Figure 1: timing-pattern

1

Figure 2: timing-n-polymorphic-universes param-1-n   0
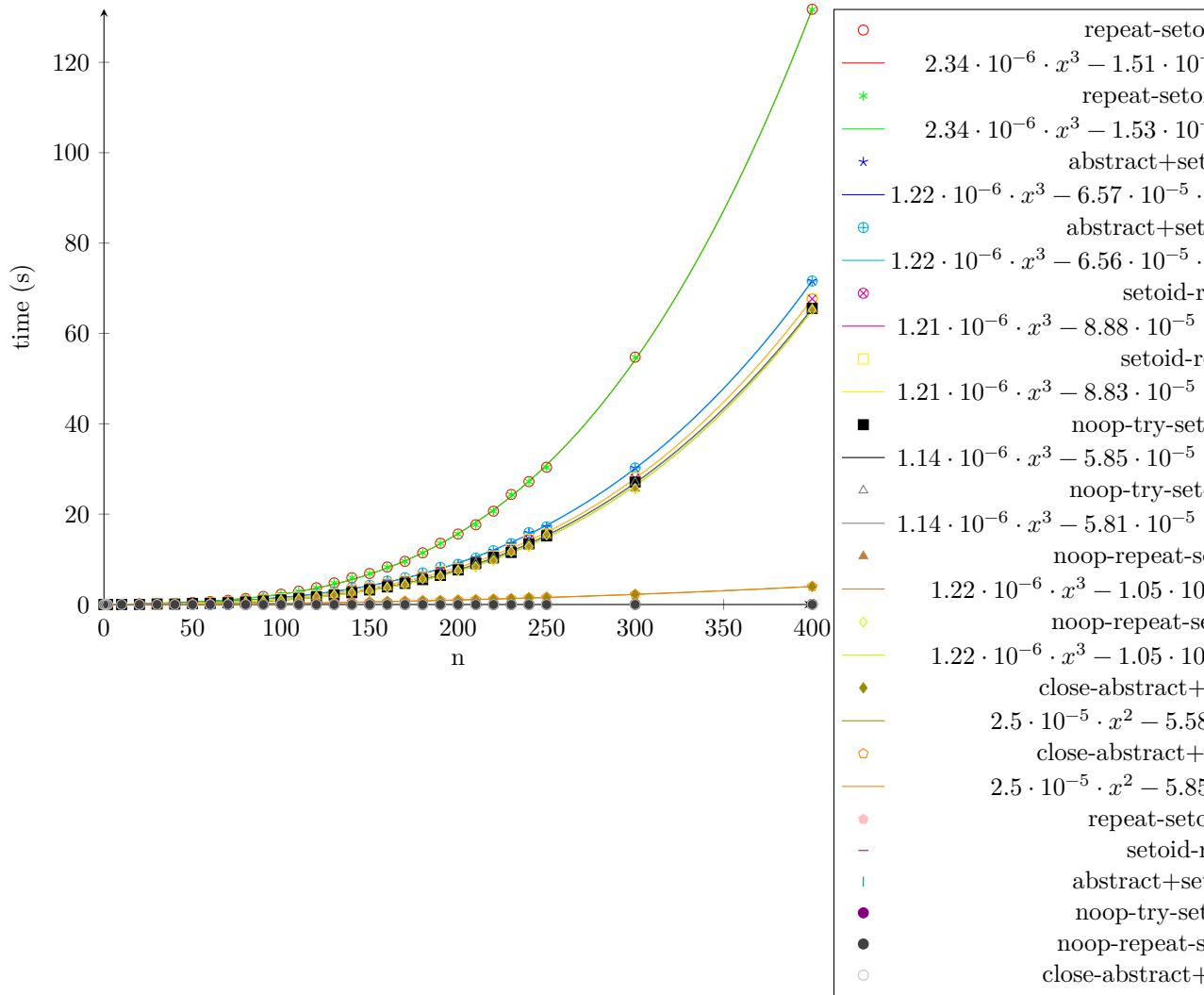
The legend in the figure contains the following entries:

- abstract-real
- $1.13 \cdot 10^{-7} \cdot x^2 + 3.72 \cdot 10^{-4} \cdot x$
- abstract-user
- $1.13 \cdot 10^{-7} \cdot x^2 + 3.71 \cdot 10^{-4} \cdot x$
- close-abstract-real
- $1.13 \cdot 10^{-7} \cdot x^2 + 2.85 \cdot 10^{-4} \cdot x$
- close-abstract-user
- $1.13 \cdot 10^{-7} \cdot x^2 + 2.82 \cdot 10^{-4} \cdot x$
- exact-real
- $8.95 \cdot 10^{-5} \cdot x - 5.51$
- exact-user
- $8.81 \cdot 10^{-5} \cdot x - 5.17$
- abstract-sys
- close-abstract-sys
- exact-sys

time (s)

