

Homework 11

Please hand your solution in during class or email them to the instructor with CC to ly603@nyu.edu.

The deadline for Homework 11 is May 6.

Problem 1 Hoare Rules (6 Points)

(a) Consider the following Hoare rule for assignments:

$$\{A\}x := e\{A[e/x]\}$$

Give a counterexample that shows that this rule is incorrect. (3 Points)

(b) Give an appropriate Hoare rule for for-loops (see Homework 10). (3 Points)

Problem 2 Weakest Preconditions (9 Points)

Give the corresponding guarded command and weakest precondition for the following IMP commands.

(a) $x := x$

(b) `if $x \leq y$ then $z := x + y$ else skip`

(c) `{true} while $X \leq X$ do $x := x$`

Problem 3 Verification (10 Points)

Consider the following Hoare triple:

$$\begin{array}{l} \{x \geq 0\} \\ y := 0; z := 0; \\ \{I\} \\ \text{while } z < x \text{ do} \\ \quad y := y + z + z + 1; z := z + 1; \\ \{y = x * x\} \end{array}$$

(a) Find an appropriate invariant I for a proof of validity of the Hoare triple. (5 Points)

(b) Give the proof of validity. (5 Points)