Assignment 3

Programming Theory

This assignment is worth 2 point in the final exam, and the deadline is 9th of December, 2008.

Assignment 1 (100%) The program below computes the number of nodes in a tree of height $h$ where each node has $n$ children. For example: if each node has 3 children, a tree of height 0 has 1 node and a tree of height 4 has a total of 121 nodes.

Use the iterative command theorem to translate the correctness of the program into the validity of a set of logical formulas and prove that the program is correct.

\[
\begin{align*}
\{Q: & \ n > 0 \land h \geq 0\} \\
& r, x, y := 1, 0, 1; \\
& \{\text{inv } P: \ r = \Sigma i : 0 \leq i < x + 1 : n^i \land 0 \leq x \leq h \land y = n^x\} \\
& \{\text{bound } t: \ h - x\} \\
& \text{do } x < h \rightarrow y := y \ast n; \\
& \quad r, x := r + y, x + 1 \\
& \text{od} \\
& \{R: \ r = \Sigma i : 0 \leq i < h + 1 : n^i\}
\end{align*}
\]