A puzzler about Inclusion-Exclusion

The inclusion-exclusion formula is
\[ n(A \cup B) = n(A) + n(B) - n(A \cap B). \]

What would it become if we had three sets?

I.e., \( n(A \cup B \cup C) = \ldots? \)
Answer

\[ n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C) \]

In general, to find the number of elements in the union of \( n \) sets,

\begin{itemize}
  \item add up the sizes of the sets
  \item subtract off the sizes of intersections, taken two at a time
  \item add back the sizes of intersections, taken three at a time
  \item etc.
\end{itemize}