Figure 1: timing-pattern

1

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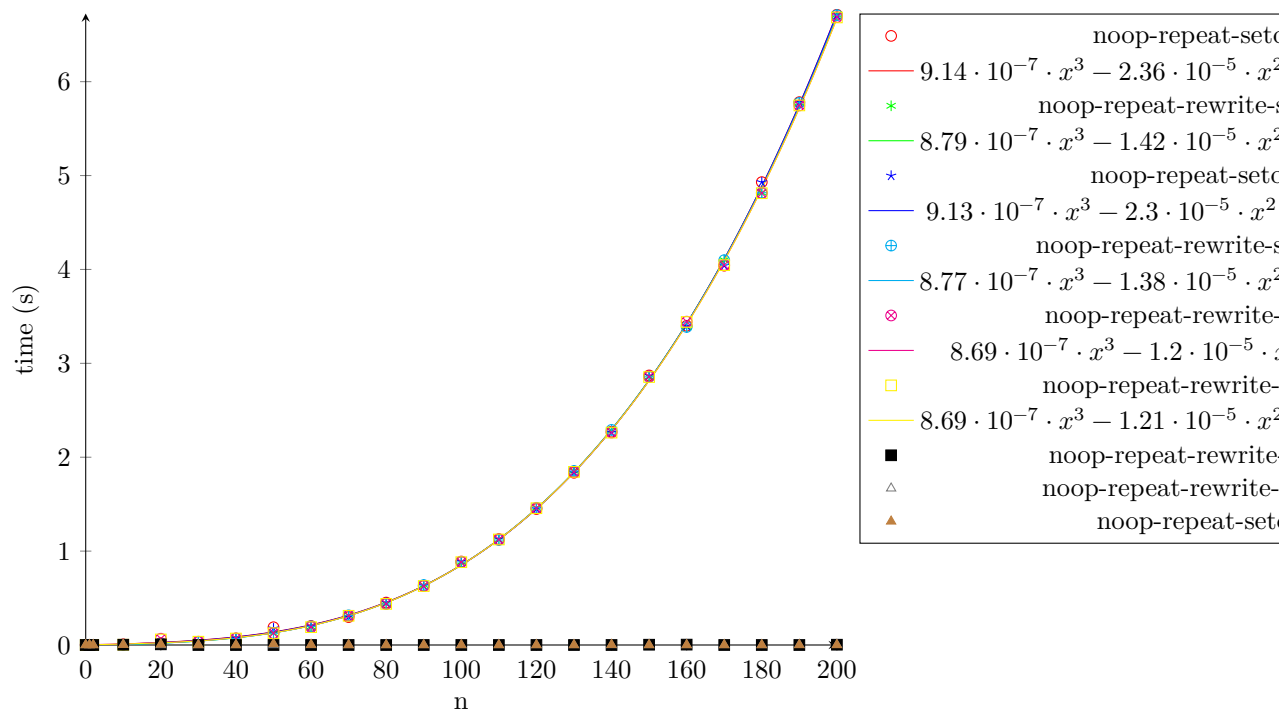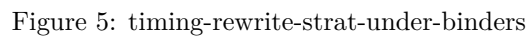
The plot legend contains the following entries:

- abstract-real: $\circ$
- $1.11 \cdot 10^{-7} \cdot x^2 + 2.6 \cdot 10^{-4} \cdot x$
- abstract-user: $*$
- $1.11 \cdot 10^{-7} \cdot x^2 + 2.56 \cdot 10^{-4} \cdot x$
- close-abstract-real: $*$
- $1.11 \cdot 10^{-7} \cdot x^2 + 2.02 \cdot 10^{-4} \cdot x$
- close-abstract-user: $\oplus$
- $1.11 \cdot 10^{-7} \cdot x^2 + 2 \cdot 10^{-4} \cdot x$
- exact-user: $\otimes$
- $5.94 \cdot 10^{-5} \cdot x - 4.44 \cdot$
- exact-real: $\square$
- $5.96 \cdot 10^{-5} \cdot x - 3.38 \cdot$
- close-abstract-sys: $\blacksquare$
- abstract-sys: $\triangle$
- exact-sys: $\blacktriangle$

The vertical axis is labeled "time (s)" ranging from 0 to over 30, and the horizontal axis is labeled "0-univ-count" ranging from 0 to 16,000.

