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#|

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|#

;; Matt Kaufmann

;; An implementation of permutationp via bags.
```

EVENT: Start with the initial **nqthm** theory.

DEFINITION:
remove1 $(a,\ x)$
$=$ **if** listp (x)
then if car $(x) = a$ **then** cdr (x)
else cons (car (x), remove1 $(a,$ cdr $(x)))$ **endif**
else x **endif**

DEFINITION:
badguy $(x,\ y)$
$=$ **if** listp (x)
then if car $(x) \in y$ **then** badguy (cdr (x), remove1 (car (x), y))
else car (x) **endif**
else 0 **endif**

DEFINITION:
subbagp $(x,\ y)$
$=$ **if** listp (x) **then** (car $(x) \in y$)
$\wedge$ subbagp (cdr (x), remove1 (car (x), y))
else t endif

DEFINITION:
occur $(a,\ x)$
$=$ **if** listp (x)
then if car $(x) = a$ **then** $1 +$ occur $(a,$ cdr $(x))$
else occur $(a,$ cdr $(x))$ **endif**
else 0 **endif**

THEOREM: member-occur
$(a \in x) = (0 <$ occur $(a,\ x))$

THEOREM: occur-remove1
occur $(a,$ remove1 $(b,\ x))$
$=$ **if** $a = b$ **then** occur $(a,\ x) - 1$
else occur $(a,\ x)$ **endif**

THEOREM: subbagp-wit-lemma
subbagp $(x,\ y) =$ (occur (badguy $(x,\ y)$, y) $\not<$ occur (badguy $(x,\ y)$, x))

THEOREM: occur-append
occur $(a,$ append $(x,\ y)) =$ (occur $(a,\ x) +$ occur $(a,\ y))$

THEOREM: subbagp-append
subbagp (append $(x,\ y)$, append $(y,\ x)$)

DEFINITION: permutationp $(x,\ y) =$ (subbagp $(x,\ y) \wedge$ subbagp $(y,\ x)$)

THEOREM: permutationp-append
permutationp (append $(x,\ y)$, append $(y,\ x)$)

THEOREM: subbagp-necc
subbagp $(x,\ y) \rightarrow$ (occur $(a,\ y) \not<$ occur $(a,\ x)$)

THEOREM: subbagp-transitive
(subbagp $(x,\ y) \wedge$ subbagp $(y,\ z)) \rightarrow$ subbagp $(x,\ z)$

THEOREM: permutationp-transitive
(permutationp $(x,\ y) \wedge$ permutationp $(y,\ z)) \rightarrow$ permutationp $(x,\ z)$

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