

Assignment 3: Derivation

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May 16, 2017

1. (a) n is a **value** parameter. m is a **result** parameter.
- (b) $inv \triangleq lrun(A, n_0, m)$
- (c) Let

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

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

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

$$\sqsubseteq \{ \text{Assignment: } lrun(A, n, n+1) \Rightarrow lrun(A, n_0, m)[m \setminus n+1] \}$$

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

\therefore

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

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

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

\therefore

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

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

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