Homework Assignment

(Due: September 5, 2012)

1. Write a partial correctness specification which is true if and only if the program S has the effect of multiplying the values of X and Y and storing the result in X. (20 points)

2. Prove that the following annotated program segments are correct:

   (a) $\{G = 0 \wedge P = N \wedge N \geq 1\}$
   while $P \geq 2$ **do**
   $G := G + 1;$
   $P := P - 1$
   od
   $\{G = N - 1\}$

   (20 points)

   (b) $\{M > 0\}$
   $X := 1;$
   $S := 0;$
   while $X \leq M$ **do**
   $S := S + X;$
   $X := X + 1$
   od
   $\{S = M \times (M + 1)/2\}$

   (20 points)

   (c) $\{X > a\}$
   if $X > Y$ **then**
   $X := X + X - Y$
   else
   $X := Y + 1$
   fi
   $\{X > a\}$

   (20 points)

   (d) $\{X = m \wedge Y = n \wedge Z = 1\}$
   while $Y \neq 0$ **do**
   while $Y\%2 = 0$ **do**
   $X := X \times X;$
   $Y := Y/2$
   od;

$Z := Z \times X$;
$Y := Y - 1$

od;

$\{Z = m^n\}$

(Hint: the two loops have the same invariant, which involves x^y as a sub-expression.)

(20 points)