Assignment 3: Derivation

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1. (a) n is a **value** parameter. m is a **result** parameter.

   (b) $inv \triangleq lrun(A, n_0, m)$

   (c) Let

$$n, m : [lrun(A, n, n+1),\ mrun(A, n_0, m)]$$

$\sqsubseteq$ {Composition: middle predicate is inv}

$$n, m : [lrun(A, n, n+1), lrun(A, n_0, m)]; \quad n, m : [lrun(A, n_0, m),\ mrun(A, n_0, m)]$$

$\sqsubseteq$ {Assignment: $lrun(A, n, n+1) \Rrightarrow lrun(A, n_0, m)[m \backslash n+1]$}

$$m := n+1; \quad n, m : [lrun(A, n_0, m),\ mrun(A, n_0, m)]$$

$\therefore$

$$lrun(A, n_0, m)[m \backslash n+1] \quad \equiv \quad lrun(A, n_0, n+1)$$

$\sqsubseteq$ {Strengthen post: $lrun(A, n_0, m) \wedge \neg(m < A.len \wedge A_{n_0} \neq A_m) \Rrightarrow mrun(A, n_0, m)$}

$$m := n+1; \quad n, m : [lrun(A, n_0, m),\ lrun(A, n_0, m) \wedge \neg(m < A.len \wedge A_{n_0} \neq A_m)]$$

$\therefore$

$$lrun(A, n_0, m)[m \backslash n+1 \quad \equiv \quad lrun(A, n_0, n+1)$$

$$lrun(A, n_0, m) \wedge \neg(m < A.len \wedge A_{n_0} \neq A_m) \Rrightarrow mrun(A, n_0, m)$$
$$\equiv \quad lrun(A, n_0, m) \wedge \neg(m < A.len \wedge A_{n_0} \neq A_m) \Rrightarrow lrun(A, n_0, m) \wedge (m < A.len \Rightarrow A_{n_0} \neq A_m)$$