Figure 1: timing-pattern

1

time (s)

3.5

3

2.5

2

1.5

1

0.5

0   2,000   4,000   6,000   8,000   10,000 12,000 14,000 16,000

0-univ-count

abstract-real
$2.15 \cdot 10^{-9} \cdot x^2 + 1.88 \cdot 10^{-4} \cdot$
abstract-user
$2.16 \cdot 10^{-9} \cdot x^2 + 1.84 \cdot 10^{-4} \cdot$
close-abstract-re
$2.06 \cdot 10^{-9} \cdot x^2 + 1.3 \cdot 10^{-4} \cdot x$
close-abstract-us
$2.07 \cdot 10^{-9} \cdot x^2 + 1.27 \cdot$
exact-real
$5.92 \cdot 10^{-5} \cdot x - 4.09$
exact-user
$5.82 \cdot 10^{-5} \cdot x - 4.63$
abstract-sys
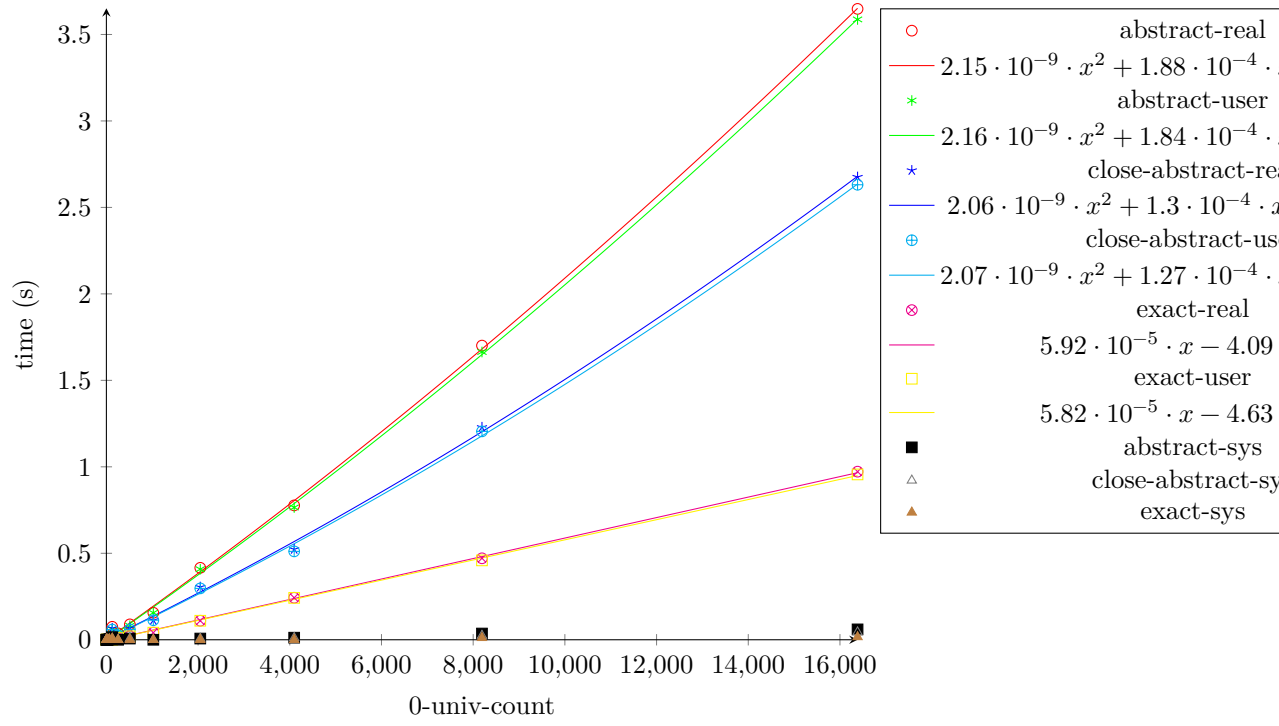close-abstract-sy
exact-sys

