Homework 2 of CS520 Theory of Programming Languages
Deadline: 6:00pm on 8 November (Friday)

Submit your solutions in KLMS. (Reminder: We adopt a very strict policy for handling dishonest behaviours. If a student is found to copy answers from fellow students or other sources in his or her homework submission, she or he will get F.)

The numbers in the questions refer to exercise questions in the textbook of the course, i.e. "Theories of Programming Languages" by John C. Reynolds.

Question 1

Solve 3.1. (25 marks)

Question 2

Prove that the following forward rule for assignment is sound:

$$\frac{x_0 \notin \mathrm{FV}(p) \cup \mathrm{FV}(e) \cup \{x\}}{\{p\}\, x := e\, \{\exists x_0.\, x = (e/x \to x_0) \wedge (p/x \to x_0)\}}$$

That is, show that the semantics of a Hoare triple derived by the above rule is always tt.
(25 marks)

Question 3

Derive the following partial correctness triple using the rules of Hoare logic that you learnt in the lectures.

$$\Big\{x \geq 0 \wedge x = x_0 \wedge y = y_0\Big\}\ \textbf{while}\ x \neq 0\ \textbf{do}\ (x := x - 1; y := y + 2 \times x)\ \Big\{y = y_0 + x_0 \times (x_0 - 1)\Big\}.$$

(25 marks)

Question 4

Solve 3.8. (25 marks)