Definition: Set Raised to a Power

For a given set X we may write X^n to represent the set $\{(x_1, x_2, \ldots, x_{n-1}, x_n) : \forall i \in [n], x_i \in X\}$, the notation is suggestive of

$$\underbrace{X \times X \times \ldots \times X}_{n \text{ times}}$$

even though elements from this set would have many nested inner tuples, which do not need to be considered.