120

100

80

60

40

20

0

0   50   100   150   200   250   300   350   400

n

repeat-seto

$2.34 \cdot 10^{-6} \cdot x^3 - 1.51 \cdot 10^{-}$

repeat-seto

$2.34 \cdot 10^{-6} \cdot x^3 - 1.53 \cdot 10^{-}$

abstract+set

$1.22 \cdot 10^{-6} \cdot x^3 - 6.57 \cdot 10^{-5} \cdot$

abstract+set

$1.22 \cdot 10^{-6} \cdot x^3 - 6.56 \cdot 10^{-5} \cdot$

setoid-r

$1.21 \cdot 10^{-6} \cdot x^3 - 8.88 \cdot 10^{-5}$

setoid-r

$1.21 \cdot 10^{-6} \cdot x^3 - 8.83 \cdot 10^{-5}$

noop-try-set

$1.14 \cdot 10^{-6} \cdot x^3 - 5.85 \cdot 10^{-5}$

noop-try-set

$1.14 \cdot 10^{-6} \cdot x^3 - 5.81 \cdot 10^{-5}$

noop-repeat-s

$1.22 \cdot 10^{-6} \cdot x^3 - 1.05 \cdot 10$

noop-repeat-s

$1.22 \cdot 10^{-6} \cdot x^3 - 1.05 \cdot 10$

close-abstract+

$2.5 \cdot 10^{-5} \cdot x^2 - 5.58$

close-abstract+

$2.5 \cdot 10^{-5} \cdot x^2 - 5.85$

repeat-seto

setoid-r

abstract+set

noop-try-set

noop-repeat-s

close-abstract+

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

3
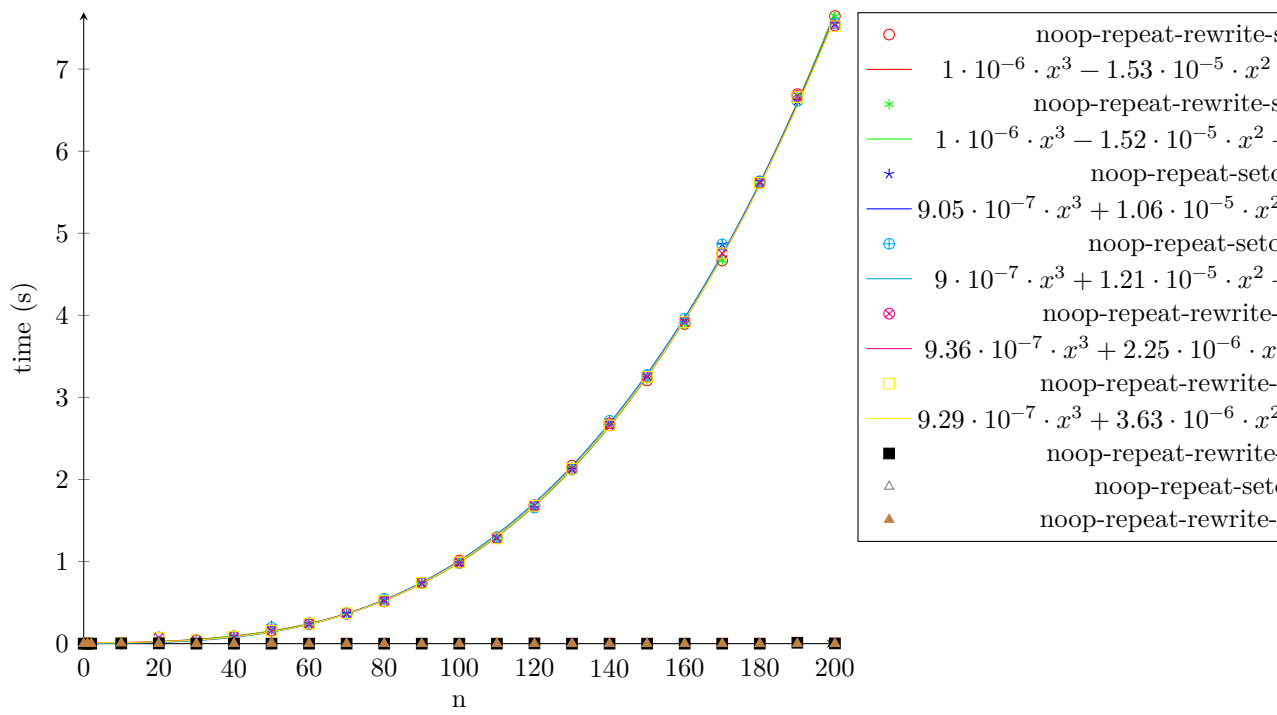
Figure 4: timing-repeat-setoid-rewrite-under-binders-noop

The legend entries read:

- ○ noop-repeat-rewrite-s
- $1 \cdot 10^{-6} \cdot x^3 - 1.53 \cdot 10^{-5} \cdot x^2$
- ∗ noop-repeat-rewrite-s
- $1 \cdot 10^{-6} \cdot x^3 - 1.52 \cdot 10^{-5} \cdot x^2$
- ∗ noop-repeat-set
- $9.05 \cdot 10^{-7} \cdot x^3 + 1.06 \cdot 10^{-5} \cdot x^2$
- ⊕ noop-repeat-set
- $9 \cdot 10^{-7} \cdot x^3 + 1.21 \cdot 10^{-5} \cdot x^2$
- ⊗ noop-repeat-rewrite-
- $9.36 \cdot 10^{-7} \cdot x^3 + 2.25 \cdot 10^{-6} \cdot x$
- □ noop-repeat-rewrite-
- $9.29 \cdot 10^{-7} \cdot x^3 + 3.63 \cdot 10^{-6} \cdot x^2$
- ■ noop-repeat-rewrite-
- △ noop-repeat-set
- ▲ noop-repeat-rewrite-