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

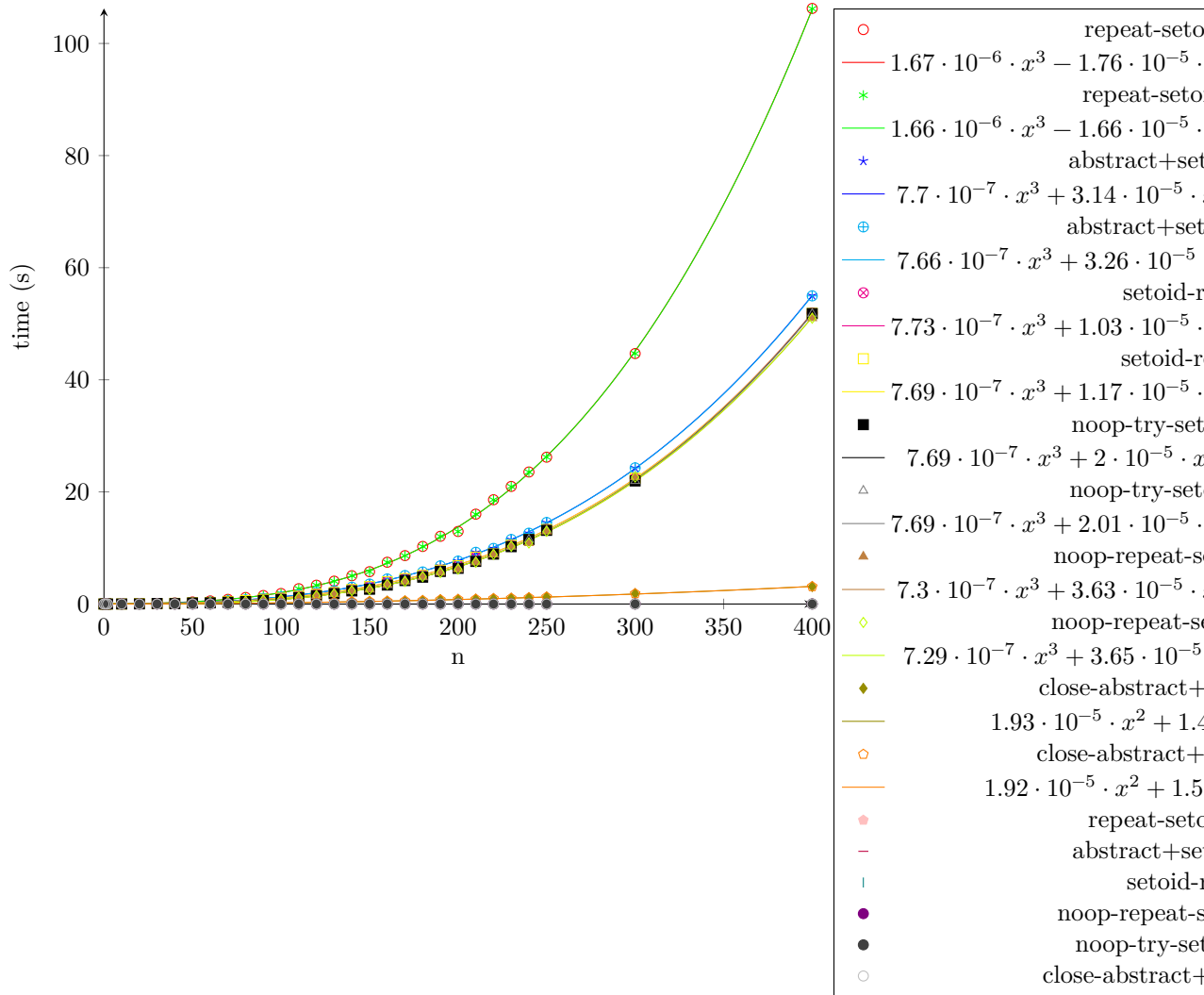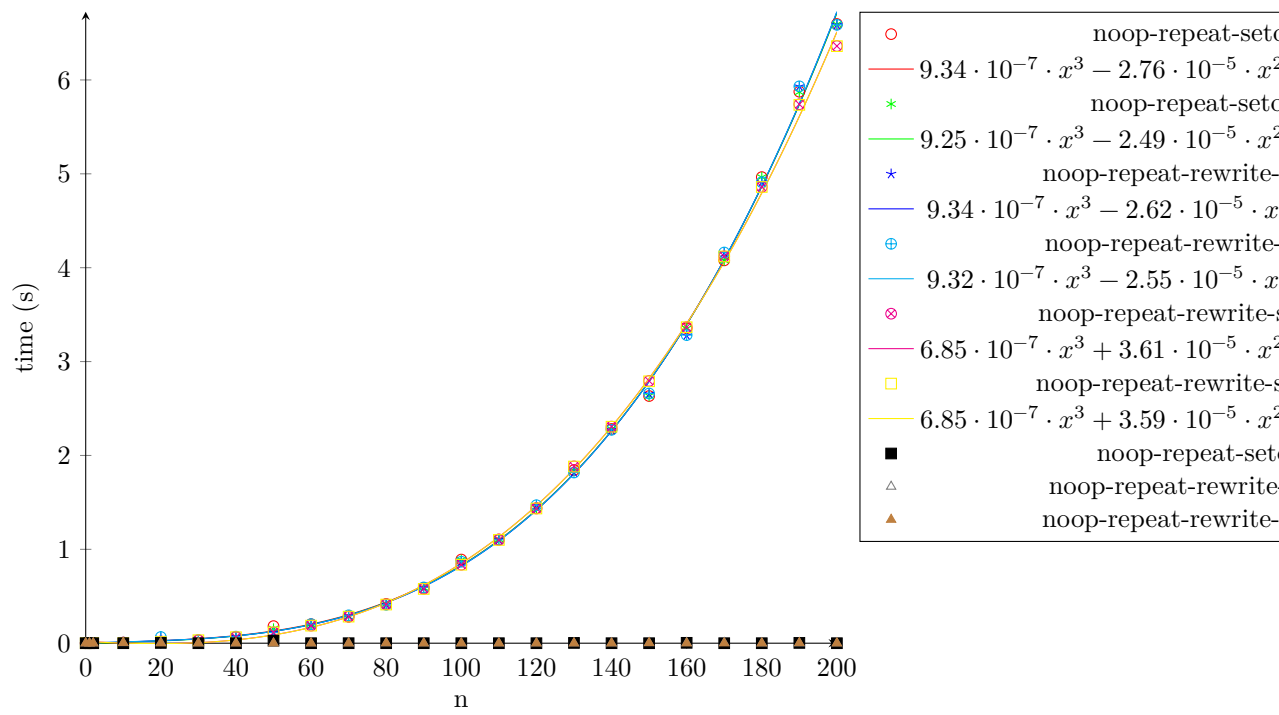Figure 3: timing-repeat-setoid-rewrite-under-binders

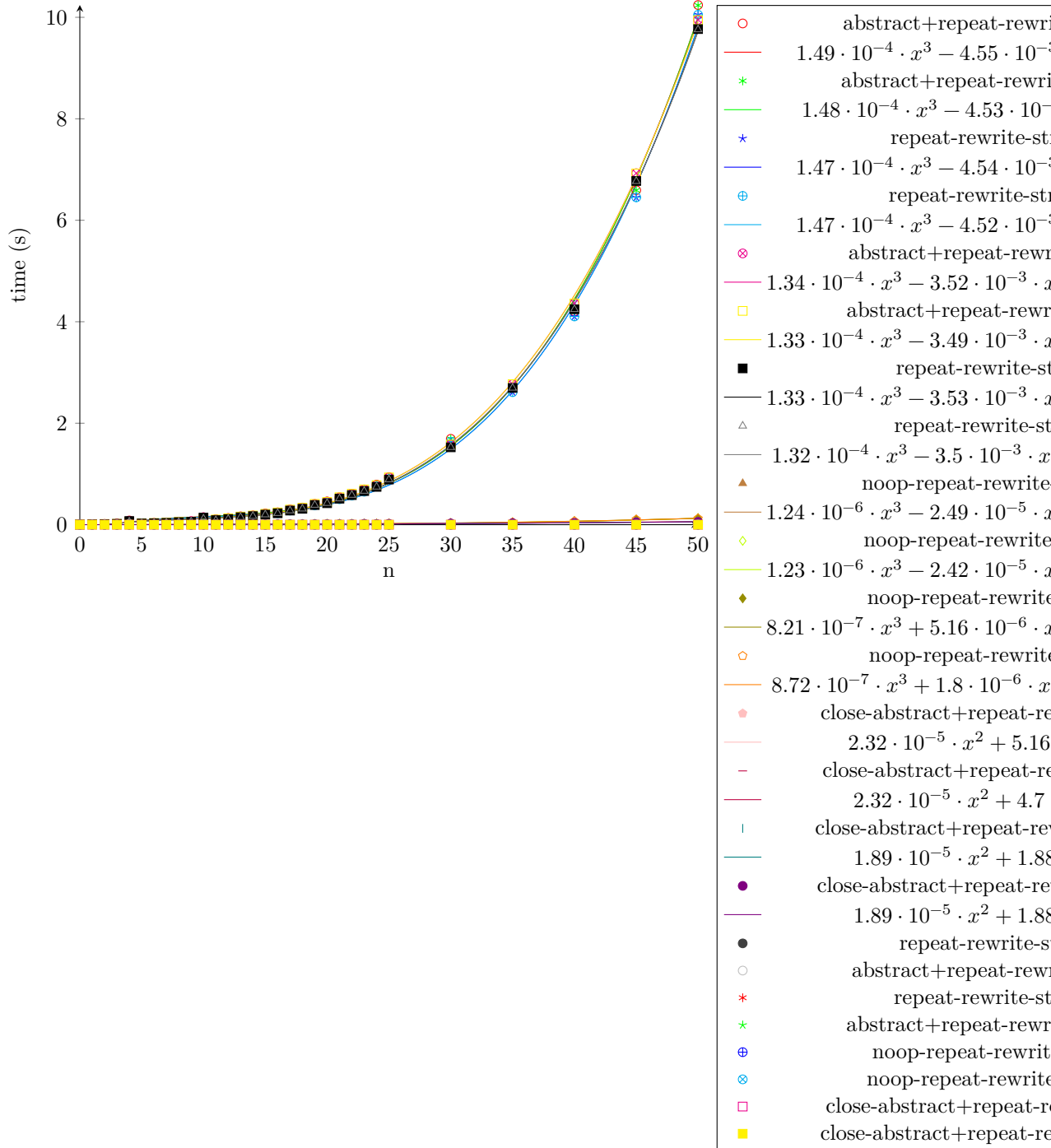Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

