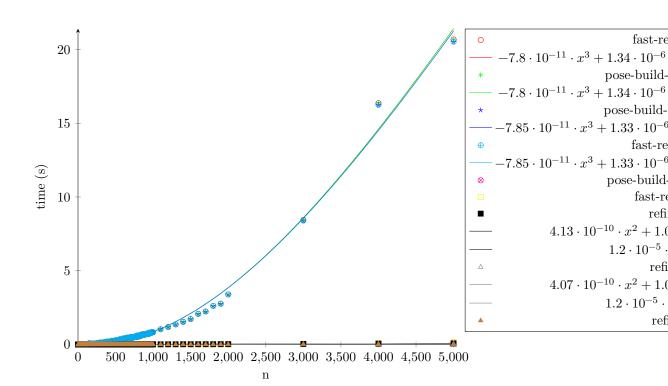
check-admit-cast-

build-eval-thunk-

 $8.39 \cdot 10^{-5} \cdot x - 7.6$ build-eval-thunk- $8.41 \cdot 10^{-5} \cdot x - 6.25$ build-thunk-use $8.32 \cdot 10^{-5} \cdot x - 8.33$ build-thunk-rea $8.34 \cdot 10^{-5} \cdot x - 6.81$

refine-real

refine-user



Figure~28:~timing-rewrite-repeated-app-fast-rewrite-no-abstract

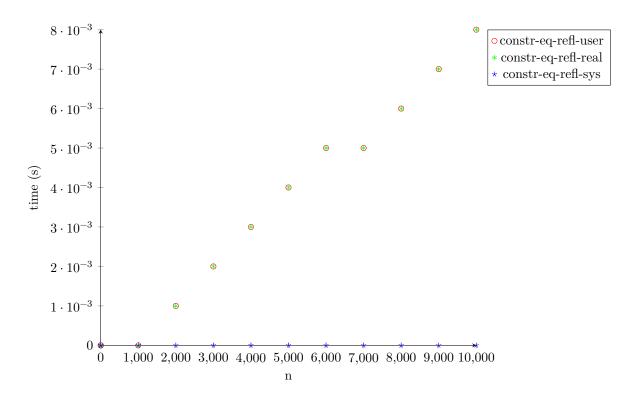


Figure 29: timing-constr-eq-alpha

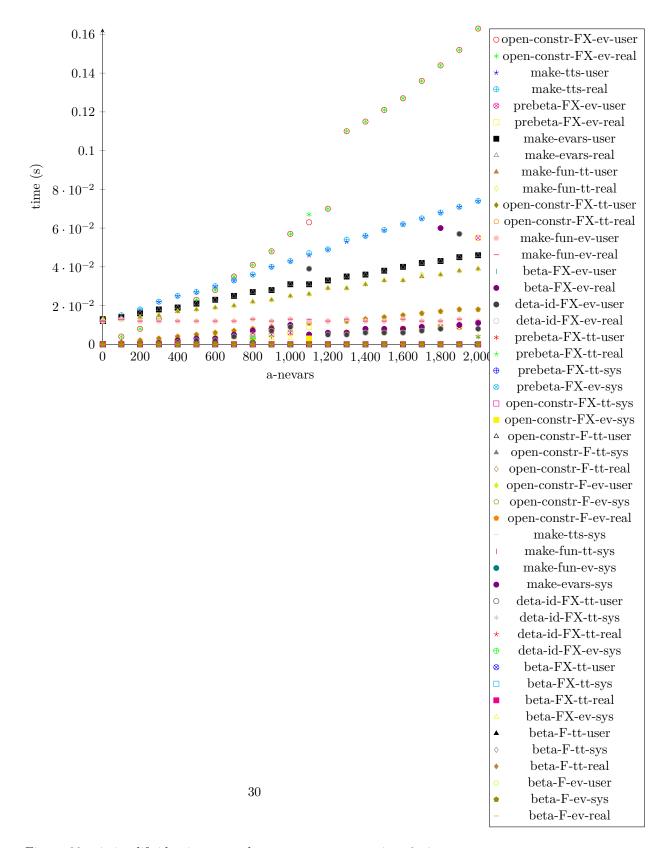


Figure 30: timing-lift-identity-evar-subst-nevars param-ctx-size $\ 0,\ 1,\$ param-extra-binders $\ 0,\ 1$

