How many DNA strings of length 4, i.e. strings in \{C, T, G, A\}^4 have exactly 2 C's, or exactly 2 T's?

Subtraction Rule:

- Exactly 2 C's
  \[
  \binom{4}{2} \cdot 3 \cdot 3 = \binom{2}{2} \cdot 3 \cdot 3
  \]
  Choose 2 out of 4 positions to have C's
  Can put remaining C in 2nd position
- Exactly 2 T's
  \[
  \frac{\binom{4}{2} \cdot 17}{2! \cdot 2!} = \frac{4!}{2! \cdot 2!} \cdot 17
  \]

How many DNA strings of length 4, i.e. strings in \{C, T, G, A\}^4 have at least 2 C's, or at least 2 T's?

- Exactly 2 C's or T's
  \[
  3 \cdot 17 + 2 \cdot \binom{4}{3} \cdot 3
  \]

- Exactly 3 C's or 3 T's
  \[
  \binom{4}{3} \cdot 3
  \]

- Exactly 4 C's
  \[
  2
  \]