4

○	abstract+repeat-rewri...
—	$1.49 \cdot 10^{-4} \cdot x^3 - 4.55 \cdot 10^{-3}$
✳	abstract+repeat-rewri...
—	$1.48 \cdot 10^{-4} \cdot x^3 - 4.53 \cdot 10^{-}$
✶	repeat-rewrite-st...
—	$1.47 \cdot 10^{-4} \cdot x^3 - 4.54 \cdot 10^{-}$
⊕	repeat-rewrite-st...
—	$1.47 \cdot 10^{-4} \cdot x^3 - 4.52 \cdot 10^{-}$
⊗	abstract+repeat-rewr...
—	$1.34 \cdot 10^{-4} \cdot x^3 - 3.52 \cdot 10^{-3} \cdot x$
□	abstract+repeat-rewr...
—	$1.33 \cdot 10^{-4} \cdot x^3 - 3.49 \cdot 10^{-3} \cdot x$
■	repeat-rewrite-st...
—	$1.33 \cdot 10^{-4} \cdot x^3 - 3.53 \cdot 10^{-3} \cdot x$
△	repeat-rewrite-st...
—	$1.32 \cdot 10^{-4} \cdot x^3 - 3.5 \cdot 10^{-3} \cdot x$
▲	noop-repeat-rewrite...
—	$1.24 \cdot 10^{-6} \cdot x^3 - 2.49 \cdot 10^{-5} \cdot x$
◇	noop-repeat-rewrite...
—	$1.23 \cdot 10^{-6} \cdot x^3 - 2.42 \cdot 10^{-5} \cdot x$
◆	noop-repeat-rewrite...
—	$8.21 \cdot 10^{-7} \cdot x^3 + 5.16 \cdot 10^{-6} \cdot x$
⬠	noop-repeat-rewrite...
—	$8.72 \cdot 10^{-7} \cdot x^3 + 1.8 \cdot 10^{-6} \cdot x$
⬠	close-abstract+repeat-re...
—	$2.32 \cdot 10^{-5} \cdot x^2 + 5.16$
−	close-abstract+repeat-re...
—	$2.32 \cdot 10^{-5} \cdot x^2 + 4.7$
⌐	close-abstract+repeat-re...
—	$1.89 \cdot 10^{-5} \cdot x^2 + 1.88$
●	close-abstract+repeat-re...
—	$1.89 \cdot 10^{-5} \cdot x^2 + 1.88$
●	repeat-rewrite-s...
○	abstract+repeat-rewr...
✳	repeat-rewrite-st...
✳	abstract+repeat-rewr...
⊕	noop-repeat-rewrit...
⊗	noop-repeat-rewrite...
□	close-abstract+repeat-re...
■	close-abstract+repeat-re...