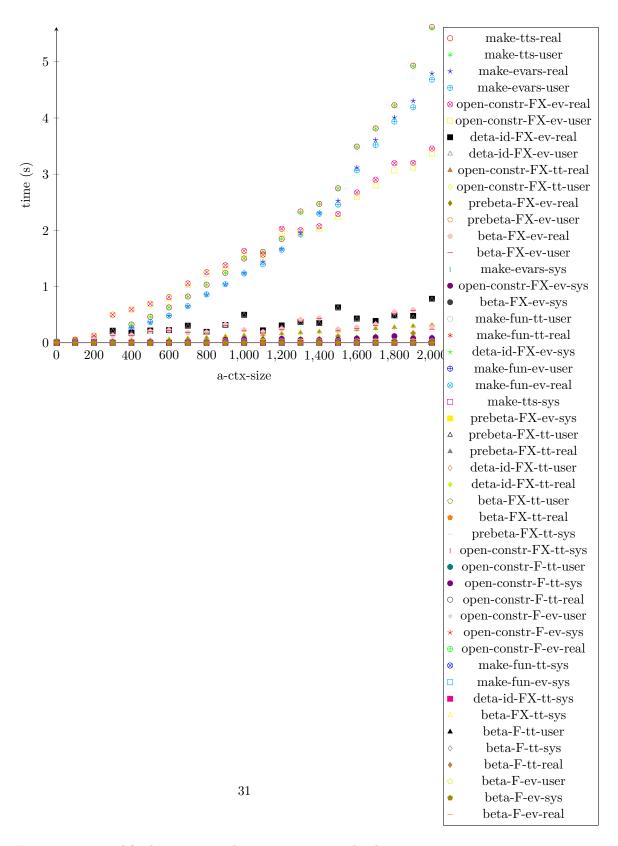


Figure 31: timing-lift-identity-evar-subst-ctx param-extra-binders $\ 0, \ 1, \ param-evars \ 0, \ 1$

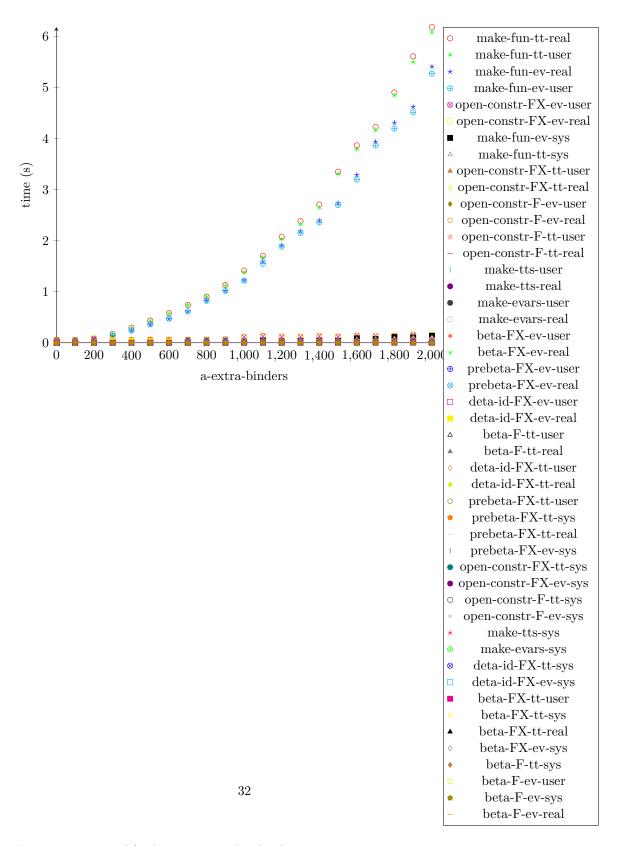


Figure 32: timing-lift-identity-evar-subst-binders param-ctx-size $\ 0,\ 1,\ param-nevars\ 0,\ 1$