2

time (s)

100

80

60

40

20

0   50   100   150   200   250   300   350   400

n

Legend:

repeat-seto
$1.84 \cdot 10^{-6} \cdot x^3 - 8.65 \cdot 10^{...}$
repeat-seto
$1.84 \cdot 10^{-6} \cdot x^3 - 8.59 \cdot 10^{...}$
abstract+set
$9.01 \cdot 10^{-7} \cdot x^3 + 4.05 \cdot 10^{-7} \cdot$
abstract+set
$9 \cdot 10^{-7} \cdot x^3 + 1.05 \cdot 10^{-6} \cdot x$
setoid-r
$8.97 \cdot 10^{-7} \cdot x^3 - 1.88 \cdot 10^{-5} \cdot$
setoid-r
$8.95 \cdot 10^{-7} \cdot x^3 - 1.8 \cdot 10^{-5} \cdot$
noop-try-set
$9.33 \cdot 10^{-7} \cdot x^3 - 4.44 \cdot 10^{-5} \cdot$
noop-try-set
$9.32 \cdot 10^{-7} \cdot x^3 - 4.45 \cdot 10^{-5} \cdot$
noop-repeat-s
$9.13 \cdot 10^{-7} \cdot x^3 - 3.83 \cdot 10^{-5} \cdot$
noop-repeat-s
$9.12 \cdot 10^{-7} \cdot x^3 - 3.8 \cdot 10^{-5} \cdot$
close-abstract+
$2.18 \cdot 10^{-5} \cdot x^2 - 2.6$
close-abstract+
$2.19 \cdot 10^{-5} \cdot x^2 - 2.7$
repeat-seto
setoid-r
abstract+set
noop-repeat-s
noop-try-set
close-abstract+

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

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

4

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

time (s)

3.5

3

2.5

2

1.5

1

0.5

0

0   50   100   150   200   250   300   350   400

n

abstract+rewrite!-
$2.47 \cdot 10^{-5} \cdot x^2 - 5.23 \cdot 10^{-4} \cdot$
abstract+autorewrit
$2.55 \cdot 10^{-5} \cdot x^2 - 7.35 \cdot 10^{-4} \cdot$
abstract+rewrite!-u
$2.47 \cdot 10^{-5} \cdot x^2 - 5.23 \cdot 10^{-4} \cdot$
abstract+autorewrit
$2.55 \cdot 10^{-5} \cdot x^2 - 7.28 \cdot 10^{-4} \cdot$
rewrite!-real
$1.63 \cdot 10^{-5} \cdot x^2 - 6.02 \cdot 10^{-4} \cdot$
autorewrite-rea
$1.69 \cdot 10^{-5} \cdot x^2 - 7.7 \cdot 10^{-4} \cdot x$
rewrite!-user
$1.63 \cdot 10^{-5} \cdot x^2 - 6.04 \cdot 10^{-4} \cdot$
autorewrite-use
$1.68 \cdot 10^{-5} \cdot x^2 - 7.55 \cdot 10^{-4} \cdot$
close-abstract+rewrit
$8.33 \cdot 10^{-6} \cdot x^2 + 8.11 \cdot 10^{-5} \cdot$
close-abstract+rewrit
$8.32 \cdot 10^{-6} \cdot x^2 + 8.02 \cdot 10^{-5} \cdot$
close-abstract+autorew
$8.66 \cdot 10^{-6} \cdot x^2 + 1.27 \cdot 10^{-5} \cdot$
close-abstract+autorew
$8.67 \cdot 10^{-6} \cdot x^2 + 3.45 \cdot 10^{-6} \cdot$
rewrite!-sys
autorewrite-sys
abstract+rewrite!-
abstract+autorewrit
rewrite?-noop-us
$2.02 \cdot 10^{-5} \cdot x - 1.92$
rewrite?-noop-re
$1.99 \cdot 10^{-5} \cdot x - 1.35$
autorewrite-noop-u
$2.23 \cdot 10^{-5} \cdot x - 8.52$
autorewrite-noop-r
$2.23 \cdot 10^{-5} \cdot x - 8.52$
rewrite?-noop-sy
close-abstract+rewrit
close-abstract+autorew
autorewrite-noop-