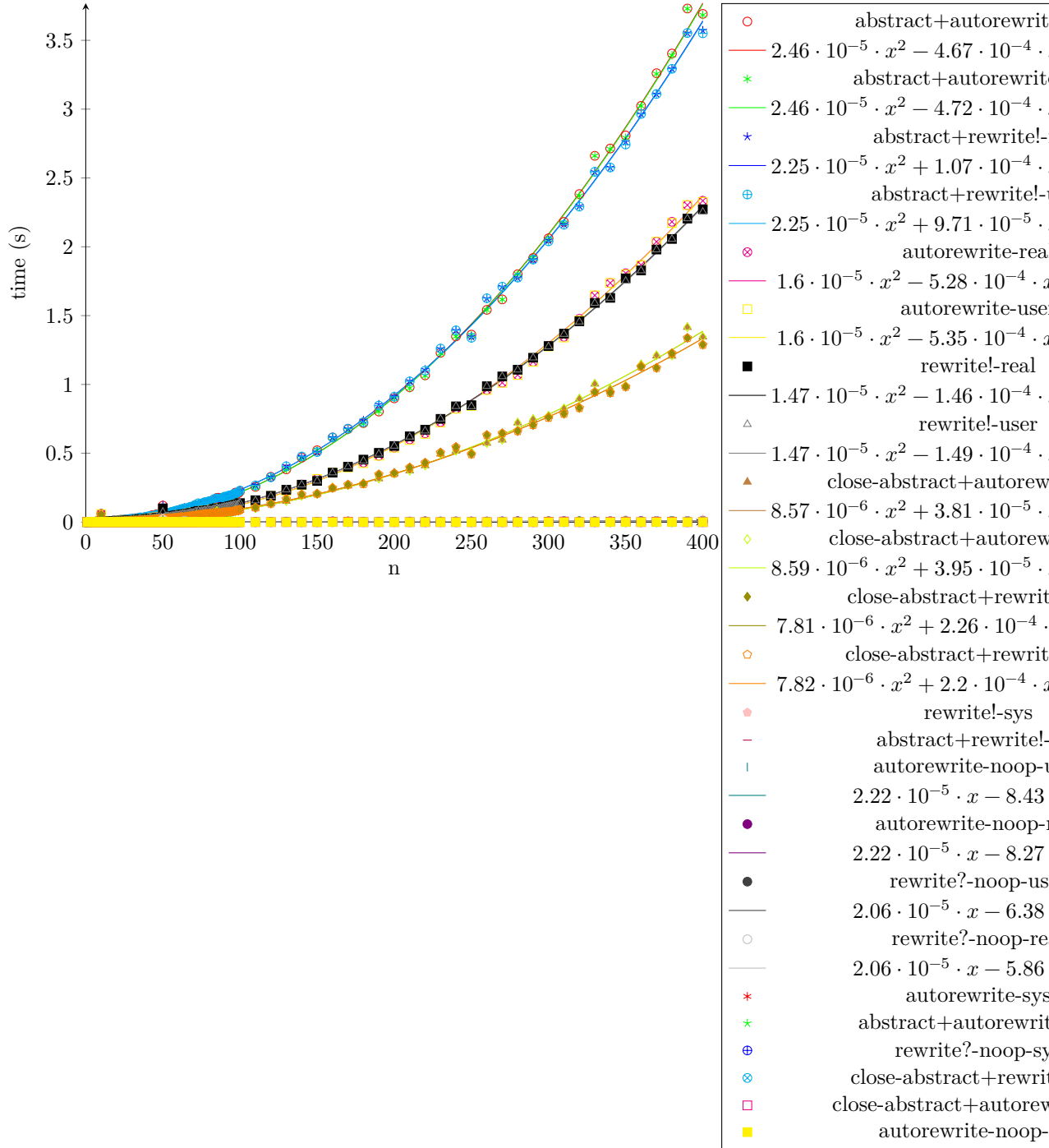Figure 5: timing-rewrite-strat-under-binders
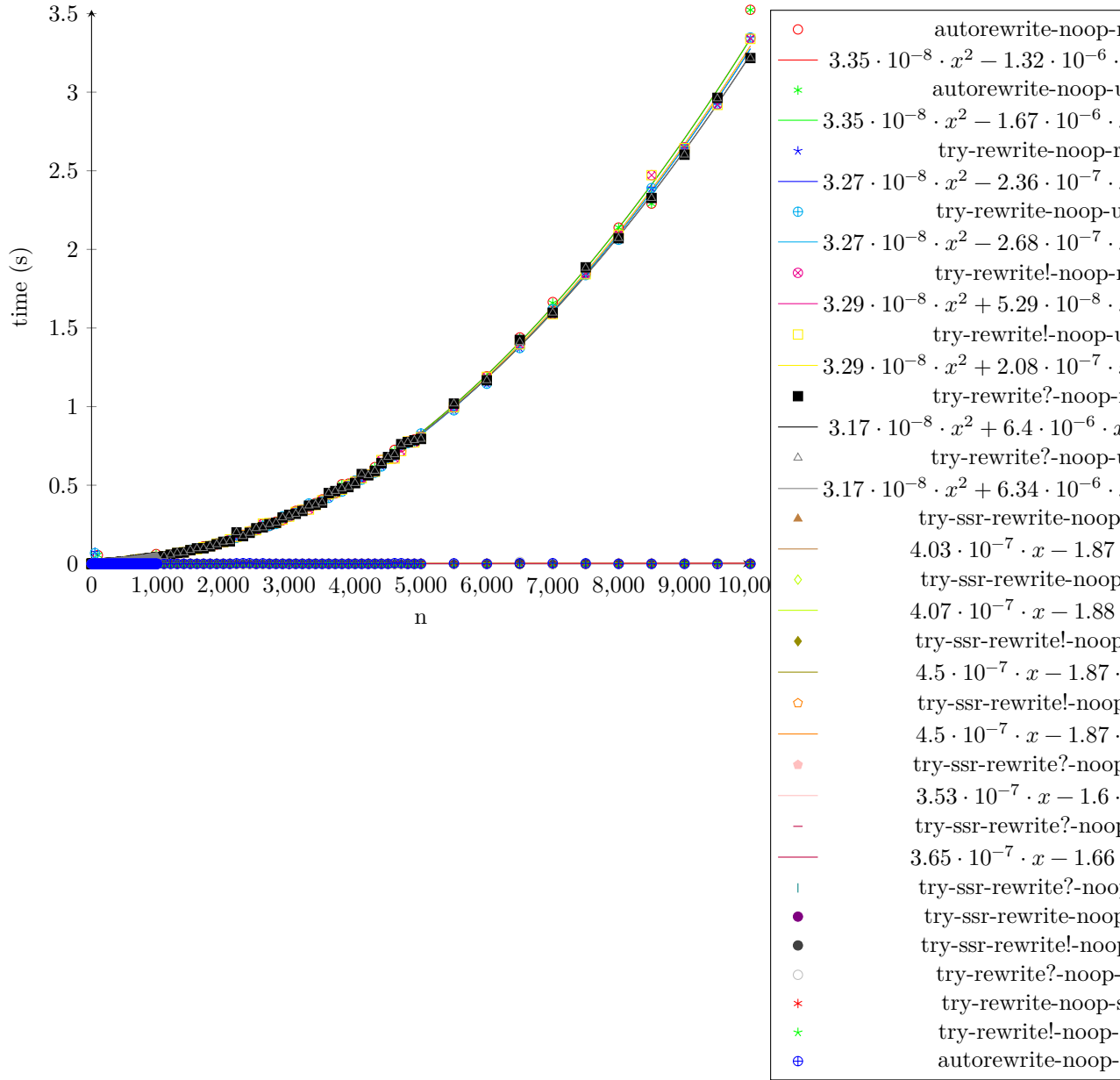
5

