For a nonnegative, integer-valued random variable N, show that

$$\mathbb{E}[N] = \sum_{i=1}^{\infty} \mathbb{P}[N \geq i].$$

Hint: $\sum_{i=1}^{\infty} \mathbb{P}[N \geq i] = \sum_{i=1}^{\infty} \sum_{k=i}^{\infty} \mathbb{P}[N = k]$. Now change the order of the sums.