

1998 Paper 7 Question 2

Specification and Verification I

Describe briefly the difference between *soundness* and *completeness* for a logic. [4 marks]

Consider the following possible assignment axioms:

(a) $\{P\} V := E \{P[E/V]\}$

(b) $\{P[E/V]\} V := E \{P\}$

(c) $\{P\} V := E \{P \wedge V = E\}$

(d) $\{P \wedge V = E\} V := E \{P\}$

For each of these *either* give a brief informal argument why it is sound, *or* give a counterexample. [8 marks]

If V is a variable, let $V++$ be a C-like expression that returns the value of V and then increments it. Describe why the simple Hoare assignment axiom is not valid if such expressions are allowed. [2 marks]

Consider a C-like operator $+=$ whose semantics is that $V += E$ adds the value of E to V . Write down an axiom for such an assignment and informally justify its soundness. [2 marks]

Write down a sound axiom for a parallel assignment

$$V_1, \dots, V_n := E_1, \dots, E_n$$

(E_1, \dots, E_n are simultaneously assigned to V_1, \dots, V_n). [2 marks]

Is this equivalent to the sequence of single assignments

$$V_1 := E_1; \dots; V_n := E_n?$$

Justify your answer. [2 marks]