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

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

7
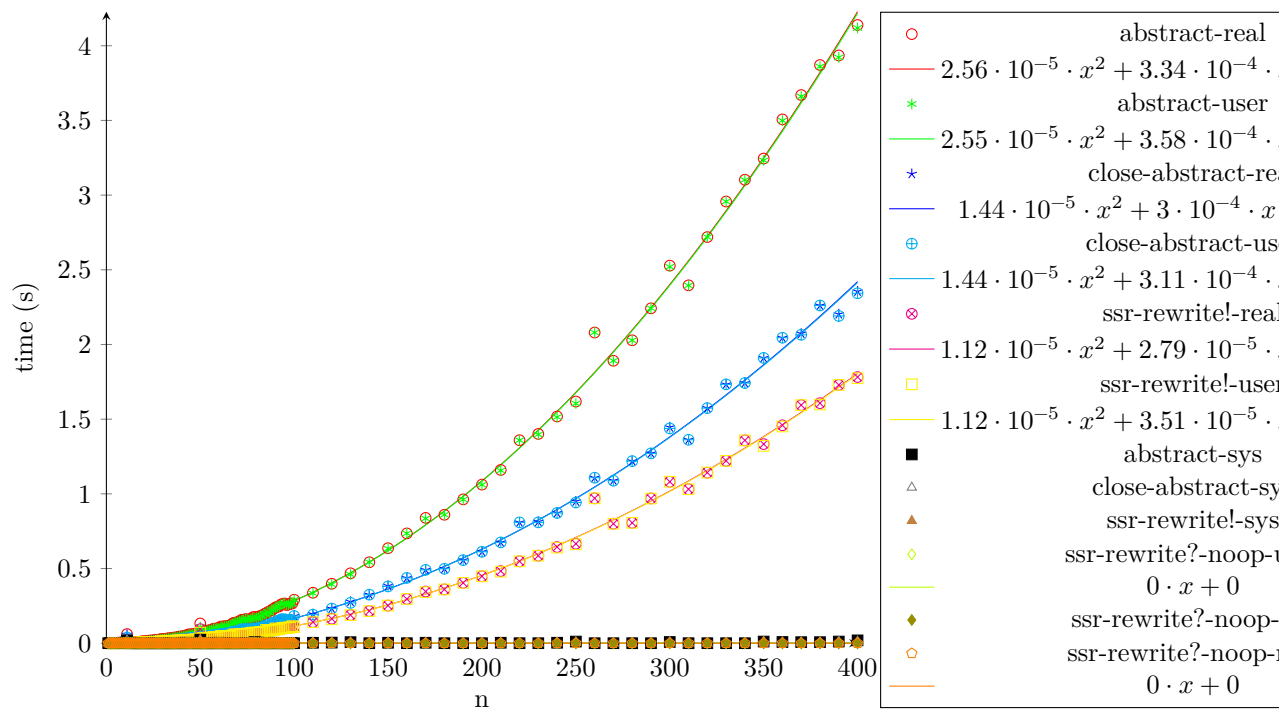
Figure 8: timing-rewrite-repeated-app-ssrrewrite
