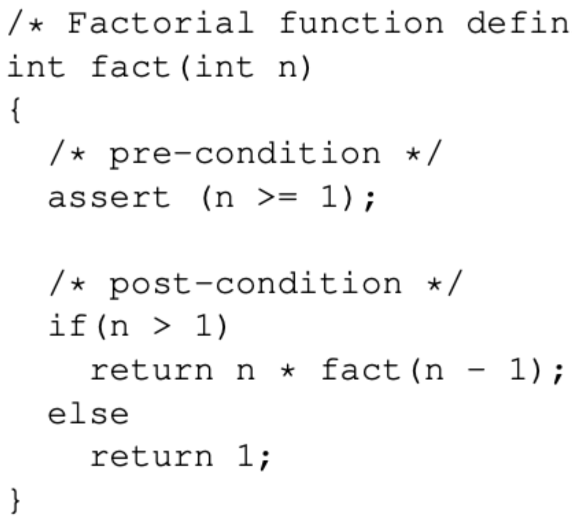
Assignment 11

(1)
We have been asked to write the proof for a recursive factorial function using proof by induction.



```
/* Factorial function definition */
int fact(int n)
{
  /* pre-condition */
  assert (n >= 1);

  /* post-condition */
  if(n > 1)
    return n * fact(n - 1);
  else
    return 1;
}
```

The program computes the factorial of an integer. It consists of a base case and a following recursive step. In this function the precondition ensures that n >=1, furthermore the base case is that if n =1 it returns 1. That is confirmed by 1 * fact(n - 1) = 1 * 0! = 1.
Now that the base case is confirmed by fact(0) = 1, we can proceed to the recursive step, that is when n > 1.
In layman’s terms the function does as shown: fact(k) = k * fact(k - 1), for any k above 1. Since we know that fact(1) is correct it would also apply to fact(2). Since fact(2) = 2 * fact(1), and fact(1) was 1, it would mean that fact(2) = 2 * 1 = 2.
Since fact(1) was correct fact(2) was also correct, the same applies to fact(3) and for fact(4) and so on, up until fact(k).
That is true because of the recursive step of the function, it moves towards the base case of the function. This proves that the program is correct for all positive integers n.