4

Figure 5: timing-rewrite-strat-under-binders
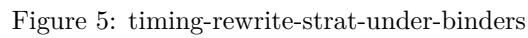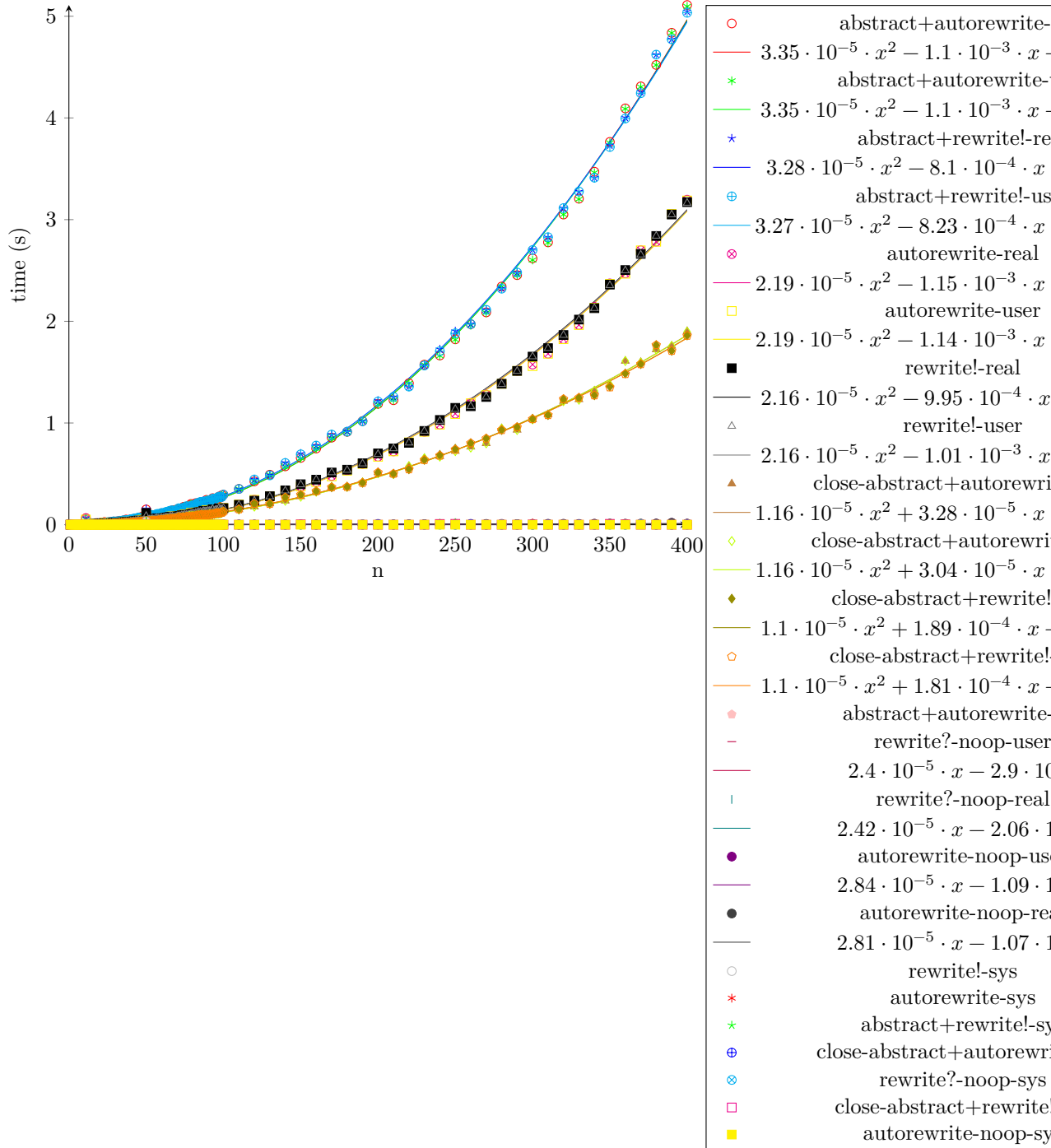
Figure 6: timing-rewrite-repeated-app-autorewrite

The legend of the figure contains the following entries:

