Program Analysis and Verification

Course 0368-4479 / 2015/16 - Semester B

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Home Work Assignment #2

Due: Lesson 16/May/2016

In the following, we refer to the “Semantics with Application” book as “the book”.
The book can be found here: http://www.daimi.au.dk/~bra8130/Wiley_book/wiley.html.

1. Write, specify, and prove using Hoare logic a program that gets as an input an array v[1..n] of integers and returns the index of the first entry negative element (i.e., the lowest i such that v[i] < 0) in the array, or n+1 if no such index exists.
2. Solve Ex 6.12, 6.14, 6.15
3. Solve Ex 6.25 in the book for all statements except while
    1. Bonus: Prove the complements of the inference rule for while statement.
4. Give a (non-trivial) specification for the following program and prove it using Owicki-Gries logic

$$\{X=A \wedge Y=B\}\ x:=X;\ Y:=1 \parallel y:=Y;\ X:=x\ \{\ \ldots\ \}$$

5. This question concern Galois Connections:

> Let A and C be lattices, and let $\alpha : C \to A$ and $\gamma : A \to C$ be total functions. Then: (A) $\forall c \in C\colon c \sqsubseteq \gamma(\alpha(c))$ and (B) $\forall a \in A\colon \alpha(\gamma(a)) \sqsubseteq a$ and (C) α and γ are monotonic **iff** (D) $\forall a \in A, c \in C\colon \alpha(c) \sqsubseteq a \Leftrightarrow c \sqsubseteq \gamma(a)$.