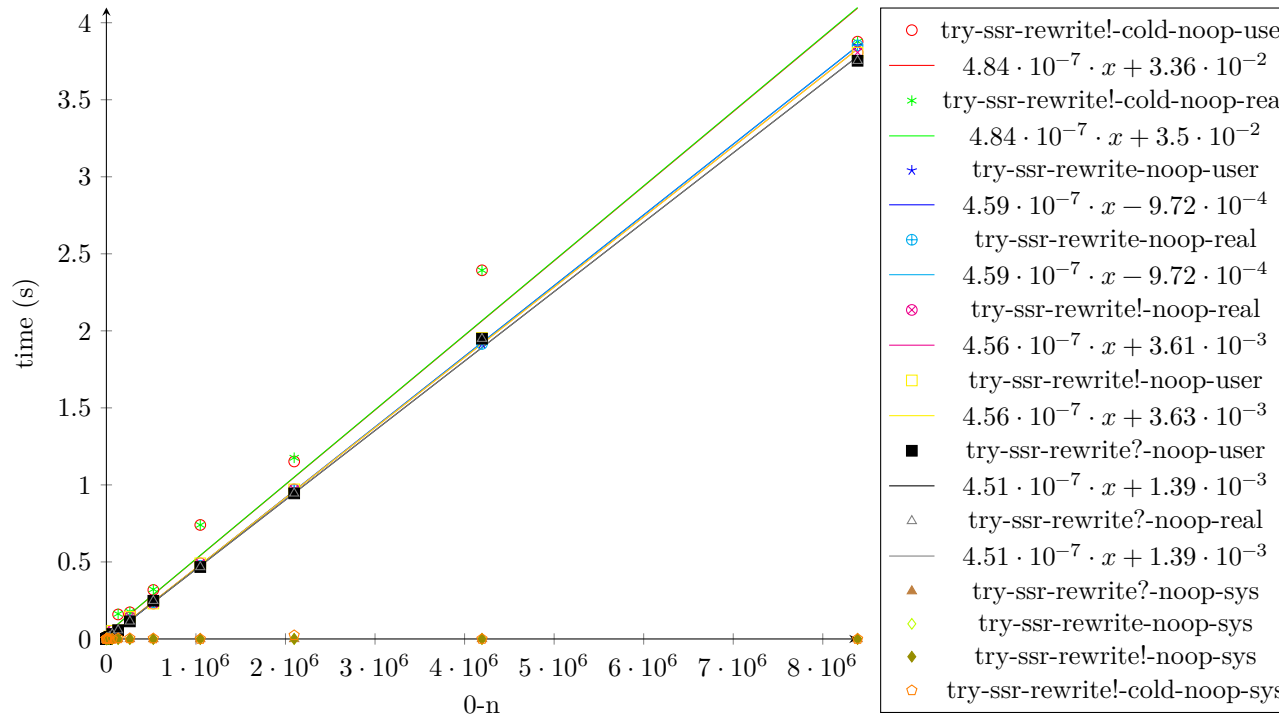
Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn 1
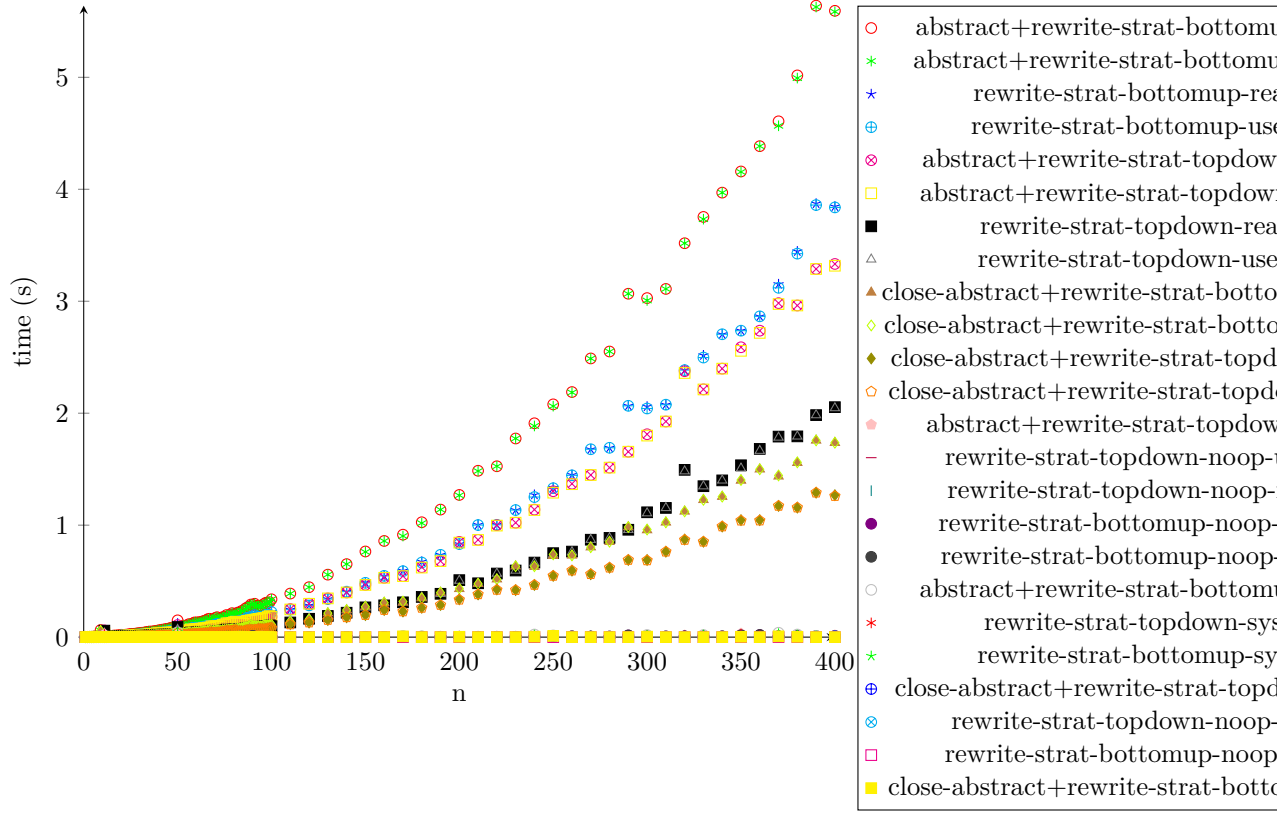
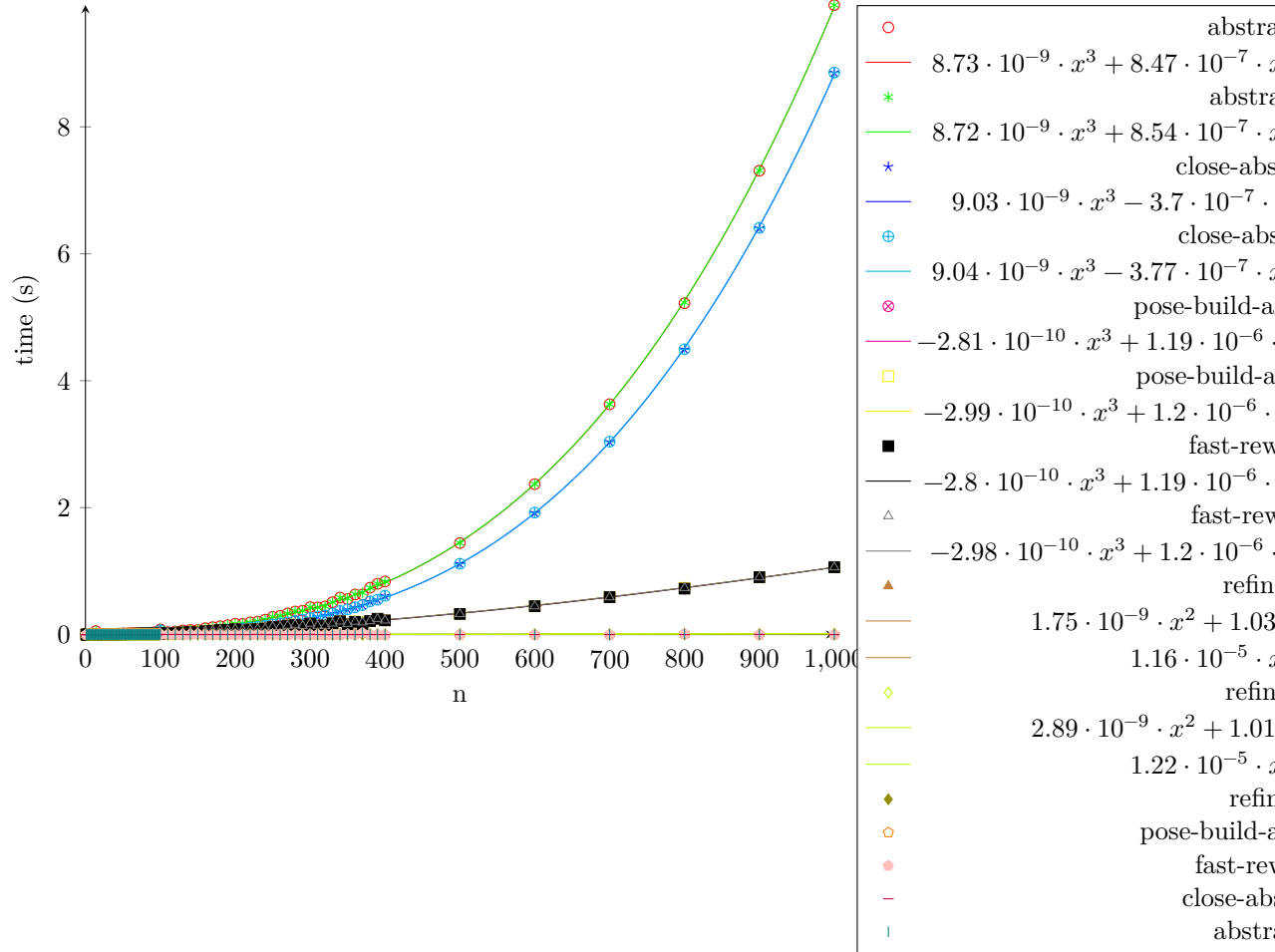Figure 10: timing-rewrite-repeated-app-rewrite-strat

