\[
\max \{x_1, \ldots, x_n\}
\]

\[\text{for } i = 2 \text{ to } n \text{ do } \]
\[\text{if } x_i > x_{\text{max}} \text{ then }
\]
\[m \leftarrow i
\]
\[\text{end if}
\]
\[\text{end for}
\]

\[\text{Formula in terms of } n \text{ and } m
\]

**Rule of Sum**

If an event \( E \) composed of event \( E_1 \) or \( E_2 \) and \( E_1 \) can happen in \( |E_1| \) ways and \( E_2 \) can happen in \( |E_2| \) ways, then \( E = E_1 + E_2 \) can happen in \( |E_1| + |E_2| \) ways.

**Rule of Product**

If an event \( E \) composed of events \( E_1 \) and \( E_2 \) and \( E_1 \) can happen in \( |E_1| \) ways and \( E_2 \) can happen in \( |E_2| \) ways, then \( E = E_1 \cap E_2 \) can happen in \( |E_1| \times |E_2| \) ways.
**Rule of Product**

\[ A \times B \times C \times D \times E \times F \]

\[ 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720 \]

\[ n! = n \times (n-1) \times \cdots \times 1 \]

\[ (n-1)! \]

\[ 0! = 1 \]

\[ n! = n \times (n-1)! \]

\[ = 1 \text{ for } n=0 \]

\[ \text{ways to arrange } n \text{ students in a row} = n! \]

\[ \text{ways to arrange } n \text{ students in a circle} \]

\[ \frac{n!}{n} = (n-1)! \]

\[ \frac{n!}{(n-1)!} \]

\[ \text{ways to arrange } n \text{ books } B_1, B_2, B_3, \ldots, B_n \]

\[ \text{ways to arrange } n \text{ books in a circle} = \frac{n!}{n} = (n-1)! \]

\[ \frac{(n-1)!}{2} \]

\[ \text{ways to arrange } n \text{ books in a circle} \text{ (upside down)} \]
Heuristics: \[ f_n = \begin{cases} 1 & n = 0, 1, 2 \\ \frac{(n-1)!}{2} & n \geq 3 \end{cases} \]

**Rule of Sum**

\[ E = E_1 + E_2 \]

\[ |E| = |E_1| + |E_2| \quad E_1 \cap E_2 = \emptyset \]

\[ |E| = |E_1| + |E_2| - |E_1 \cap E_2| \]

\[ E_1 \quad E_2 \quad E_3 \]

\[ |E| = |E_1| + |E_2| + |E_3| - |E_1 \cap E_2| - |E_1 \cap E_3| - |E_2 \cap E_3| + |E_1 \cap E_2 \cap E_3| \]

**Principle of Inclusion-Exclusion**

\[ |E| = |E_1| + |E_2| + |E_3| + (E_1 \cap E_2) + (E_1 \cap E_3) + (E_2 \cap E_3) - (E_1 \cap E_2 \cap E_3) - (E_1 \cap E_4) \]

\[ + (E_2 \cap E_4) + (E_3 \cap E_4) + (E_1 \cap E_2 \cap E_3 \cap E_4) \]

\[ - (E_1 \cap E_2 \cap E_3 \cap E_4) \]
$D_n = \text{derangements of } n \text{ items}$

2n people
M, M, ... M
W, W, ... W

Ménage

Google