University of Toronto, St. George Campus
Department of Computer Science

CSC 236H
Winter 2007

Assignment #3

Due Date: Wenesday, March 14 at 10:00am

1. You've already seen an algorithm for computing the greatest common divisor in tutorial, but it's hardly the only one. Perhaps the most well-known approach is the Euclidean algorithm:

```
public static int euclidGCD( int m, int n ) {
   int r, x = m, y = n;
   while( y != 0 ) {
      r = x % y;
      x = y;
      y = r;
   }
   return x;
}
```

   (a) State an appropriate precondition/postcondition pair for the given function.

   (b) Using your answer to part(a), prove that the function is correct.

2. Prove that the following method is correct:

```
/* Precondition: m, n are natural numbers, m > 0
 * Postcondition: returns floor( n/m )
 */
public static int integerDiv( int m, int n ) {
   int q = 0, r = n;
   while( r >= m ) {
      r = r - m;
      q = q + 1;
   }
   return q;
}
```

3. And we're back to greatest common divisors. Prove that the following recursive method is correct:

```
 /* Precondition: m, n >= 1
  * Postcondition: returns a natural number z such that
  *      - z divides m
  *      - z divides n
  *      - if x is a natural number that divides m and n,
  *        then x <= z
  */
public static int recGCD( int m, int n ) {
   if( m == n ) {
      return m;
   } else if( m > n ) {
      return recGCD( m-n, n );
   } else {
      return recGCD( m, n-m );
   }
}
```