Technische Universität Wien
Compilers and Languages
Prof. J. Knoop

A-1040 Wien
Argentinierstr. 8
Tel.: 01-58801-18510

“Analysis and Verification (185.276, VU 2.0, ECTS 3.0)” SS 2019

Assignment 3 20 March 2019

Exercise 1 : (16 Points)

Consider the below Hoare assertions for partial/total correctness (or: Hoare triples for partial/total correcness; or: partial/total correctness assertions):

1. $\models_{pk} \{p_1\}\ \pi_1\ \{false\}$
2. $\models_{tk} \{p_2\}\ \pi_2\ \{false\}$
3. $\models_{pk} \{p_3\}\ \pi_3\ \{true\}$
4. $\models_{tk} \{p_4\}\ \pi_4\ \{true\}$
5. $\models_{pk} \{false\}\ \pi_5\ \{q_5\}$
6. $\models_{tk} \{false\}\ \pi_6\ \{q_6\}$
7. $\models_{pk} \{true\}\ \pi_7\ \{q_7\}$
8. $\models_{tk} \{true\}\ \pi_8\ \{q_8\}$
9. $\models_{pk} \{true\}\ \pi_9\ \{false\}$
10. $\models_{tk} \{true\}\ \pi_{10}\ \{false\}$
11. $\models_{pk} \{false\}\ \pi_{11}\ \{false\}$
12. $\models_{tk} \{false\}\ \pi_{12}\ \{false\}$
13. $\models_{pk} \{true\}\ \pi_{13}\ \{true\}$
14. $\models_{tk} \{true\}\ \pi_{14}\ \{true\}$
15. $\models_{pk} \{false\}\ \pi_{15}\ \{true\}$
16. $\models_{tk} \{false\}\ \pi_{16}\ \{true\}$

Assuming that the above correctness assertions are valid, what conclusions can be drawn on the preconditions p_i, $1 \leq i \leq 4$, the programs π_i, $1 \leq i \leq 16$, and the postconditions q_i, $5 \leq i \leq 8$, (wrt the characterization sets $Ch(p_i)$, $Ch(q_i)$, and $Def(\llbracket\, \pi_i \,\rrbracket)$)? Can in fact all triples assumed to be correct, or are some triples not satisfiable? Are all triples meaningful? Are some of them trivial? Provide a brief reasoning for your answer.

Exercise 2 : (2 Points)

Show that the at first sight tempting naive version of the forward assignment rule without quantors is not correct:

$$[\text{ass}_{fw\text{-}naive}] \quad \frac{\quad}{\{p\}\ x{:=}t\ \{p[t/x]\}}$$

Exercise 3 : (8 Points)

Using the Hoare calculus for partial correctness, prove (in terms of a linear proof sketch) that the below Hoare assertion is partially correct:

$$\{x = n\ \wedge y = m\}\ \ \textbf{while}\ x \neq 1\ \textbf{do}\ y := y + m;\ x := x - 1\ \textbf{od}\ \ \{y = n * m\}$$

Submission: Wednesday, 10 April 2019, before the lecture.