

Activity: More Assignment, More Loops

A. Why?

The different assignment rules can be useful in different situations. Loops with conditionals in their body are common.

B. Outcomes

At the end of the activity, you should

- Understand the different versions of the assignment rule and how to use them.
- Be familiar with loops with conditionals in their body (e.g. binary search).

C. Questions

1. Use forward assignment rules to fill in the following proof outline. List the predicate logic obligation(s).

$$\{q_0 \equiv \text{Sorted}(b, n) \wedge n \geq 1 \wedge b[0] \leq x < b[n]\}$$

$$lt := 0; \{ \underline{q_0 \wedge lt = 0} \} rt := n; \{ \underline{q_0 \wedge lt = 0 \wedge rt = n} \}$$

$$\{p_2 \equiv 0 \leq lt < rt \leq n \wedge (b[lt] = x \vee b[lt] < x < b[rt])\}$$

2. (Use forward assignment rules to) fill in the following proof outline. List the predicate logic obligation(s).

$$\{0 \leq i \leq n \wedge s = \text{sum}(0, i) \wedge i < n\} \text{ } s := s + i + 1 \text{ } ; \{ \text{_____} \}$$

$$i := i + 1 \text{ } \{ \text{_____} \} \{0 \leq i \leq n \wedge s = \text{sum}(0, i)\}$$

3. Fill in the following proof outline. List the predicate logic obligation(s).

$$\{a > 0 \wedge b > 0 \wedge a = a' \wedge b = b'\}$$

$$\{\text{inv } p \equiv a > 0 \wedge b > 0 \wedge \text{gcd}(a', b') = \text{gcd}(a, b)\}$$

while $a \neq b$ **do**

$$\{p \wedge a \neq b\}$$

if $a > b$ **then**

$$\{ \text{_____} \} a := a - b \{ \text{_____} \} \{p\}$$

else

$$\{ \text{_____} \} b := b - a \{ \text{_____} \} \{p\}$$

fi $\{p\}$

od $\{p \wedge a = b\} \{a = \text{gcd}(a', b')\}$