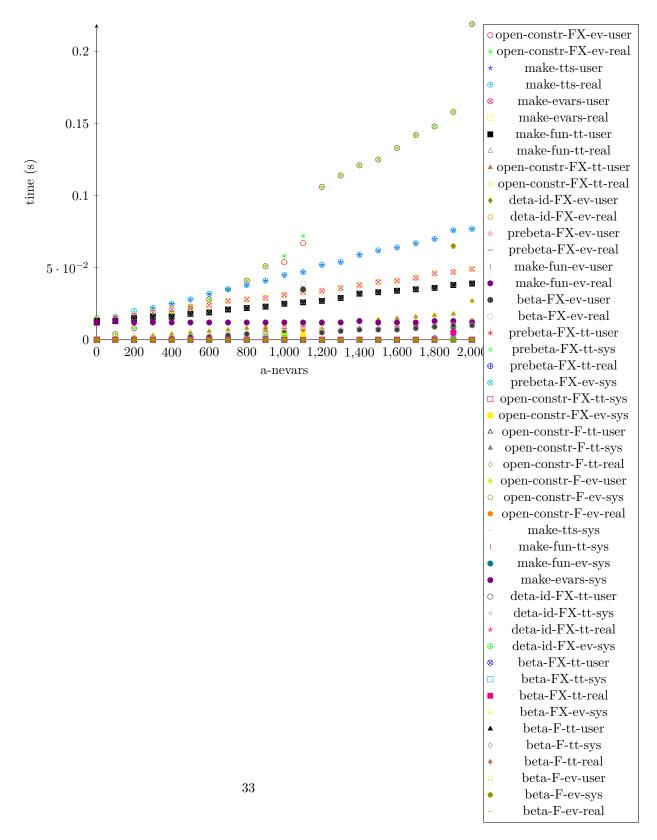


Figure 33: timing-lift-non-identity-evar-subst-nevars param-ctx-size $0,\ 1,$ param-extra-binders $0,\ 1$

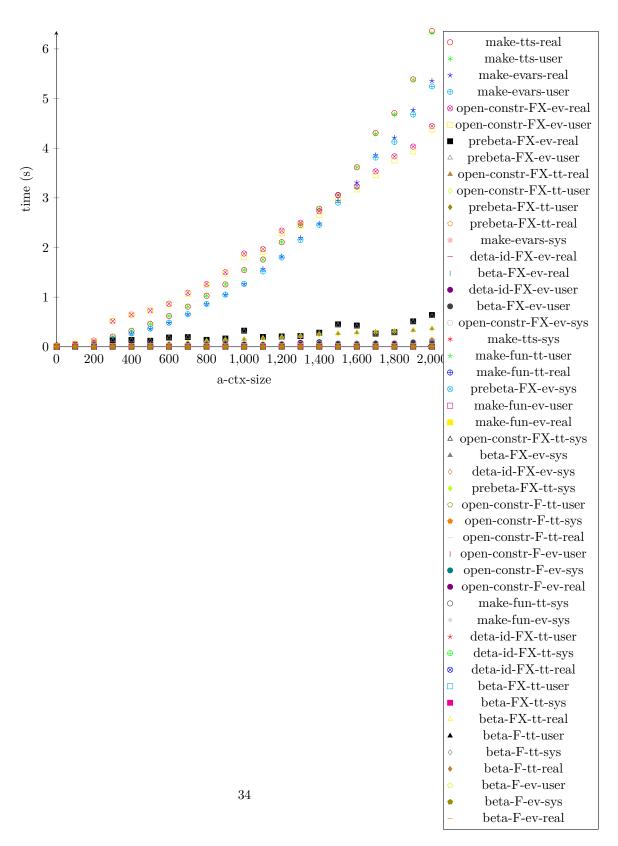


Figure 34: timing-lift-non-identity-evar-subst-ctx param-extra-binders 0, 1, param-nevars 0, 1