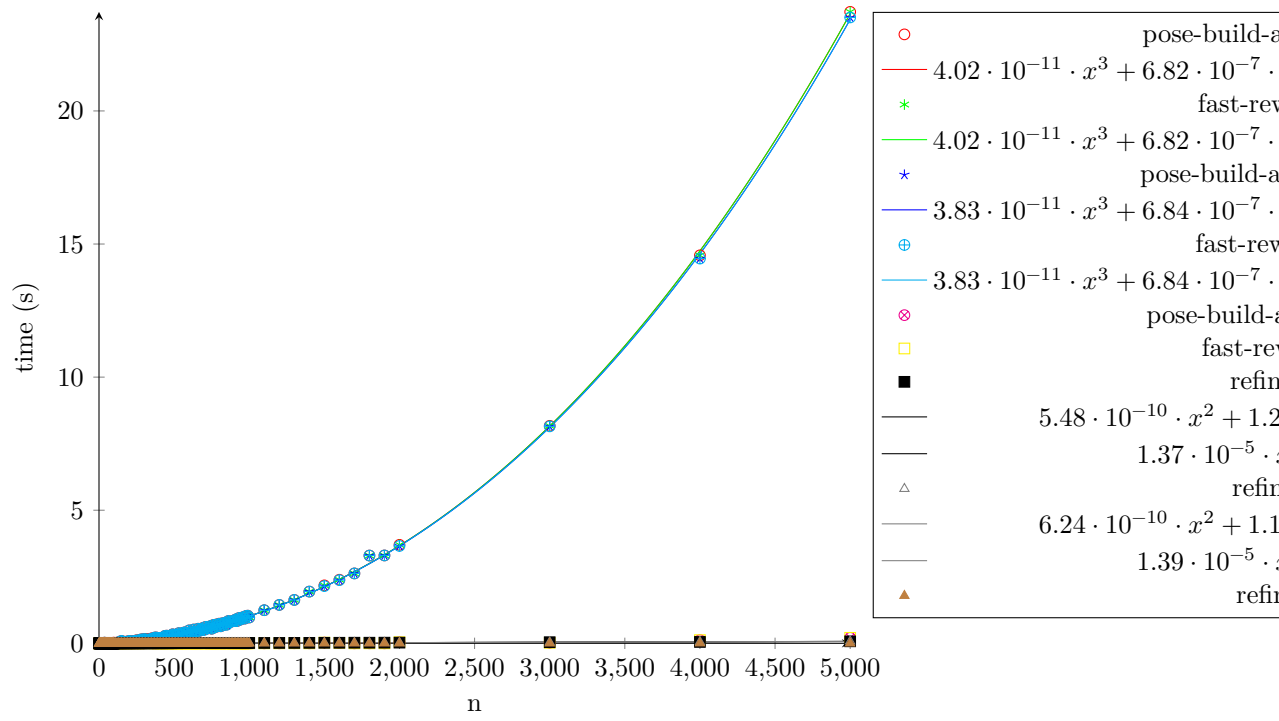Figure 11: timing-rewrite-repeated-app-fast-rewrite

