Homework XI

1. [15 points]
Prove the Hoare while normal form theorem (i.e., provide a construction to replace
if–then– with sequential execution and while–do–), and justify its correctness.

2 (repeated from Homework X). [25 points]
Provide an axiomatic proof of partial correctness for the Wren program fragment using
integer variables:
   \{true\}
   if A=B or A=-B
       then if A>B then C:= A else C:= B-A+1 end if
       else if A*B>0 then C:= A*B else C:= 1-A*B end if
   end if
   \{C>0\}

3. [25 points]
Provide an axiomatic proof of partial correctness for the Wren program fragment with
pre/post-conditions below (computing the “square root”), using integer variables:
   \{N≥1\}
   R:= 0;
   while R*R < N do R:= R+1 end while
   \{(R-1)² < N ≤ R²\}

4. [25 points]
Provide an axiomatic proof of partial correctness for the Wren program fragment with
pre/post-conditions below (computing the “binary logarithm”), using integer variables:
   \{N>0\}
   P:= 0; M:= 1;
   while M < N do P:= P+1; M:= 2*M end while
   \{2^{P-1} < N ≤ 2^P \geq N\}