Signature 1. Let n be a natural number. $n!$ is a natural number.

Axiom 2. $0! = 1$.

Axiom 3. Let n be a natural number. Then $n+1! = n! \cdot (n+1)$.

Proposition 4. Let n be a natural number. Then $n! \neq 0$.

Proof. Define $\Phi := \{n' \in \mathbb{N} \mid n'! \neq 0\}$.

(1) Φ contains 0. Indeed $0! = 1 \neq 0$.

(2) For all $n' \in \Phi$ we have $n'+1 \in \Phi$.

Proof. Let $n' \in \Phi$. We have $n'+1! = (n'+1) \cdot n'!$. $n'+1$ and $n'!$ are nonzero. Hence $n'+1! \neq 0$. $\square$

Thus Φ contains every natural number (by induction). Therefore $n! \neq 0$. $\blacksquare$