

CSE526: Principles of Programming Languages (Spring 2003)
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Exam 1 (version 25mar2003)

Each problem is worth 20 points. Justify your answers.

Problem 1

Exercise 3.6.

Problem 2

Exercise 5.4 (a).

Problem 3

Consider the input command $?v$, whose original semantics is given in Section 5.6. Consider the following change to the meaning of that command. Informally, the new meaning is that $?v$ repeatedly reads inputs until it reads a value k that is not equal to the current value of v , and then it stores that value k in variable v . Give a new direct semantic equation for $?v$ that reflects the new meaning. Do this in two steps, as follows.

(a) Modify the direct semantic equation near the top of page 114 to reflect the new iterative nature of the command by defining $\llbracket ?v \rrbracket_{\text{comm}}$ circularly (recursively); in other words, $\llbracket ?v \rrbracket_{\text{comm}}$ occurs on both sides of the semantic equation.

(b) Use the fixed-point operator $\mathbf{Y}_{\Sigma \rightarrow \Omega}$ (which is used in the semantics of the **while** command in Section 5.2) to eliminate the circularity in the semantic equation for $?v$; in other words, use $\mathbf{Y}_{\Sigma \rightarrow \Omega}$ to eliminate the occurrence of $\llbracket ?v \rrbracket_{\text{comm}}$ on the right side of the semantic equation.

Problem 4

Exercise 6.2 (a).

Problem 5

Suppose we change the transition semantics in Section 7.1 by replacing the rule

$$\frac{\langle g, \sigma \rangle \rightarrow \mathbf{false}}{\langle \mathbf{if } g \mathbf{ fi} \rangle \rightarrow \langle \mathbf{abort}, \sigma \rangle}$$

with

$$\frac{\langle g, \sigma \rangle \rightarrow \mathbf{false}}{\langle \mathbf{if } g \mathbf{ fi} \rangle \rightarrow \sigma}$$

Give new inference rules for partial-correctness and total-correctness specifications of alternative commands. In other words, give new versions of the rules ACP and ACT on page 149. (The rules in the textbook might be unsound or relatively incomplete as a result of this change to the semantics.)