

1)

By using proof by induction, I will prove that the the following factorial function works. ‘

```
/* 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;  
}
```

Note there is two components to an inductive proof, a base case, and a recursive step.

In this example, the base case is, if $n=1$, 1 will be returned, in other word the function $\text{fact}(1)=1$, which is true since $1!=1$. Now let us check the recursive step, which is $\text{return } n * \text{fact}(n - 1)$. Since we know that $\text{fact}(1)$ is correct, let us check $\text{fact}(2)$, which will result in: $2 * \text{fact}(2-1) \Leftrightarrow 2 * \text{fact}(1) \Leftrightarrow 2 * 1 = 2$. $\text{Fact}(2) = 2$, which is also true, since $2!=2$. Since we know $\text{fact}(2)$ is correct, we can try out $\text{fact}(3)=3 * \text{fact}(2) \Leftrightarrow 3 * 2 = 6$. This is also correct, because $3!=6$. So therefore, we can conclude that this function works.