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

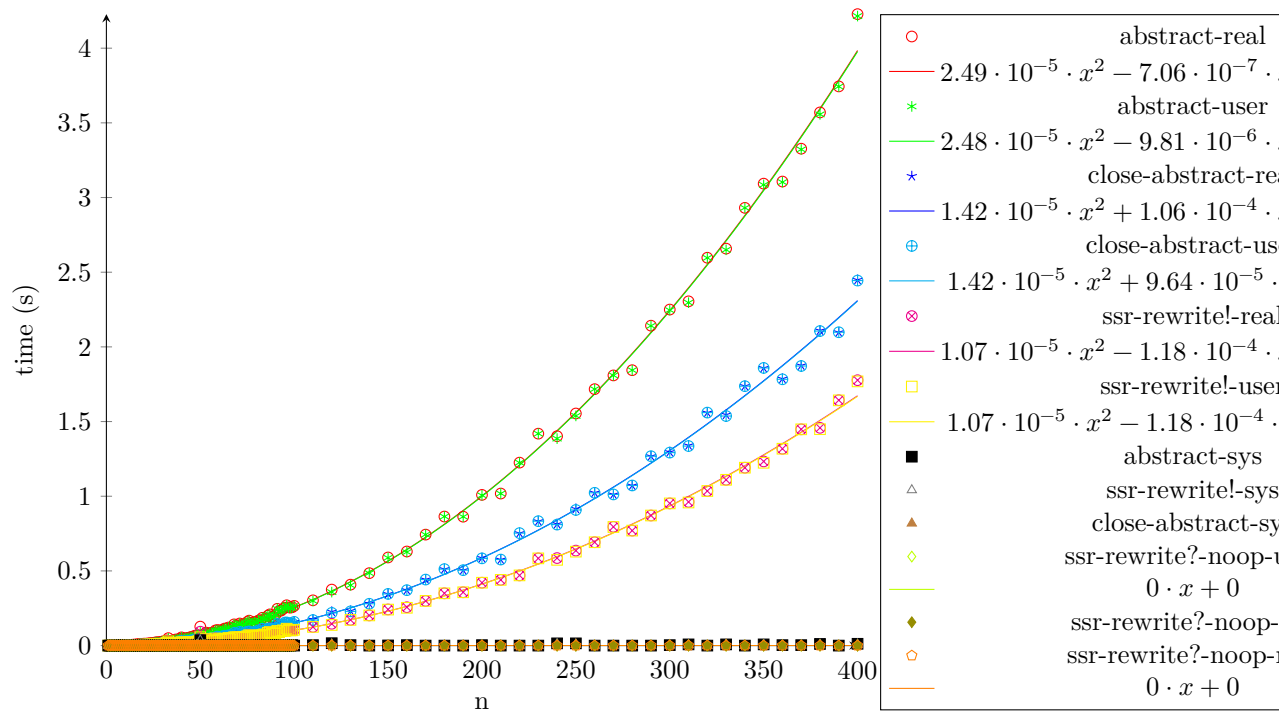Figure 7: timing-rewrite-repeated-app-autorewrite-noop
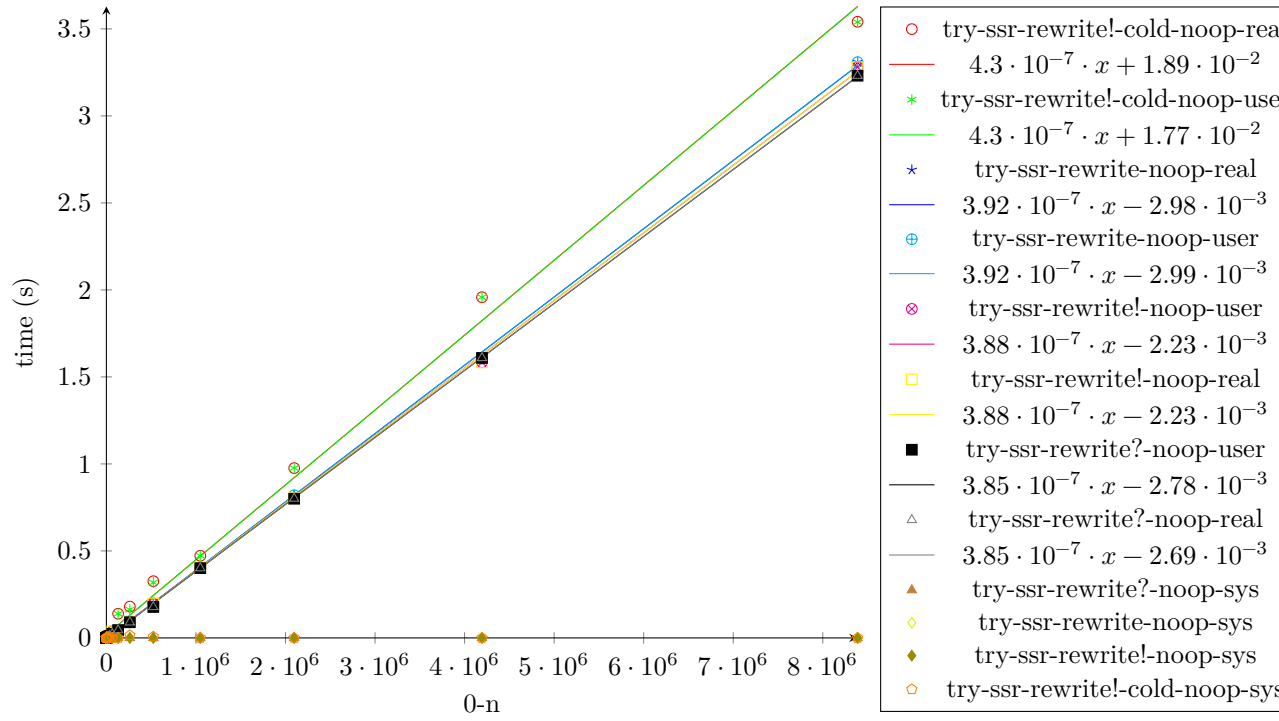
Figure 8: timing-rewrite-repeated-app-ssrrewrite

