

1)

Factorial function proof by induction

Base case:

$\text{fact}(1) = 1$

This is true since the factorial of 1 is defined to 1.

Inductive step:

Inductive hypothesis: It is assumed that $\text{fact}(k-1)$ correctly calculates the factorial of $(k-1)$.

If the hypothesis is true, then $\text{fact}(k) = k * \text{fact}(k-1) = k * (k-1)!$ is true.

$k * (k-1)!$ Is the definition of $k!$, therefore the function has been proved.