

- (1) Write down a proof that the following recursive factorial function is correct using *proof by induction*. Put your inductive proof into a pdf file (`text_answers.pdf`).
Hint: review the lecture slides for the two components of a proof by induction, i.e. (a) the base case and (b) the inductive step.

```
/* 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;
}
```

We start by finding the base case which $\text{fact}(1)=1$, which the first factorial number.

If we slot $\text{fact}(1)$ in we get return 1, which is correct.

If we now use K as any given number.

Inserting that we get $\text{fact}(k) = k * \text{fact}(k-1)$.

If we now assume that $\text{fact}(k) - 1$ is correct, any number smaller than $\text{fact}(k)$ is also correct.

So $k-1 < k$, assuming this.

If $\text{fact}(2)$ is correct, $\text{fact}(3)$ is also correct;

If $\text{fact}(1)$ is correct, $\text{fact}(2)$ is also correct;

So assuming this, $\text{fact}(k)$ is correct, as long as $\text{fact}(n)$ is correct