8

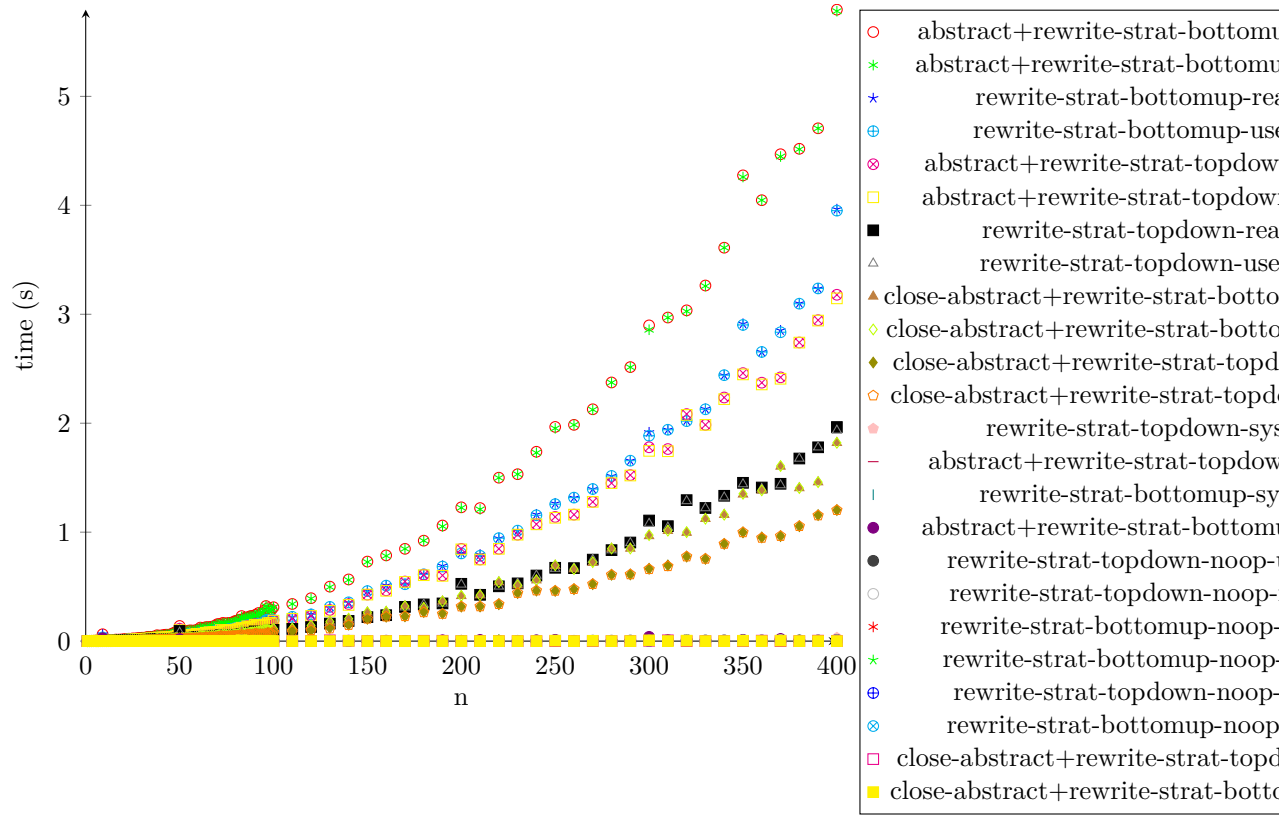Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn 1

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

The legend entries (partially cut off) read:

- abstract+rewrite-strat-bottomu...
- abstract+rewrite-strat-bottomu...
- rewrite-strat-bottomup-rea...
- rewrite-strat-bottomup-use...
- abstract+rewrite-strat-topdow...
- abstract+rewrite-strat-topdow...
- rewrite-strat-topdown-rea...
- rewrite-strat-topdown-use...
- close-abstract+rewrite-strat-botto...
- close-abstract+rewrite-strat-botto...
- close-abstract+rewrite-strat-topd...
- close-abstract+rewrite-strat-topd...
- rewrite-strat-topdown-sys...
- abstract+rewrite-strat-topdow...
- rewrite-strat-bottomup-sy...
- abstract+rewrite-strat-bottomu...
- rewrite-strat-topdown-noop-...
- rewrite-strat-topdown-noop-...
- rewrite-strat-bottomup-noop-...
- rewrite-strat-bottomup-noop-...
- rewrite-strat-topdown-noop-...
- rewrite-strat-bottomup-noop...
- close-abstract+rewrite-strat-topd...
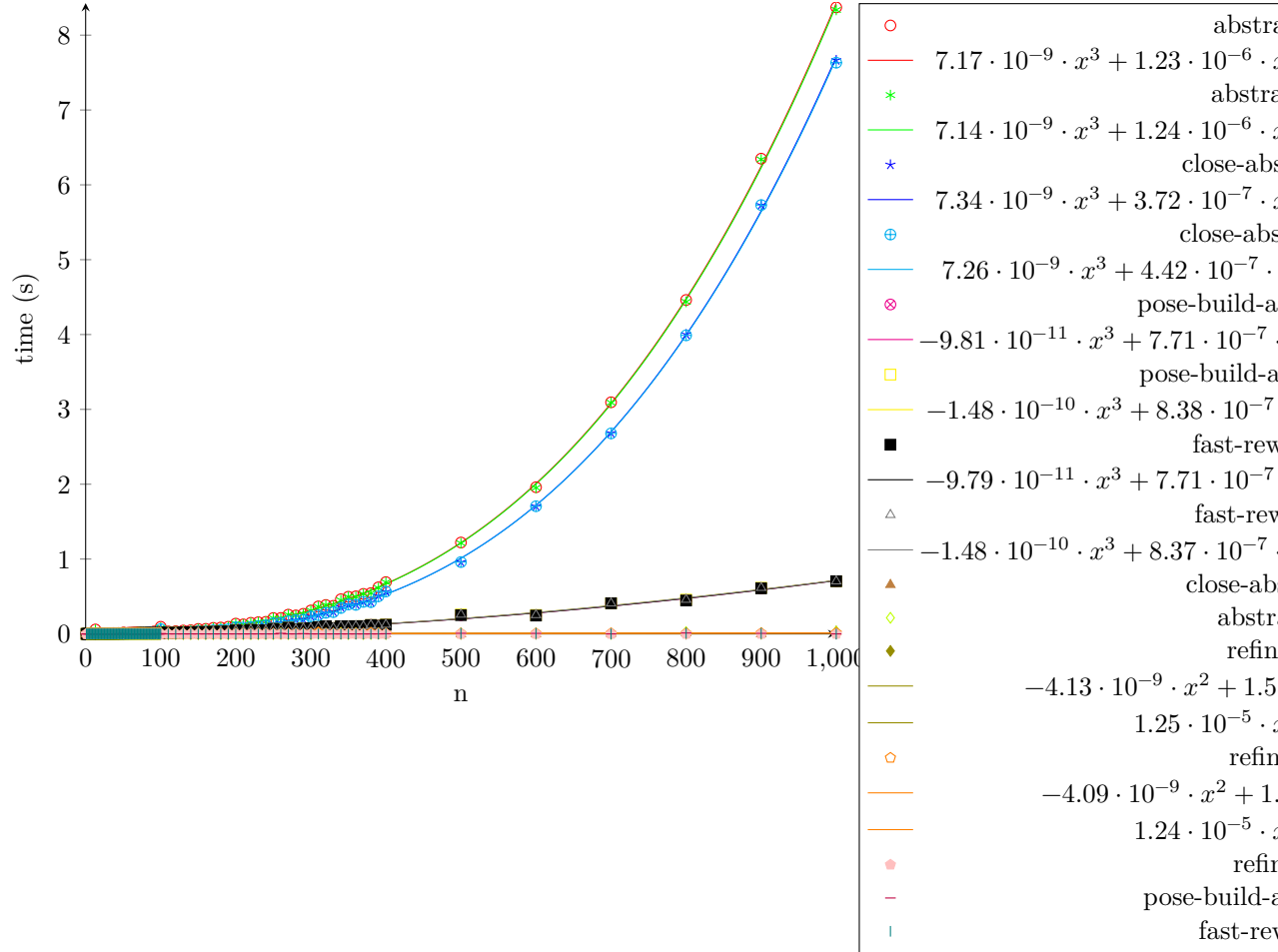- close-abstract+rewrite-strat-botto...

