Deductive Program Verification: Exercise #1

Yih-Kuen Tsay

Dept. of Information Management, National Taiwan University

FLOLAC 2007: July 2–13, 2007

Note

This assignment is due at the end of the morning lab/tutor hour on July 10, 2007. Please write or type your answers on A4 (or similar size) paper. Late submission will not be accepted. You may discuss the problems with others, but copying answers is strictly forbidden.

Problems

We assume the binding powers of the various operators decrease in this order: $(\cdot)^n$ (exponentiation), $\{+, -\}$, $\neg$, $\{=, \geq, \leq\}$, $\{\forall, \exists\}$, $\{\wedge, \vee\}$, $\rightarrow$, $\leftrightarrow$, $\equiv$.

1. Prove the partial correctness of the following annotated program segment:

   $\{g = 0 \wedge p = n \wedge n \geq 1\}$
   S1: **while** $p \geq 2$ **do**
       S2: $g, p := g + 1, p - 1$
   od
   $\{g = n - 1\}$

   (40 points)

2. Prove the total correctness of the following annotated program segment:

   $\{x = n \wedge n \geq 0\}$
   S1: $y := 0;$
   S2: **while** $x > 0$ **do**
       S3: $y := y + (2x - 1);$
       S4: $x := x - 1$
   od
   $\{y = n^2\}$

   (60 points)