COMS22201: Language Engineering

Lab Exercises - Week 20 - Questions

14/03/2016, csxor@bristol.ac.uk

This worksheet will give you practice in using the axiomatic semantics of total correctness to prove the correctness of **While** programs.

1. Determine which of the following assertions hold, and prove those that do using the axiomatic semantics of *total* correctness (remembering to discharge any proof obligations):

   (a) $\left[\begin{array}{c} x=n \\ n \geq 0 \end{array}\right]$ while 2≤x do x:=x-2 $\left[\begin{array}{c} x=n\%2 \end{array}\right]$

   (b) $\left[\begin{array}{c} x=n \end{array}\right]$ y:=1; while ¬(x=1) do (y:=y*x; x:=x-1) $\left[\begin{array}{c} y=n! \\ n> \ 0 \end{array}\right]$

   (c) $\left[\begin{array}{c} x=n \\ n> \ 0 \end{array}\right]$ y:=1; while ¬(x=1) do (y:=y*x; x:=x-1) $\left[\begin{array}{c} y=n! \end{array}\right]$

   (d) $[true]$ while true do skip $[false]$

   (e) $[true]$ while false do skip $[false]$

   (f) $[false]$ while false do skip $[true]$

   (g) $[false]$ while false do skip $[false]$

2. Suppose we wish to replace the while-do loop construct of the **While** language with a repeat-until loop construct of the form `repeat S until b` - which has the effect of executing `S` before testing `b` and then either stopping if `b` is true or looping otherwise. Suggest an an axiomatic inference rule for the partial correctness of repeat-until loops.

3. Write a simple program of your choice and prove its correctness with respect to some appropriate pre and postconditions using the axiomatic semantics. Bring your proof to the tutorial tomorrow.