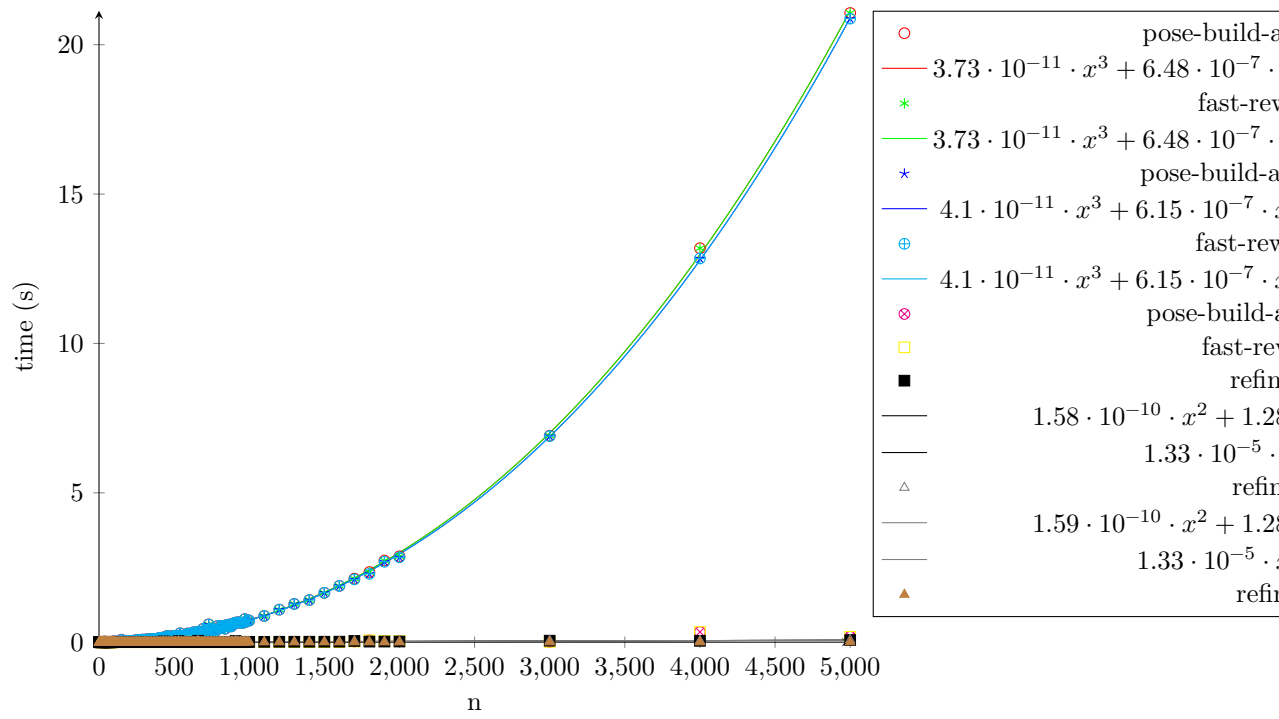Figure 11: timing-rewrite-repeated-app-fast-rewrite

