Claim: Every positive integer greater than 1 can either be written as the product of prime numbers or is a prime number itself.

Proof by Strong Induction:

Variable:
\[ n \] is an element of positive natural numbers greater than 1 i.e., \{2,3,4\ldots\}, so \( n \in \mathbb{N}^* - \{1\} \)

Prop:
\( P(n): n \) is either a prime number or the product of prime numbers.

1) Base Case:

Let 2 be the base case. 2 is a prime number.

2) Induction Step:

[I.H.] Let \( n \geq k \geq 2 \). Assume \( k \) can be written as the product of primes, or that \( k \) is a prime number.

N.O.S. that \( n+1 \) is a product of prime numbers or is prime.

Case 1 - If \( n+1 \) is prime, this satisfies the claim

Case 2 - If \( n+1 \) isn’t prime, let there exist integers \( x,y \) where \( n > x \geq 2 \) and \( n > y \geq 2 \) such that \( xy = n+1 \).

Since \( x \) and \( y \) are both primes or the product of primes by the I.H., \( xy = n+1 \) is a product of primes.