

CMPS 290G – Topics in Software Engineering
Winter 2004 – Software Validation and Defect Detection
Homework 3

Due: 19 Feb 2004

1. Which of the following Hoare triples are correct?
 - (a) $\{x < y\} \ t := x; \ x := y; \ y := t; \ \{y < x\}$. Can you write a stronger postcondition?
 - (b) $\{\text{false}\} \ x := 2; \ \{x = 4\}$
 - (c) $\{x = 1\} \ x := 2; \ \{x = 4\}$
 - (d) $\{x > 0\} \ \text{while } x \neq 0 \ \text{do } x++; \ \{x = 0\}$
 - (e) $[x > 0] \ \text{while } x \neq 0 \ \text{do } x++; \ [x = 0]$
 - (f) $\{x < 0 \ \text{and } x \in \text{Integer}\} \ \text{while } x \neq 0 \ \text{do } x++; \ \{x = 0\}$
 - (g) $[x < 0 \ \text{and } x \in \text{Integer}] \ \text{while } x \neq 0 \ \text{do } x++; \ [x = 0]$
2. Compute the following weakest preconditions, and simplify the result where possible.
 - (a) $\text{WP}(t := x; \ x := y; \ y := t, \ y < x)$
 - (b) $\text{WP}(x := 2, \ x = 4)$
 - (c) $\text{WP}(x := 2, \ x = 2)$
3. Compute (and simplify where possible) $\text{VC}(\text{while } x \neq 0 \ \text{do } x++, \ x = 0)$
 - (a) using the loop invariant **false**
 - (b) using the loop invariant $x < 0 \ \text{and } x \in \text{Integer}$
4. Show how to compute a satisfying assignment for

$$(a \vee b \vee c) \wedge (\neg b \vee c) \wedge (a \vee b) \wedge (a \vee c) \wedge (\neg b \vee \neg c) \wedge (\neg a \vee c)$$

using the Davis-Putnam procedure. (Hint: Plug the resulting satisfying assignment in to the formula to check your work.)

5. In class, we considered how to compute weakest preconditions for a language with assignment, sequential composition, if expressions, and a **throw** construct that throws an exception to the nearest enclosing **try** s_1 **catch** s_2 construct.

Suppose we extended this language with a “**stopwhen** E ” statement that stops program computation if the expression E is true. Show how to compute weakest preconditions for this language in a way that supports reasoning about the final program state.

Hint: Use a *wp* function that takes three postconditions.