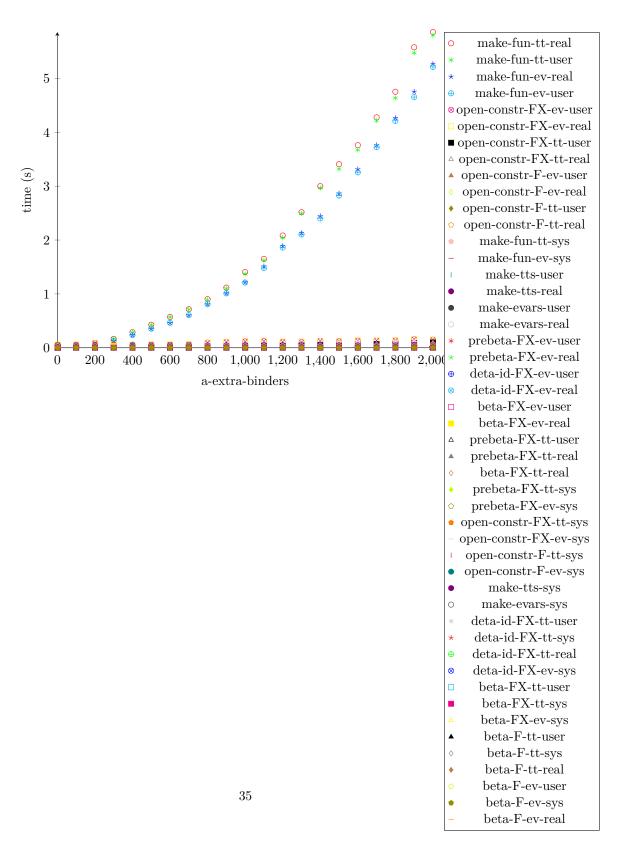
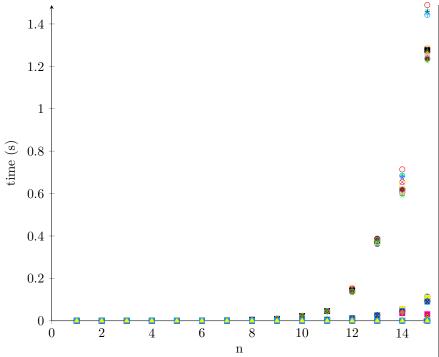
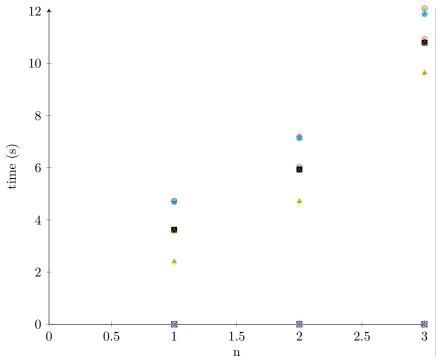


Figure 35: timing-lift-non-identity-evar-subst-binders param-ctx-size 0, 1, param-nevars 0, 1



o unify-delta-1-fast-real * unify-delta-1-slow-real \star unify-delta-1-fast-user • unify-delta-1-slow-user ⊗ unify-zeta-1-fast-real unify-beta-1-fast-real ■ unify-zeta-1-fast-user △ unify-beta-1-fast-user ▲ unify-zeta-2-slow-real unify-zeta-2-slow-user • unify-beta-2-slow-user o unify-beta-2-slow-real unify-beta-2-fast-real - unify-zeta-2-fast-real unify-beta-2-fast-user • unify-zeta-1-slow-user • unify-zeta-1-slow-real o unify-beta-1-slow-real * unify-beta-1-slow-user unify-zeta-2-fast-user delta-1-fast-user delta-1-fast-real delta-1-slow-user delta-1-slow-real beta-2-slow-user beta-2-slow-real zeta-1-fast-user zeta-1-fast-real beta-1-slow-user beta-1-slow-real zeta-2-slow-user zeta-2-slow-real zeta-2-fast-user zeta-2-fast-real beta-1-fast-user beta-1-fast-real zeta-1-slow-user zeta-1-slow-real beta-2-fast-user beta-2-fast-real unify-delta-1-fast-sys unify-delta-1-slow-sys unify-zeta-2-fast-sys unify-beta-1-fast-sys unify-zeta-1-fast-sys unify-beta-2-fast-sys unify-zeta-2-slow-sys unify-beta-1-slow-sys zeta-2-slow-sys zeta-2-fast-sys zeta-1-slow-sys

