Tutorials 03:
Programming Language Semantics

Exercise 01

Check whether the following statements are theorems:

{x = 3 and y = 2} If x = 3 : If y > x : y := x - 1 Else x := x - 1 EndIf EndIf {x = y}

{x # 3 and x = y} If x = 3 : If y > x : y := x - 1 Else x := x - 1 EndIf EndIf {x = y}

{x = 3 and x = y} If x = 3 : If y > x : y := x - 1 Else x := x - 1 EndIf EndIf {x = y}

Exercise 02

a) Give the proof tree and show whether the following statement is a theorem:

{n > 0} x:=0; y:=1; i:=1; While i < n : y := x+y; x := y-x; i := i+1 EndWhile {y = Fib(n)}

b) Give the proof tree and find the weakest precondition necessary for the statement to be a theorem:

{E} x:=0; If y < x : x := y-1; If x+y = z : z := y Else z := x EndIf EndIf {x = z}

Exercise 03

Show whether the statement {n >= 0)} P {x = n*n} is a theorem in Hoare's formal system. P being the following program:

```
i := 0;
j := 0;
x := 0;
While   (j < n)
     x := x+1;
     i := i+1;
    If  (i = n)
        j := j+1;
        i := 0;
    EndIf
EndWhile
```