COMP340B: Reasoning about Programs

Assignment 9

Due 5PM, Wednesday 1 October, 2008

Note: please submit your assignment to the COMP340 slot on Level 3 of G Block. Please submit by the due time, or expect to incur the 10% *late penalty (going up* 10% *for each additional day late).*

1. [10 marks] Prove using Hoare logic that if it terminates, the piece of code below calculates $sum = \Sigma_{j=1}^{n} j!$.

```
i:=1;
sum:=0;
f:=1;
while (i != n+1)
     { sum:=sum+f;
         i:=i+1;
         f:=f*i}
```

2. [15 marks] Prove using Hoare logic that for the piece of code P given below, the Hoare triple $(\!|\alpha|\!)\ P\ (\!|\beta|\!)$ is partially correct, where

$$\alpha = (\forall j \in \{1, 2, \ldots, n\} : (a[j] = A[j]))$$

and

$$\beta = (\forall j \in \{1, 2, \ldots, n\} : (a[j] = \Sigma_{k=1}^{j} A[k])).$$

```
i:=1;
s:=0;
while (i <= n)
     {   s:=s+a[i];
         a[i]:=s;
         i:=i+1
     }
```

3. [5 marks] Prove the correctness of the following Hoare triple.

$$(\!|\ a[i] \geq 0\ |\!)\ \ a[i] := a[i] + a[j]\ \ (\!|\ a[i] \geq a[j]\ |\!)$$