- abstract+autorewrite-
- $3.35 \cdot 10^{-5} \cdot x^2 - 1.1 \cdot 10^{-3} \cdot x -$
- abstract+autorewrite-
- $3.35 \cdot 10^{-5} \cdot x^2 - 1.1 \cdot 10^{-3} \cdot x -$
- abstract+rewrite!-re
- $3.28 \cdot 10^{-5} \cdot x^2 - 8.1 \cdot 10^{-4} \cdot x$
- abstract+rewrite!-us
- $3.27 \cdot 10^{-5} \cdot x^2 - 8.23 \cdot 10^{-4} \cdot x$
- autorewrite-real
- $2.19 \cdot 10^{-5} \cdot x^2 - 1.15 \cdot 10^{-3} \cdot x$
- autorewrite-user
- $2.19 \cdot 10^{-5} \cdot x^2 - 1.14 \cdot 10^{-3} \cdot x$
- rewrite!-real
- $2.16 \cdot 10^{-5} \cdot x^2 - 9.95 \cdot 10^{-4} \cdot x$
- rewrite!-user
- $2.16 \cdot 10^{-5} \cdot x^2 - 1.01 \cdot 10^{-3} \cdot x$
- close-abstract+autorewri
- $1.16 \cdot 10^{-5} \cdot x^2 + 3.28 \cdot 10^{-5} \cdot x$
- close-abstract+autorewri
- $1.16 \cdot 10^{-5} \cdot x^2 + 3.04 \cdot 10^{-5} \cdot x$
- close-abstract+rewrite!
- $1.1 \cdot 10^{-5} \cdot x^2 + 1.89 \cdot 10^{-4} \cdot x -$
- close-abstract+rewrite!
- $1.1 \cdot 10^{-5} \cdot x^2 + 1.81 \cdot 10^{-4} \cdot x -$
- abstract+autorewrite-
- rewrite?-noop-user
- $2.4 \cdot 10^{-5} \cdot x - 2.9 \cdot 10$
- rewrite?-noop-real
- $2.42 \cdot 10^{-5} \cdot x - 2.06 \cdot 1$
- autorewrite-noop-use
- $2.84 \cdot 10^{-5} \cdot x - 1.09 \cdot 1$
- autorewrite-noop-rea
- $2.81 \cdot 10^{-5} \cdot x - 1.07 \cdot 1$
- rewrite!-sys
- autorewrite-sys
- abstract+rewrite!-sy
- close-abstract+autorewri
- rewrite?-noop-sys
- close-abstract+rewrite!
- autorewrite-noop-sy

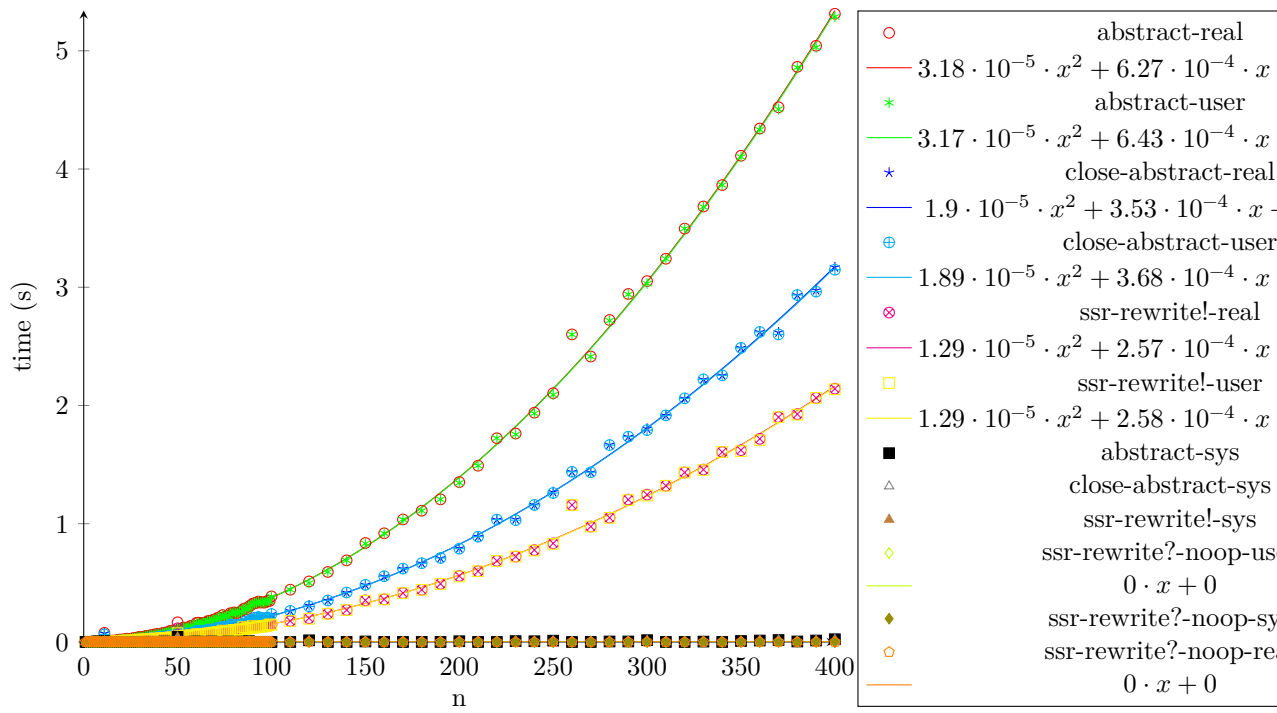Figure 7: timing-rewrite-repeated-app-autorewrite-noop

