

1. Prove the correctness of the following algorithm.

```
1: function MULT(m, n)
2:   # Precondition:  $m \in \mathbb{N}, n \in \mathbb{Z}$ 
3:    $x = m$ 
4:    $y = n$ 
5:    $z = 0$ 
6:   # Loop Invariant:  $z = m \times n - x \times y$ 
7:   while  $x \neq 0$  do
8:     if  $x \% 2 == 1$  then
9:        $z = z + y$ 
10:    end if
11:     $y = y \ll 1$ 
12:     $x = x \gg 1$ 
13:  end while
14:  return  $z$ 
15:  # Postcondition: returns  $m \times n$ 
16: end function
```

▷ left shift, equivalent to  $y = y \times 2$

▷ right shift, equivalent to  $x = \lfloor \frac{x}{2} \rfloor$