Exercises

(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 first need a **base case**.
We start by writing a bit of the sequence that is given by the factorial function, to give us an idea of what it might look like.
Lets say n = 6
Then the sequence is
6*5*4*3*2*1

In the case of factorial sequence the integer range is from n>=1
so n is the smallest integer we can input and therefore make a good base case.
The we give the base case of
fact(1) = 1.

Next we need the **induction step**
Suppose we give k an input of k>1.
Then : return n * fact(n-1)
We assume this is correct. This is called the induction hypothesis
Hereby we see that the k'th number of the fact series is:
Factk = k * fact(k-1)
Let's take an example.

Lets say k = 4 which k>1
The program would compute: 4*3*2*1= 24
We assume this is correct which then fact(4) is correct.
Hereby I have proven that fact(4) is correct, which then means that fact(3) would be correct and fact(2)... and so on.