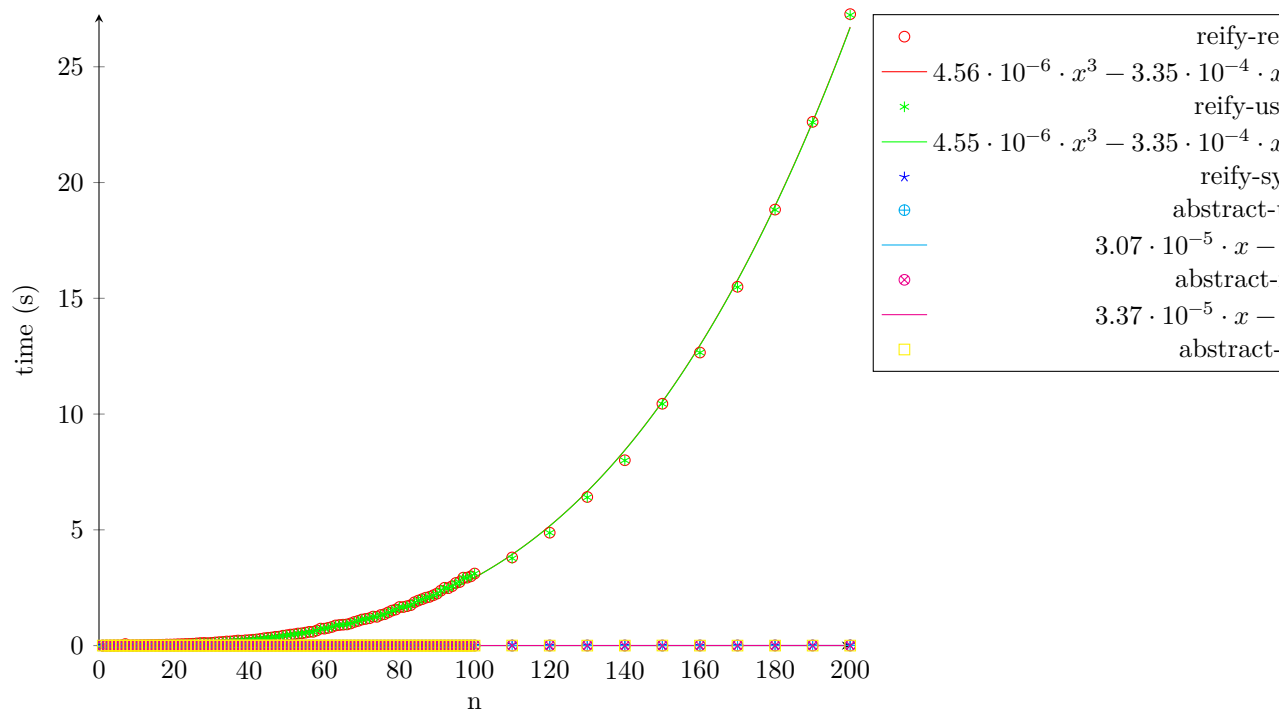Figure 12: timing-rewrite-repeated-app-fast-rewrite-no-abstract
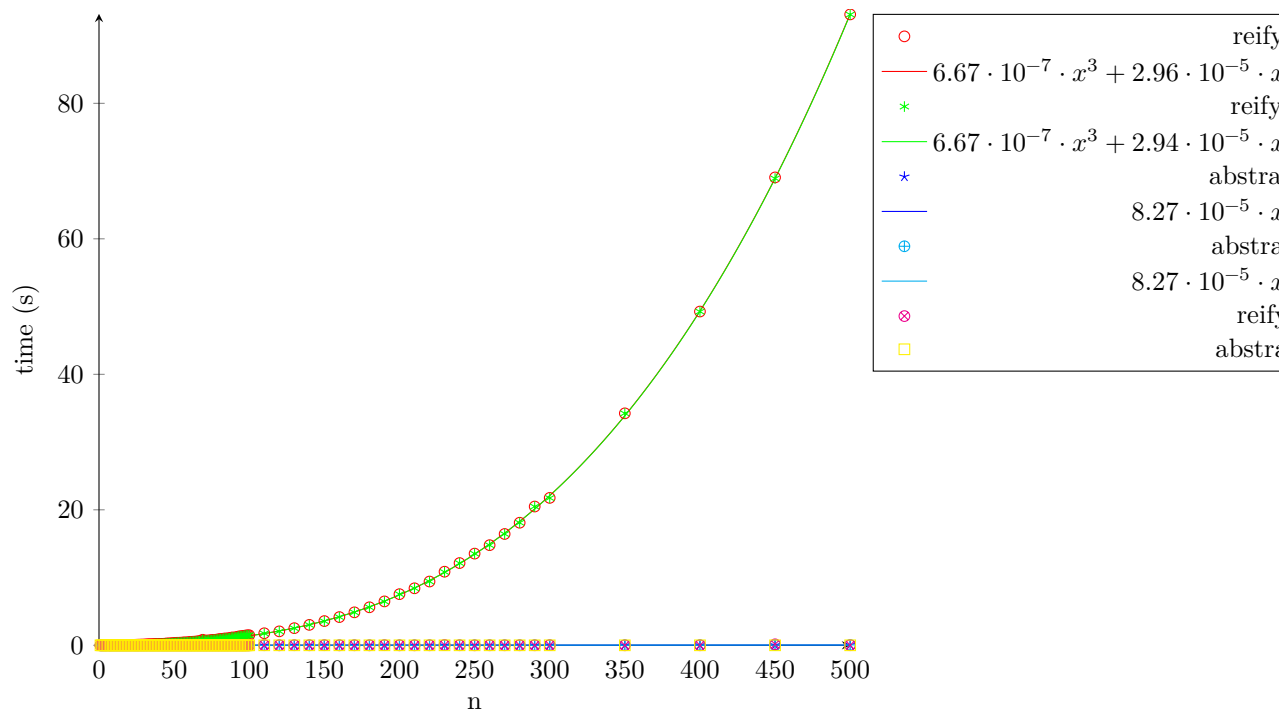
12

Figure 13: timing-typeclass-reification-let-in-HOAS

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

time (s)

n

abstract-real
$2.51 \cdot 10^{-6} \cdot x^2 - 1.62 \cdot 10^{-3}$

abstract-user
$2.52 \cdot 10^{-6} \cdot x^2 - 1.63 \cdot 10^{-3}$

fast-rewrite-real
$2.28 \cdot 10^{-6} \cdot x^2 - 1.67 \cdot 10^{-3}$

fast-rewrite-user
$2.28 \cdot 10^{-6} \cdot x^2 - 1.67 \cdot 10^{-3}$

check-pf-cast-user
$3.59 \cdot 10^{-7} \cdot x^2 - 3.11 \cdot 10^{-4} \cdot x$

check-pf-cast-real
$3.58 \cdot 10^{-7} \cdot x^2 - 3.11 \cdot 10^{-4} \cdot x$

check-admit-cast-user
$3.59 \cdot 10^{-7} \cdot x^2 - 3.11 \cdot 10^{-4} \cdot x$

check-admit-cast-real
$3.59 \cdot 10^{-7} \cdot x^2 - 3.11 \cdot 10^{-4} \cdot x$

type-admit-real
$3.42 \cdot 10^{-7} \cdot x^2 - 2.89 \cdot 10^{-4} \cdot x$

type-admit-user
$3.42 \cdot 10^{-7} \cdot x^2 - 2.89 \cdot 10^{-4} \cdot x$

close-abstract-user
$2.38 \cdot 10^{-7} \cdot x^2 + 4.33 \cdot 10^{-5} \cdot x$

close-abstract-real
$2.38 \cdot 10^{-7} \cdot x^2 + 4.38 \cdot 10^{-5} \cdot x$

type-admit-cast-real
$3 \cdot 10^{-7} \cdot x^2 - 2.27 \cdot 10^{-4} \cdot x$

check-admit-real
$3.14 \cdot 10^{-7} \cdot x^2 - 2.45 \cdot 10^{-4} \cdot x$

check-admit-user
$3.14 \cdot 10^{-7} \cdot x^2 - 2.45 \cdot 10^{-4} \cdot x$

type-admit-cast-user
$3 \cdot 10^{-7} \cdot x^2 - 2.27 \cdot 10^{-4} \cdot x$

type-pf-cast-user
$3.07 \cdot 10^{-7} \cdot x^2 - 2.25 \cdot 10^{-4} \cdot x$

type-pf-cast-real
$3.07 \cdot 10^{-7} \cdot x^2 - 2.25 \cdot 10^{-4} \cdot x$

refine-user
$2.89 \cdot 10^{-7} \cdot x^2 - 2.04 \cdot 10^{-4} \cdot x$
$3.97 \cdot 10^{-4} \cdot x - 4.76 \cdot$

refine-real
$2.89 \cdot 10^{-7} \cdot x^2 - 2.03 \cdot 10^{-4} \cdot x$
$3.97 \cdot 10^{-4} \cdot x - 4.75 \cdot$

build-eval-thunk-user
$9.43 \cdot 10^{-5} \cdot x - 4.99 \cdot$

build-eval-thunk-real
$9.45 \cdot 10^{-5} \cdot x - 4.38 \cdot$

build-thunk-user
$9.35 \cdot 10^{-5} \cdot x - 5.72 \cdot$

build-thunk-real
$9.38 \cdot 10^{-5} \cdot x - 5.14 \cdot$

check-I-user