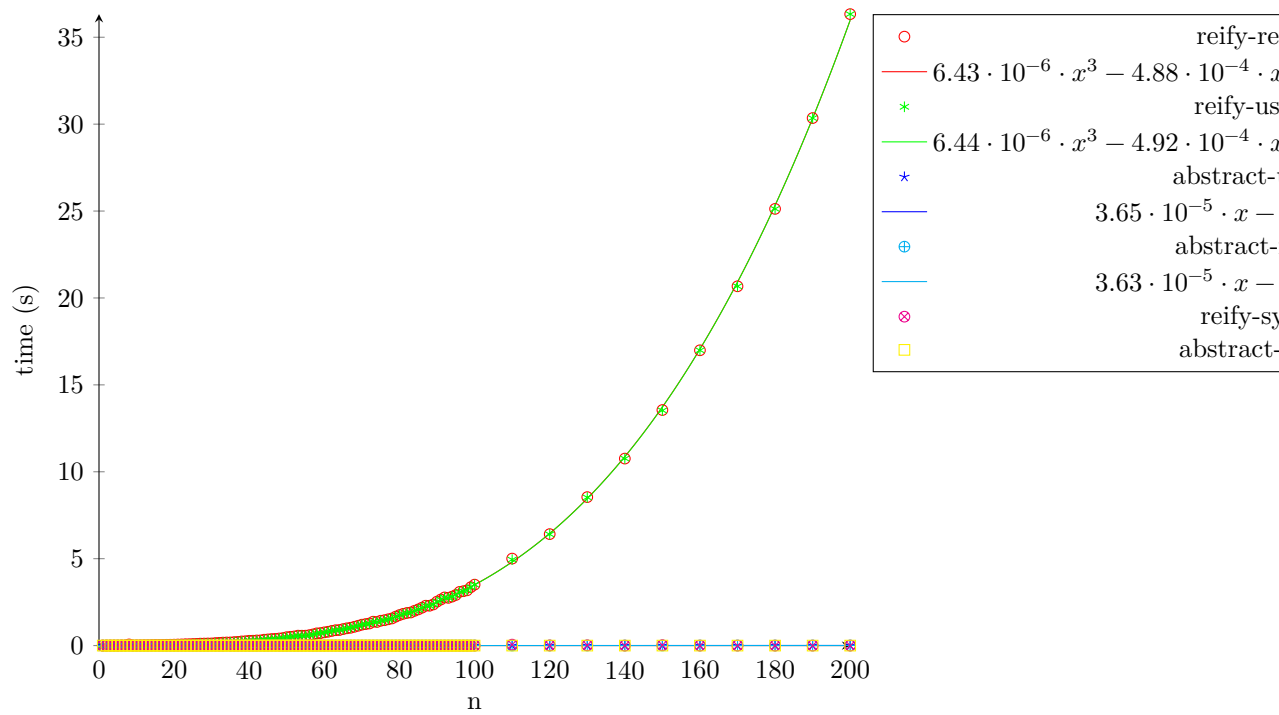Figure 12: timing-rewrite-repeated-app-fast-rewrite-no-abstract

