CvP - Homework 4

- Deadline: October 5, at the start of the werkcollege.
- Your solution can typed (preferred!) or handwritten.
- You can submit your solution in person or via liacscvp2018@gmail.com
- Don't forget your name and student number.

Chapter 3

1. Which part of an inference rule is the antecedent?
2. Explain what the preconditions and postconditions of a given statement mean in axiomatic semantics.
3. What is a loop invariant? Explain with an example.
4. What is the use of the wp function? Why is it called a predicate transformer?
5. Explain the difference between total correctness and partial correctness.
6. Compute the weakest precondition for each of the following pairs of assignment statement and postcondition:
   (a) $a = 2 * (b - 1) - 1; \{a > 0\}$
   (b) $b = (c + 10)/3; \{b > 6\}$
   (c) $a = a + 2 * b - 1; \{a > 1\}$
   (d) $x = 2 * y + x - 1; \{x > 11\}$
7. Compute the weakest precondition for each of the following sequences of assignment statements and their postconditions:
   (a) $a = 2 * b + 1; b = a - 3; \{b < 0\}$
   (b) $a = 3 * (2 * b + a); b = 2 * a - 1; \{b > 5\}$
8. Compute the weakest precondition for each of the following code segments and their postconditions:

(a) **if** $(a = b)$ **then** $b = 2 * a + 1;$ **else** $b = 2 * a;$ **fi** $\{b > 1\}$

(b) **if** $(x < y)$ **then** $x = x + 1;$ **else** $x = 3 + x;$ **fi** $\{x < 0\}$

(c) **if** $(x > y)$ **then** $y = 2 * x + 1;$ **else** $y = 3 * x - 1;$ **fi** $\{y > 3\}$

9. Prove that the following program is partially correct:

$\{\text{true}\}$
$x := 0;$
$y := 0;$
while $(y < 5)$ **do**
    $y := y + 1;$
    $x := x + 2;$
od
$\{x = 10\}$