Figure 8: timing-rewrite-repeated-app-ssrrewrite
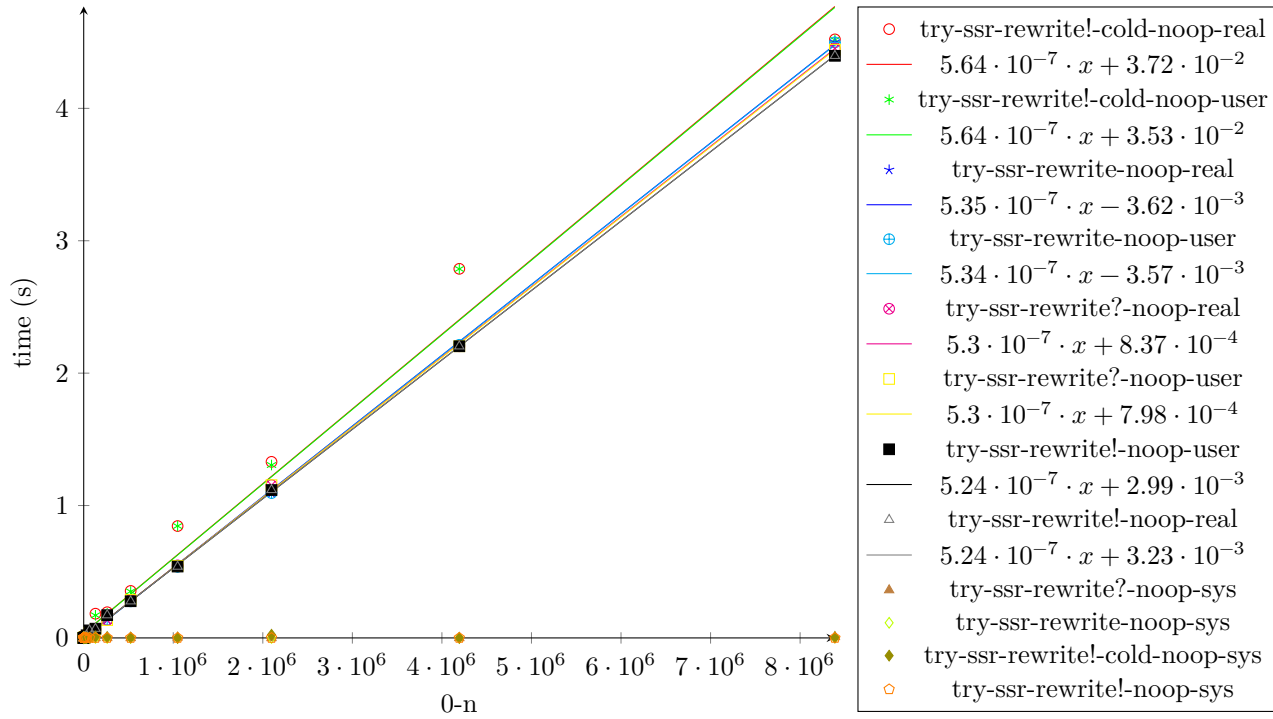
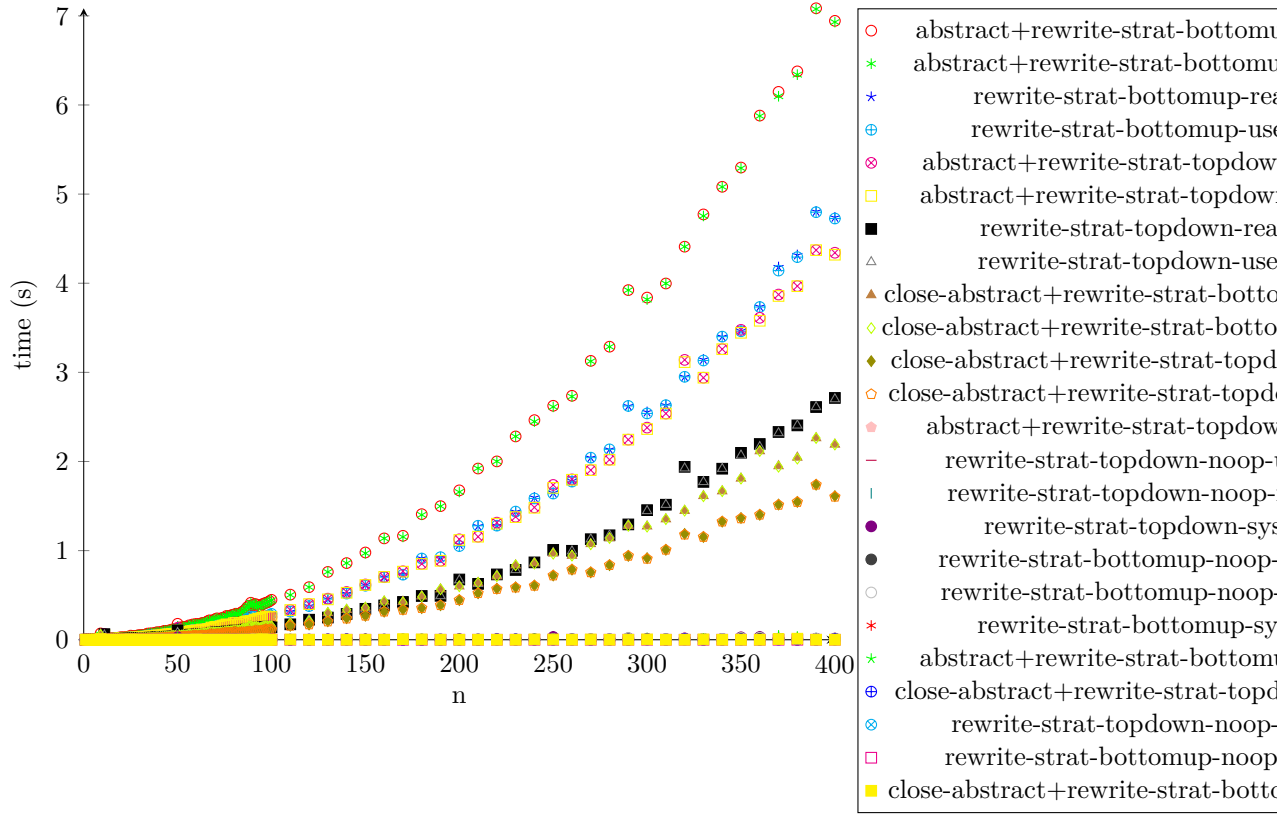Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn 1

