```
#|

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|#
```

EVENT: Start with the library "mlp" using the compiled version.

```
; acc_CSXA00.bm
;   . definition of circuit (only 1 here) [assumes stringadd.bm] :
; - no hint: FAIL
; - w/ TOPOR:  OK!
;   . proof of equivalence w/ Spec(s): OK!
; NOTE: the above comments date back to the hand-generation time, when we
;       were still trying to FIND a way to feed things to BM.  They are kept
;       here for historical purposes only...

;;; DEFINITION OF CIRCUIT:
#|
```

```
(setq sysd '(SY-ACC (x)
(Yacc S Plus x Yacc2)
(Yacc2 R 0 Yacc)
))

(setq acc_CSXA00 '(
-rsb |#
; BM DEFINITIONS and A2 LEMMAS, generated by BMSYSD:
; comb_plus.bm: Plus combinational element.
; U7-DONE

;   no character function definition since BM already knows about Plus..

; Everything below generated by:     (bmcomb 'plus '() '(x y))
```

DEFINITION:
s-plus $(x,\ y)$
$=$ **if** empty (x) **then** E
else a (s-plus (p (x), p (y)), l (x) + l (y)) **endif**

```
;; A2-Begin-S-PLUS
```

THEOREM: a2-empty-s-plus
empty (s-plus $(x,\ y)$) = empty (x)

THEOREM: a2-e-s-plus
(s-plus $(x,\ y)$ = E) = empty (x)

THEOREM: a2-lp-s-plus
len (s-plus $(x,\ y)$) = len (x)

THEOREM: a2-lpe-s-plus
eqlen (s-plus $(x,\ y)$, x)

THEOREM: a2-ic-s-plus
(len (x) = len (y))
$\rightarrow$ (s-plus (i $(c\_x,\ x)$, i $(c\_y,\ y)$) = i $(c\_x + c\_y$, s-plus $(x,\ y)$))

THEOREM: a2-lc-s-plus
$(\neg$ empty $(x)) \rightarrow$ (l (s-plus $(x,\ y)$) = (l (x) + l (y)))

THEOREM: a2-pc-s-plus
p (s-plus $(x,\ y)$) = s-plus (p (x), p (y))

THEOREM: a2-hc-s-plus
$((\neg \text{ empty}(x)) \wedge (\text{len}(x) = \text{len}(y)))$
$\rightarrow \quad (\text{h}(\text{s-plus}(x, y)) = (\text{h}(x) + \text{h}(y)))$

THEOREM: a2-bc-s-plus
$(\text{len}(x) = \text{len}(y)) \rightarrow (\text{b}(\text{s-plus}(x, y)) = \text{s-plus}(\text{b}(x), \text{b}(y)))$

THEOREM: a2-bnc-s-plus
$(\text{len}(x) = \text{len}(y)) \rightarrow (\text{bn}(n, \text{s-plus}(x, y)) = \text{s-plus}(\text{bn}(n, x), \text{bn}(n, y)))$

```
;; A2-End-S-PLUS

; eof:comb_plus.bm
```

DEFINITION:
topor-sy-acc (ln)
= **if** ln = `'yacc` **then** `1`
elseif ln = `'yacc2` **then** `0`
else `0` **endif**

DEFINITION:
sy-acc (ln, x)
= **if** ln = `'yacc` **then** s-plus $(x,$ sy-acc $($`'yacc2`$, x))$
elseif ln = `'yacc2`
then if empty (x) **then** E
else i $($`0`, sy-acc $($`'yacc`, p $(x)))$ **endif**
else sfix (x) **endif**

```
;; A2-Begin-SY-ACC
```

THEOREM: a2-empty-sy-acc
$\text{empty}(\text{sy-acc}(ln, x)) = \text{empty}(x)$

THEOREM: a2-e-sy-acc
$(\text{sy-acc}(ln, x) = \text{E}) = \text{empty}(x)$

THEOREM: a2-lp-sy-acc
$\text{len}(\text{sy-acc}(ln, x)) = \text{len}(x)$

THEOREM: a2-lpe-sy-acc
$\text{eqlen}(\text{sy-acc}(ln, x), x)$

THEOREM: a2-pc-sy-acc
$\text{p}(\text{sy-acc}(ln, x)) = \text{sy-acc}(ln, \text{p}(x))$

```
;; A2-End-SY-ACC

;;; SPEC definition (hand, of course):
```

DEFINITION:
numer-acc (x)
= **if** empty (x) **then** 0
else numer-acc (p (x)) + l (x) **endif**

```
; this is the standard extension from last-char-fun to MLP-string-fun.
```

DEFINITION:
spec-acc (x)
= **if** empty (x) **then** E
else a (spec-acc (p (x)), numer-acc (x)) **endif**

```
;;; Circuit CORRECTNESS:

; Acc-correct-ax-help makes the proof of acc_correct_ax much easier, but is
; not necessary.
;
;(prove-lemma acc-correct-ax-help (rewrite)
;(implies (not (empty x))
;  (equal (L (sy-acc 'yacc x))
; (plus (numer-acc (P x)) (L x))))
;((induct (induct-P x))
; (expand (sy-acc 'yacc x))
;)
;)

; Acc-correct-ax is a "predicative correctness statement", i.e. what we would
; do if we didn't have functional equality as a specification method, but
; instead used a purely axiomatic approach.
; BM finds the proof on its own, but still needs quite a few generalizations...
```

THEOREM: acc-correct-ax
$(\neg$ empty $(x)) \rightarrow$ (l (sy-acc ('yacc, x)) = numer-acc (x))

```
; to go to a functional equality once we have the "last" (ax) statement is
; a trivial induction, if we start out with an P-L split which is unnatural
; for BM, so we force it w/ a USE hint of A-p-l-split
```

THEOREM: a-p-l-split
$(\neg\ \text{empty}\,(x))$
$\rightarrow\quad (\text{sy-acc}\,(\texttt{'yacc},\ x) = \text{a}\,(\text{p}\,(\text{sy-acc}\,(\texttt{'yacc},\ x)),\ \text{l}\,(\text{sy-acc}\,(\texttt{'yacc},\ x))))$

THEOREM: acc-correct
$\text{sy-acc}\,(\texttt{'yacc},\ x) = \text{spec-acc}\,(x)$

```
; eof: acc_CSXA00.bm
; -rsb ))
```

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