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#|

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|#

;; See CLI Internal Note 185 for a tutorial introduction to the
;; Boyer-Moore prove based on this example.
```

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

DEFINITION:
rotate (n, lst)
$=$ **if** $n \simeq 0$ **then** lst
else rotate $(n - 1,$ append $($cdr $(lst),$ list $($car $(lst))))$ **endif**

DEFINITION:
length (x)
$=$ **if** listp (x) **then** $1 +$ length $($cdr $(x))$
else 0 **endif**

DEFINITION:
properp (x)
$=$ **if** listp (x) **then** properp $($cdr $(x))$
else $x =$ **nil endif**

DEFINITION:
firstn $(n,\ lst)$
$=$ **if** $n \simeq 0$ **then nil**
else cons (car (lst), firstn $(n - 1,$ cdr $(lst)))$ **endif**

DEFINITION:
nthcdr $(n,\ lst)$
$=$ **if** $n \simeq 0$ **then** lst
else nthcdr $(n - 1,$ cdr $(lst))$ **endif**

THEOREM: associativity-of-append
append (append $(x,\ y),\ z)$ = append $(x,$ append $(y,\ z))$

THEOREM: append-nil
properp $(x) \rightarrow$ (append $(x,$ **nil**$) = x)$

DEFINITION:
rotate-append-induction $(n,\ lst,\ extra)$
$=$ **if** $(n = 0) \vee (n \notin \mathbf{N})$ **then t**
elseif $lst \simeq$ **nil then t**
else rotate-append-induction $(n - 1,$
cdr (lst),
append $(extra,$ list (car $(lst))))$ **endif**

THEOREM: properp-append
properp (append $(x,\ y))$ = properp (y)

THEOREM: rotate-append
(properp $(extra) \wedge$ (length $(lst) \not< n))$
$\rightarrow$ (rotate $(n,$ append $(lst,\ extra))$
$=$ append (nthcdr $(n,\ lst)$, append $(extra,$ firstn $(n,\ lst))))$

THEOREM: nthcdr-length
properp $(lst) \rightarrow$ (nthcdr (length $(lst),\ lst)$ = **nil**)

THEOREM: firstn-length
properp $(lst) \rightarrow$ (firstn (length $(lst),\ lst) = lst)$

THEOREM: rotate-length
properp $(lst) \rightarrow$ (rotate (length $(lst),\ lst) = lst)$

Index

append-nil, 2
associativity-of-append, 2

firstn, 2
firstn-length, 2

length, 1, 2

nthcdr, 2
nthcdr-length, 2

properp, 1, 2
properp-append, 2

rotate, 1, 2
rotate-append, 2
rotate-append-induction, 2
rotate-length, 2