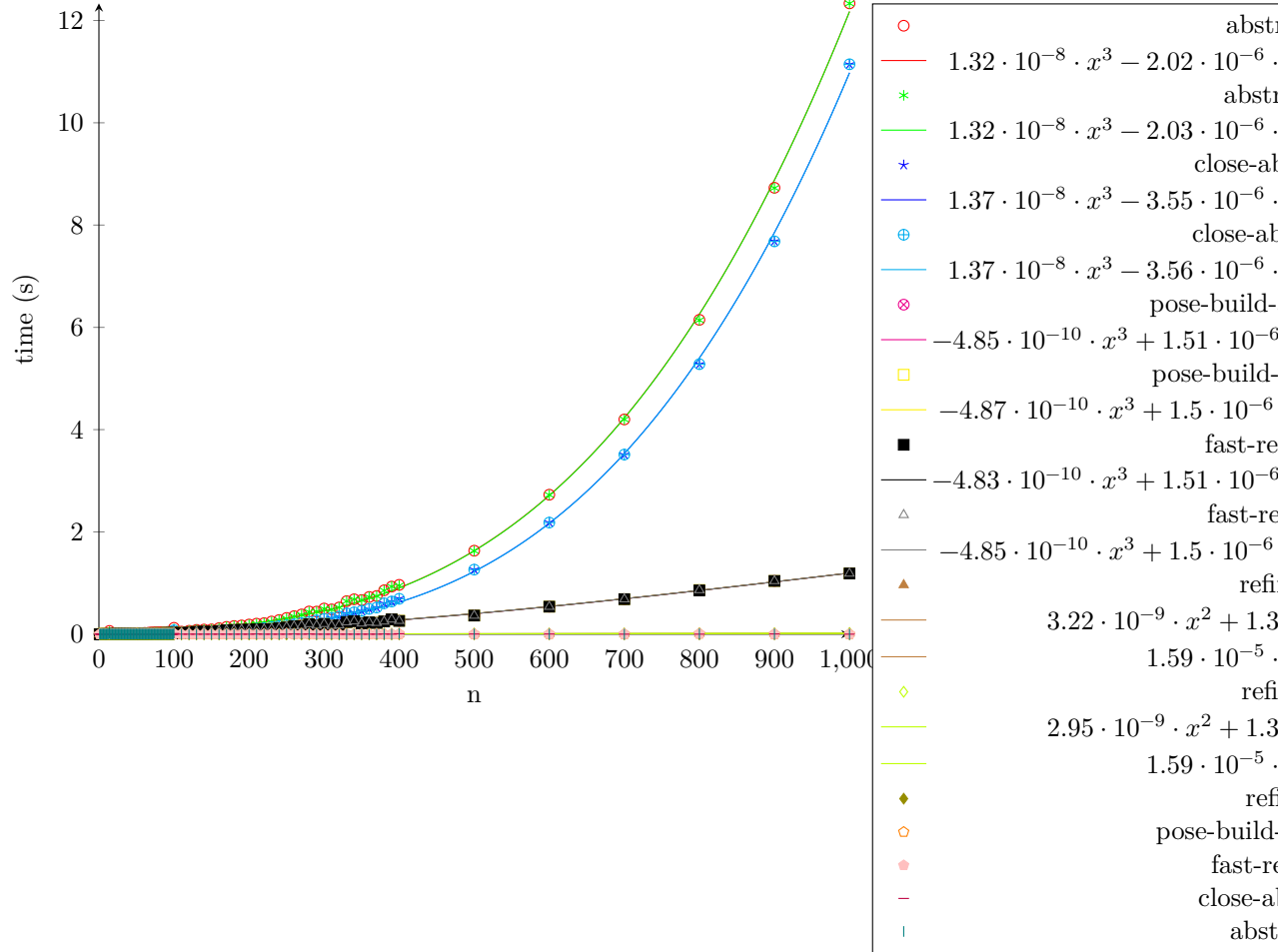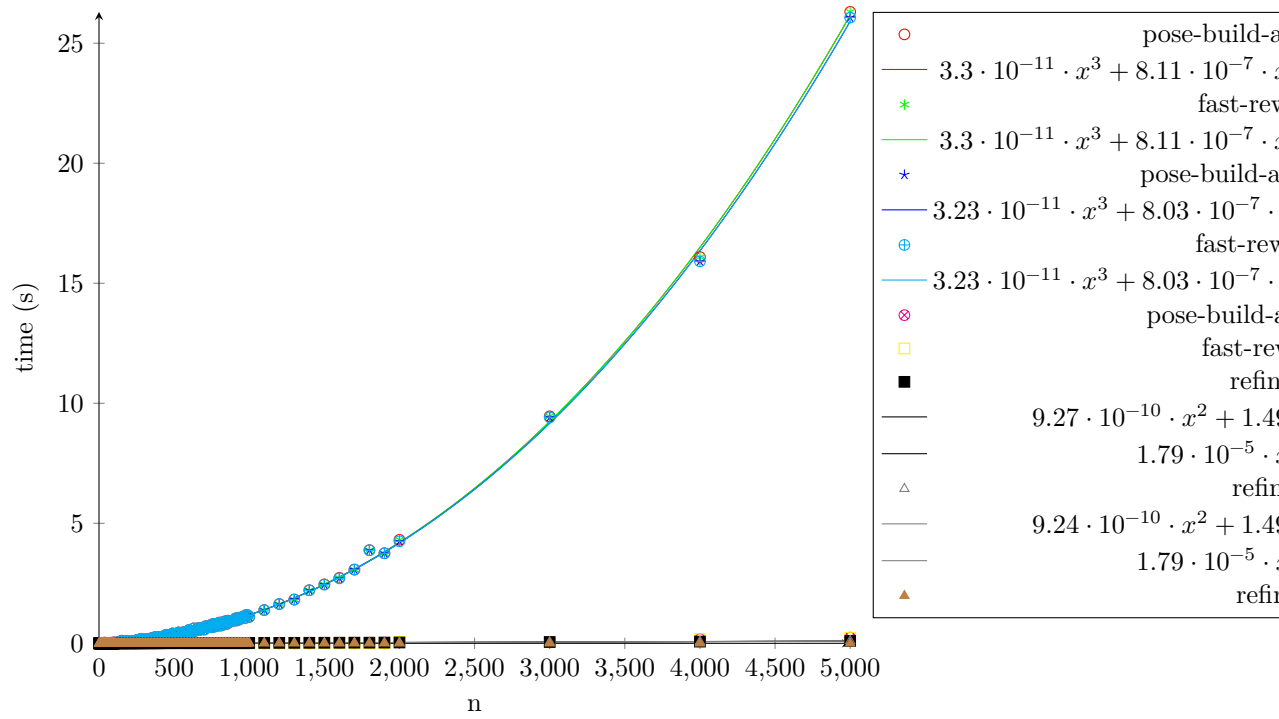Figure 10: timing-rewrite-repeated-app-rewrite-strat

