Improving Eliminate-Irrelevance for ACL2

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(Joint Work with J Moore)

The University of Texas at Austin

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   - Section **Example**
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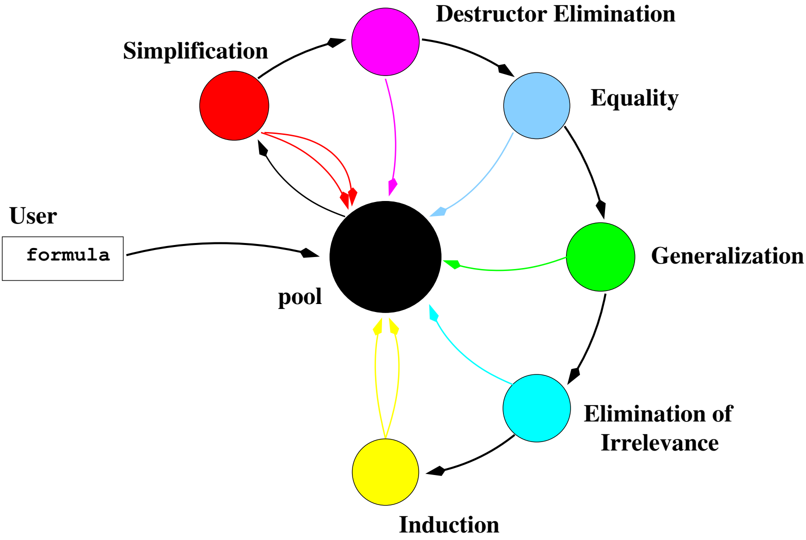
3. Remark on considerations when designing and implementing that change.
   - Section **Further Considerations**

THE ACL2 WATERFALL



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NOTE: Converse need not hold!

Introduction to Eliminate-Irrelevance

Example from the ACL2 regression suite, in:
`books/workshops/2006/cowles-gamboa-euclid/Euclid/fld-u-poly/`.

```
(ld "fuproducto.port")
(in-package "FUPOL")
(rebuild "fuproducto.lisp" '*)
; Succeeds:
(thm ; polinomiop-*
 (polinomiop (* p q)))
; Fails:
(thm ; polinomiop-*
 (polinomiop (* p q))
 :hints
 (("Goal"
   :do-not '(eliminate-irrelevance))))
```

From successful proof, after `(set-gag-mode nil)`:

```
Subgoal *1/2'5'
(IMPLIES (AND (MONOMIOP P1)
              (POLINOMIOP P2)
              (POLINOMIOP V*0))
         (POLINOMIOP (APPEND (*-MONOMIO P1 Q) V*0))).

We suspect that the term (POLINOMIOP P2) is irrelevant to the truth
of this conjecture and throw it out.  We will thus try to prove

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Consider again this goal:

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ACL2 represents this as a clause (disjunction of literals):

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ACL2 drops the component that has a single member.

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These are disjoint sets! So the function symbol `p` is marked as *relevant*, since `(p)` can be useful for rewriting calls that don't involve its (empty set of) variables.

THE NEW HEURISTIC IN MORE DETAIL

Suppose p is a Boolean and we have two terms, as follows.

- Let t_1 be `(FN V1 ... VK)`, an application of a function symbol to distinct variables.
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Then `FN` is *relevant with parity p* whenever t_1 or its negation is a hypothesis (perhaps among others), in which case:

- p = `t` if t_1 is a hypothesis;
- p = `nil` if (not t_1) is a hypothesis.

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Recall our earlier example rewrite rule and the problem goal:

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(P . T)
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For a call u of `FN` on distinct variables:

- literal u is never irrelevant (dropped) if p = nil; and
- literal (not u) is never irrelevant (dropped) if p = t.

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- There is a second criterion for irrelevant components (besides single-literal components based on calls of irrelevant literals): all function symbols the component are among a fixed set of primitives.
  - Unchanged, except that `NOT` has been added to that set (since the other criterion is stricter).

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Regression suite didn't show significant time difference, but let's look at other evidence against slowdown.

TIMING (2)

Stress test:

`(time$ (include-book "doc/top" :dir :system)).`

Showed essentially no change!

```
;;; old
; 782.20 seconds realtime, 777.17 seconds runtime
; (23,612,574,784 bytes allocated).

;;; new
; 775.99 seconds realtime, 772.39 seconds runtime
; (23,952,558,640 bytes allocated).

ACL2 !>(length (global-val 'never-irrelevant-fns-alist
                           (w state)))
11869
ACL2 !>
```

TIMING (3)

Seems like the new global is a non-issue, since a symbol-alist of length 11,869 is trivial to traverse. On my Mac:

```
ACL2 !>:q

Exiting the ACL2 read-eval-print loop.  To re-enter, execute (I
? (defun foo (sym n)
    (let ((x (make-list n :initial-element '(a . b))))
      (time$ (assoc-eq sym x))))
FOO
? (foo 'c 1000000)
; (ASSOC-EQ SYM ...) took
; 0.00 seconds realtime, 0.00 seconds runtime
; (0 bytes allocated).
NIL
? (foo 'c 10000000)
; (ASSOC-EQ SYM ...) took
; 0.03 seconds realtime, 0.03 seconds runtime
; (0 bytes allocated).
NIL
?
```

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Then just as we don't want to drop a hypothesis (negated literal for) `(f3 x)`, we don't want to drop `(f1 x)` or `(f2 x)`.

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Then just as we don't want to drop a hypothesis (negated literal for) `(f3 x)`, we don't want to drop `(f1 x)` or `(f2 x)`.
Answer: Nah, seems like overkill for such a last-ditch heuristic.

CONCLUDING REMARKS

- Bottom line: `Eliminate-irrelevance` is fairly minor. But this tweak, which arose from J's work on `apply$`, was helpful for that work and could help others.
- **Thanks for your attention.**
- (If there's extra time, I could give a sense of the source code (e.g., `eliminate-irrelevance-clause` (through `irrelevant-lits` and `irrelevant-clausep`) and `add-rewrite-rule` (through `add-rewrite-rule2` and `extend-never-irrelevant-fns-alist`).)