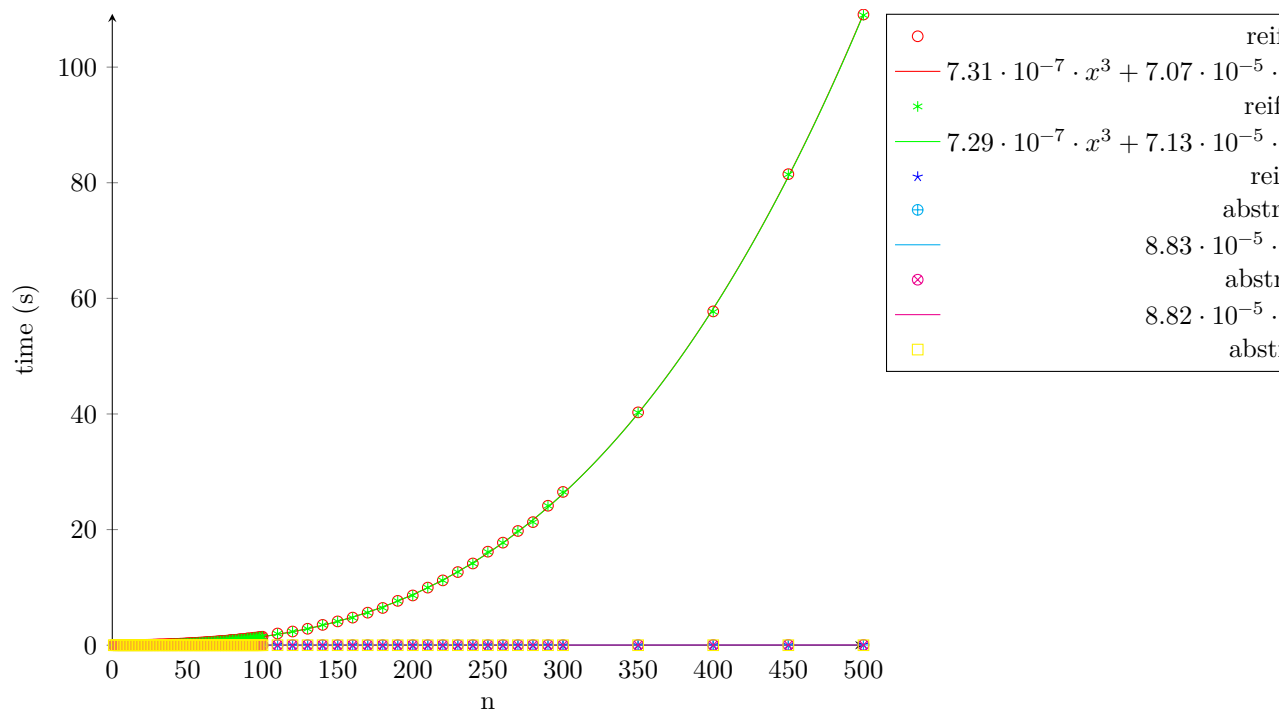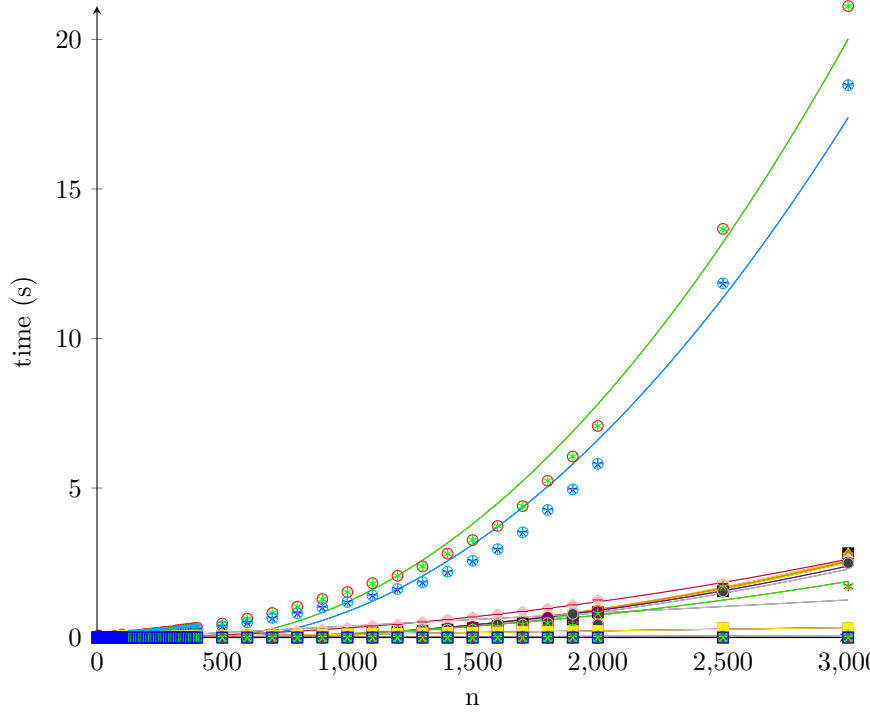Figure 13: timing-typeclass-reification-let-in-HOAS