The legend entries (partially cut off at the right edge) 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...
- ● abstract+rewrite-strat-topdow...
- – rewrite-strat-topdown-noop-...
- | rewrite-strat-topdown-noop-...
- ● rewrite-strat-topdown-sys...
- ● rewrite-strat-bottomup-noop-...
- ○ rewrite-strat-bottomup-noop-...
- ✳ rewrite-strat-bottomup-sy...
- ✳ abstract+rewrite-strat-bottomu...
- ⊕ close-abstract+rewrite-strat-topd...
- ⊗ rewrite-strat-topdown-noop-...
- □ rewrite-strat-bottomup-noop...
- ■ close-abstract+rewrite-strat-botto...

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

11

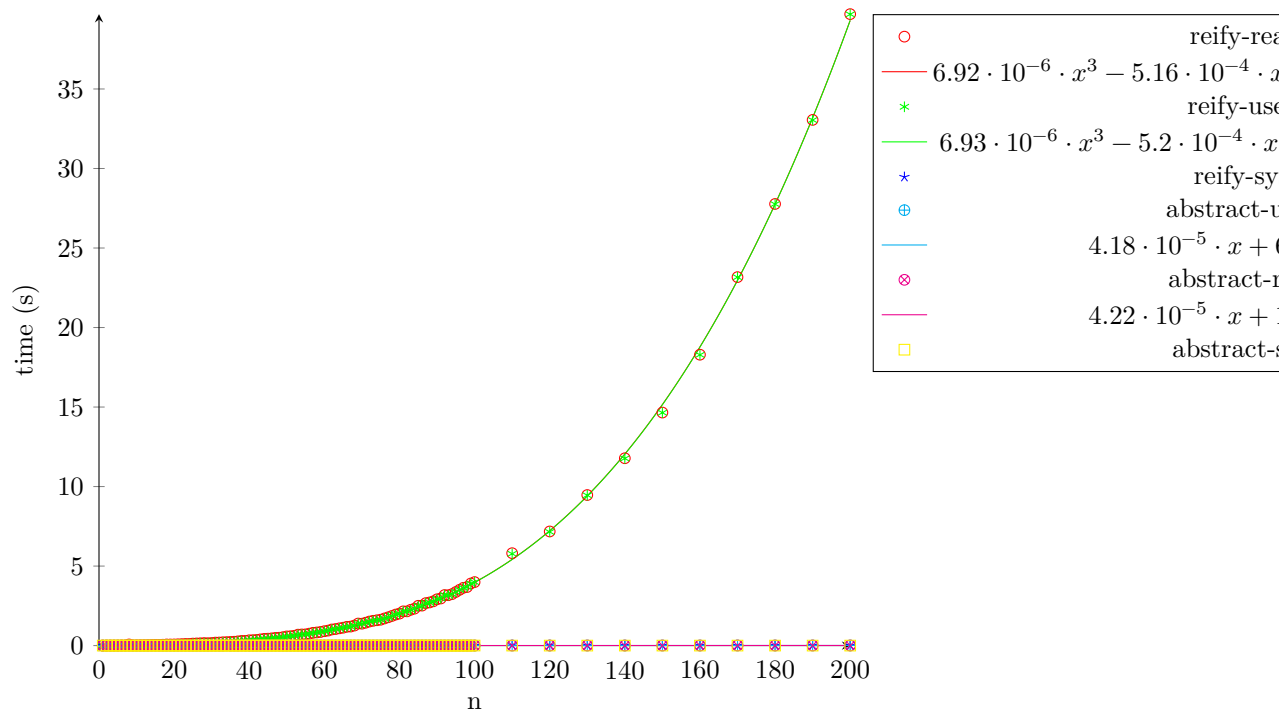Figure 12: timing-rewrite-repeated-app-fast-rewrite-no-abstract
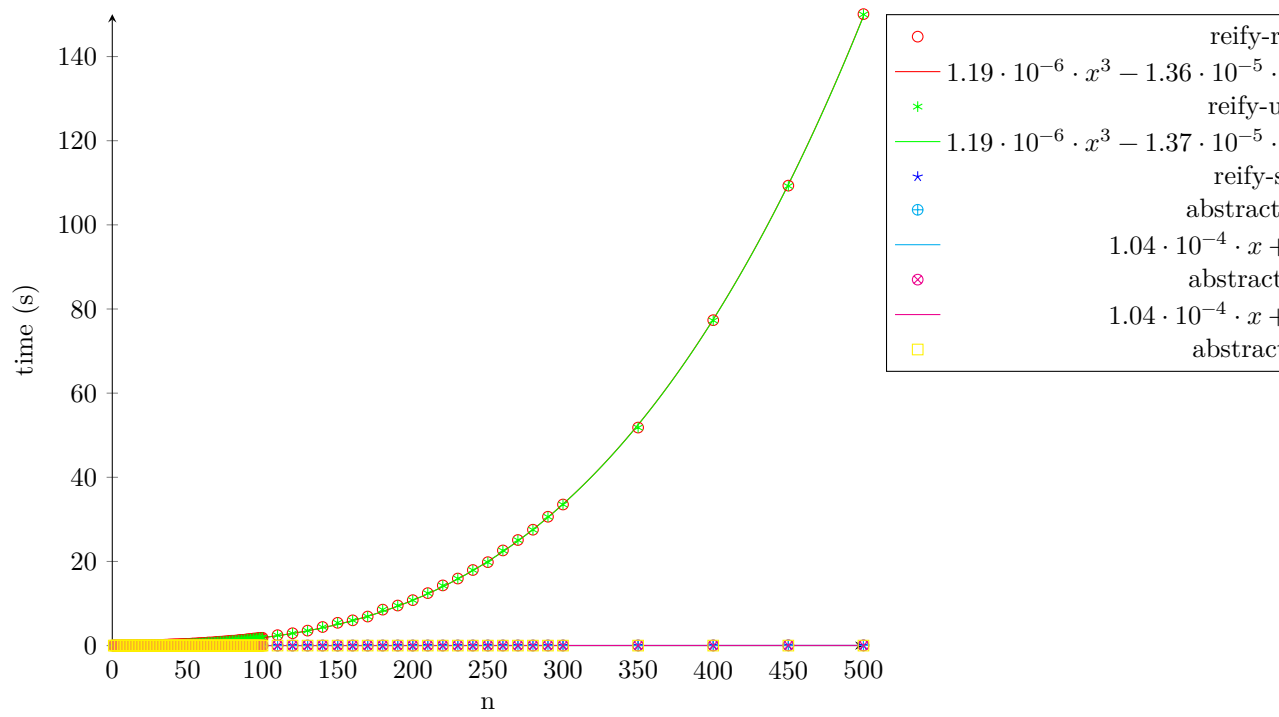
Figure 13: timing-typeclass-reification-let-in-HOAS

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