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**Rule 0.26** *⟨Cache Array Length in Loops⟩*


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<pre> [...]  <b>contract</b> A {    [...]    <b>function</b> f(pds) {      [...]      <b>for</b>(init; i &lt; arr.length; upd) {        stmts      }      stmts'    }    [...]  }</pre>	=	<pre> [...]  <b>contract</b> A' {    [...]    <b>function</b> f(pds) {      [...]      <b>uint</b> len = arr.length;      <b>for</b>(init; i &lt; len; upd) {        stmts      }      stmts'    }    [...]  }</pre>
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**where**

*arr* is an array whose length is accessed in the loop condition;  
*arr.length* is the array length property accessed in each loop iteration;  
*len* is a local variable that caches the array length;  
*init* and *upd* are the loop initialization and update expressions;  
*i* is the loop index variable;  
*stmts* represents the loop body statements;  
*pds* are the parameter declarations of function *f*;  
*stmts'* represents statements following the loop.

**provided**

The array length is accessed in the loop condition on every iteration;  
 The array *arr* is not modified within the loop in a way that changes its length;  
 No operations within the loop (e.g., **push**, **pop**) alter the array size;  
 Caching the length does not affect the correctness of the loop;  
 The cached length remains valid throughout loop execution.

**Invariant:**

Let  $s_i$  and  $s'_i$  be the initial state of *A* and *A'*, respectively.  
 Let  $s_f$  and  $s'_f$  be the state reached by *A* and *A'*, respectively, after *A.f()* and *A'.f()* are executed from  $s_i$  and  $s'_i$ , respectively.  
 Then, the coupling invariant is

$$\forall s_i, s'_i. (s_i = s'_i) \rightarrow (s_f = s'_f)$$


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