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

time (s)

20

15

10

5

0

0   500   1,000   1,500   2,000   2,500   3,000

n

abstract-real
$2.8 \cdot 10^{-6} \cdot x^2 - 1.78 \cdot 10^{-3}$

abstract-user
$2.8 \cdot 10^{-6} \cdot x^2 - 1.78 \cdot 10^{-3}$

fast-rewrite-real
$2.52 \cdot 10^{-6} \cdot x^2 - 1.83 \cdot 10^{-3}$

fast-rewrite-user
$2.52 \cdot 10^{-6} \cdot x^2 - 1.83 \cdot 10^{-3}$

type-admit-cast-real
$4.03 \cdot 10^{-7} \cdot x^2 - 3.47 \cdot 10^{-4} \cdot x$

type-admit-cast-user
$4.03 \cdot 10^{-7} \cdot x^2 - 3.47 \cdot 10^{-4} \cdot x$

type-pf-cast-user
$3.93 \cdot 10^{-7} \cdot x^2 - 3.42 \cdot 10^{-4} \cdot x$

type-pf-cast-real
$3.93 \cdot 10^{-7} \cdot x^2 - 3.42 \cdot 10^{-4} \cdot x$

type-admit-user
$3.88 \cdot 10^{-7} \cdot x^2 - 3.36 \cdot 10^{-4} \cdot x$

type-admit-real
$3.88 \cdot 10^{-7} \cdot x^2 - 3.36 \cdot 10^{-4} \cdot x$

check-admit-cast-user
$3.87 \cdot 10^{-7} \cdot x^2 - 3.17 \cdot 10^{-4} \cdot x$

check-admit-cast-real
$3.87 \cdot 10^{-7} \cdot x^2 - 3.17 \cdot 10^{-4} \cdot x$

close-abstract-real
$2.76 \cdot 10^{-7} \cdot x^2 + 4.73 \cdot 10^{-5} \cdot x$

close-abstract-user
$2.76 \cdot 10^{-7} \cdot x^2 + 4.7 \cdot 10^{-5} \cdot x$

check-pf-cast-user
$3.5 \cdot 10^{-7} \cdot x^2 - 2.59 \cdot 10^{-4} \cdot x$

check-pf-cast-real
$3.5 \cdot 10^{-7} \cdot x^2 - 2.6 \cdot 10^{-4} \cdot x$

refine-user
$3.45 \cdot 10^{-7} \cdot x^2 - 2.8 \cdot 10^{-4} \cdot x$
$4.37 \cdot 10^{-4} \cdot x - 5.28 \cdot$

refine-real
$3.45 \cdot 10^{-7} \cdot x^2 - 2.79 \cdot 10^{-4} \cdot x$
$4.37 \cdot 10^{-4} \cdot x - 5.28 \cdot$

check-admit-real
$2.53 \cdot 10^{-7} \cdot x^2 - 1.35 \cdot 10^{-4} \cdot x$

check-admit-user
$2.52 \cdot 10^{-7} \cdot x^2 - 1.34 \cdot 10^{-4} \cdot x$

build-eval-thunk-real
$1.12 \cdot 10^{-4} \cdot x - 7.04 \cdot$

build-thunk-real
$1.12 \cdot 10^{-4} \cdot x - 7.96 \cdot$

build-eval-thunk-user
$1.12 \cdot 10^{-4} \cdot x - 8.24 \cdot$

build-thunk-user
$1.11 \cdot 10^{-4} \cdot x - 9.09 \cdot$

check-L-user