zeta-1-fast-sysunify-zeta-1-slow-sys



o abstract-unify-beta-2-slow-real * abstract-unify-beta-2-slow-user * abstract-unify-zeta-2-slow-real • abstract-unify-zeta-2-slow-user ⊗ abstract-unify-zeta-1-slow-real abstract-unify-zeta-1-slow-user ■ abstract-unify-beta-1-slow-real \triangle abstract-unify-beta-1-slow-user ▲ abstract-unify-delta-1-slow-real ♦ abstract-unify-delta-1-slow-user • abstract-unify-zeta-1-slow-sys • abstract-unify-beta-2-slow-sys abstract-unify-beta-1-slow-sys abstract-unify-delta-1-slow-sys abstract-unify-zeta-2-slow-sys • abstract-unify-zeta-2-fast-user abstract-unify-zeta-2-fast-real abstract-unify-zeta-1-fast-user * abstract-unify-zeta-1-fast-real * abstract-unify-delta-1-fast-user • abstract-unify-delta-1-fast-real abstract-unify-beta-2-fast-user \square abstract-unify-beta-2-fast-real abstract-unify-beta-1-fast-user △ abstract-unify-beta-1-fast-real zeta-2-slow-user zeta-2-slow-sys zeta-2-slow-real zeta-2-fast-user zeta-2-fast-sys zeta-2-fast-real zeta-1-slow-user zeta-1-slow-sys zeta-1-slow-real zeta-1-fast-user zeta-1-fast-sys zeta-1-fast-real Ф unify-zeta-2-slow-user 8 unify-zeta-2-slow-sys

> unify-zeta-2-slow-real unify-zeta-2-fast-user unify-zeta-2-fast-sys unify-zeta-2-fast-real unify-zeta-1-slow-user unify-zeta-1-slow-sys

unify-zeta-1-slow-real unify-zeta-1-fast-user unify-zeta-1-fast-sys unify-zeta-1-fast-real unify-delta-1-slow-user unify-delta-1-slow-real unify-delta-1-fast-user

