COMP 3610 Tutorial 8

5 October, 2023

Exercise 1

Assume that standard IMP allows expressions of the form $a_1 \neq a_2$ with the obvious semantics, and similarly, that assertions have a definition for the arithmetic operator $*$, again using its standard meaning. Consider the following program:

$$
\begin{array}{l}
l_3 \ := \ 0; \\
l_4 \ := \ 0; \\
\textbf{while} \ !l_3 \ \neq \ !l_2 \ \textbf{do} \\
\quad l_4 \ := \ !l_4 \ + \ !l_1; \\
\quad l_3 \ := \ !l_3 \ + \ 1;
\end{array}
$$

1. Decorate this program with Floyd-Hoare logic assertions that show that after running this program, l_4 contains the product of l_1 and l_2.
2. Do your assertions represent a Hoare logic proof for total or partial correctness? If it is the latter, what change would you need to make to get to total correctness?

Exercise 2

Give the weakest liberal preconditions of the following programs:

1. **if** $!l_1 \ \geq \ !l_2$ **then** $l_2 \ := \ !l_1$ **else skip** $\quad \{l_2 \ \geq \ l_3\}$
2. $l_3 := l_2 + 4; l_1 := l_3 + 5; l_3 := l_3 + 1 \qquad \{20 \geq l_1 \wedge l_3 \geq 4\}$

Exercise 3

Give the strongest postconditions of the following programs:

- $\{l_1 = 5\} \qquad$ **if** $3 \ \geq \ !l_1$ **then** $l_2 \ := \ 5$ **else** $l_2 \ := \ !l_1 + 3$
- $\{\exists i.\ l_1 = i + i\} \qquad l_1 := l_1 + 1; l_2 := l_1 + l_1$