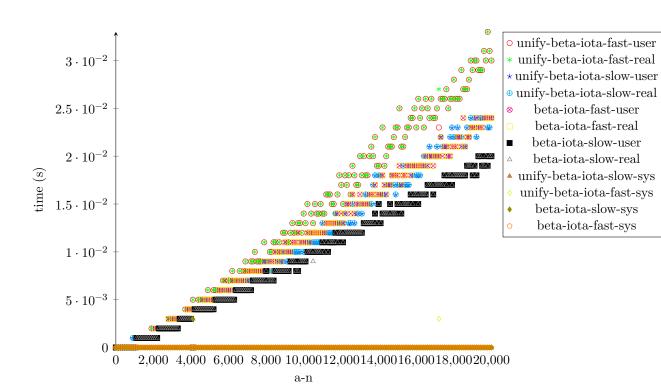


Figure 38: timing-iota-reduction-fact8 param-fact-n $\,\,8\,$

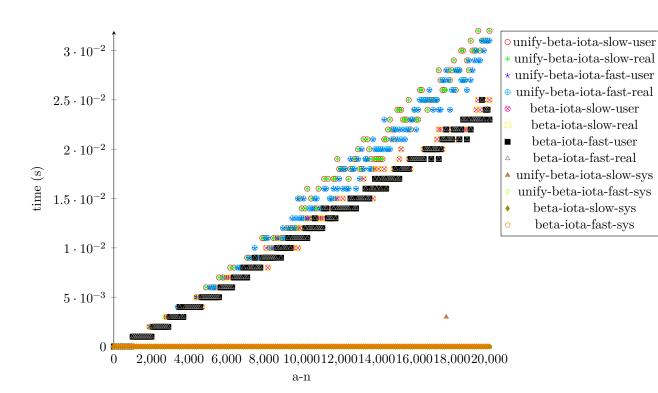


Figure 39: timing-iota-reduction-fact9 param-fact-n $\ 9$

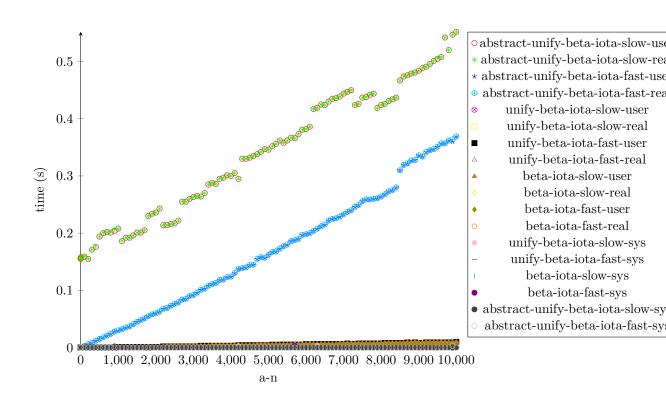


Figure 40: timing-iota-reduction-with-abstract-fact8 param-fact-n $\,\,8\,$

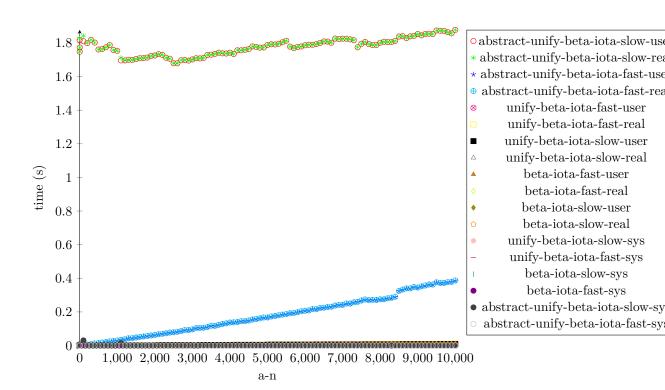


Figure 41: timing-iota-reduction-with-abstract-fact9 param-fact-n $\,\,9$

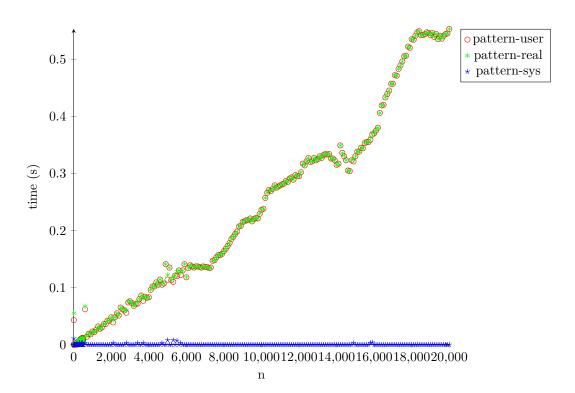


Figure 42: timing-pattern

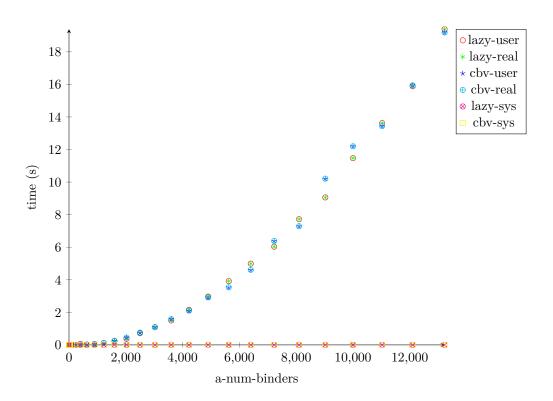


Figure 43: timing-quadratic-cbv-lazy-PHOAS param-n $\,\,0\,\,$

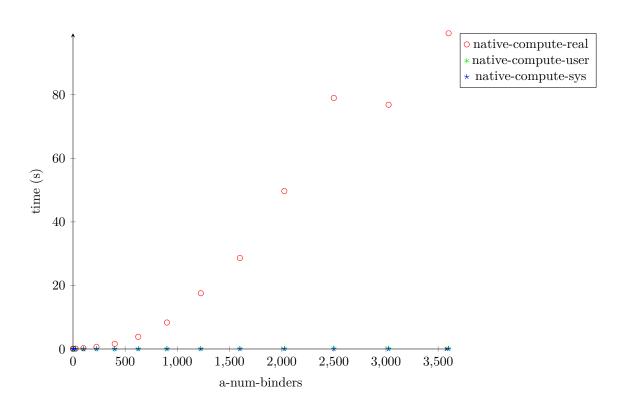


Figure 44: timing-quadratic-native-PHOAS param-n $\,0\,$

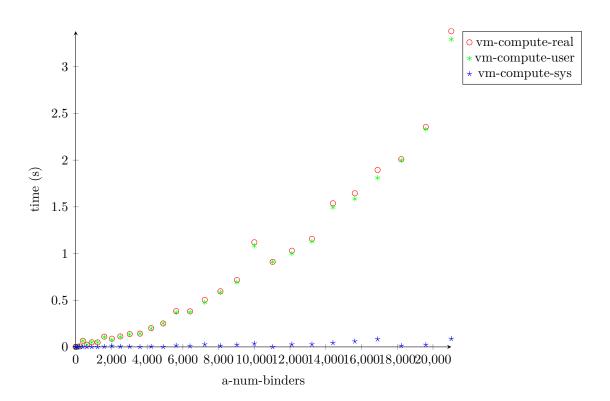


Figure 45: timing-quadratic-vm-PHOAS param-n $\,0\,$