

Foundations of Mathematics › Set Theory › Sets ›

MathWorld Contributors › Librik ›

Subset

A subset is a portion of a set. B is a subset of A (written $B \subseteq A$) iff every member of B is a member of A . If B is a proper subset of A (i.e., a subset other than the set itself), this is written $B \subset A$. If B is not a subset of A , this is written $B \not\subseteq A$. (The notation $B \not\subseteq A$ is generally not used, since $B \not\subseteq A$ automatically means that B and A cannot be the same.)

The subsets (i.e., power set) of a given set can be found using `Subsets[list]`.

An efficient algorithm for obtaining the next higher number having the same number of 1 bits as a given number (which corresponds to computing the next subset) is given by Gosper (1972) in PDP-10 assembler.

The set of subsets of a set S is called the power set of S , and a set of n elements has 2^n subsets (including both the set itself and the empty set). This follows from the fact that the total number of distinct k -subsets on a set of n elements is given by the binomial sum

$$\sum_{k=0}^n \binom{n}{k} = 2^n.$$

For sets of $n = 1, 2, \dots$ elements, the numbers of subsets are therefore 2, 4, 8, 16, 32, 64, ... (OEIS A000079). For example, the set $\{1\}$ has the two subsets $\emptyset$ and $\{1\}$. Similarly, the set $\{1, 2\}$ has subsets $\emptyset$ (the empty set), $\{1\}$, $\{2\}$, and $\{1, 2\}$.

SEE ALSO

Empty Set, Implies, Improper Subset, k -Subset, p -System, Power Set, Proper Subset, Subset Sum Problem, Superset, Venn Diagram

Explore this topic in the MathWorld classroom

EXPLORE WITH WOLFRAM|ALPHA





More things to try:



Courant, R. and Robbins, H. *Methods in Mathematics: An Elementary Approach to Ideas and Methods*, 2nd ed. Oxford, England: Oxford University Press, p. 109, 1996.

Gosper, R. W. Item 175 in Beeler, M.; Gosper, R. W.; and Schroeppe, R. *HAKMEM*. Cambridge, MA: MIT Artificial Intelligence Laboratory, Memo AIM-239, Feb. 1972.

<http://www.inwap.com/pdp10/hbaker/hakmem/hacks.html#item175>.

Kamke, E. *Theory of Sets*. New York: Dover, p. 6, 1950.

Ruskey, F. "Information of Subsets of a Set." <http://www.theory.csc.uvic.ca/~cos/inf/comb/SubsetInfo.html>.

Skiena, S. "Binary Representation and Random Sets." §1.5.2 in *Implementing Discrete Mathematics: Combinatorics and Graph Theory with Mathematica*. Reading, MA: Addison-Wesley, pp. 41-42, 1990.

Sloane, N. J. A. Sequence A000079/M1129 in "The On-Line Encyclopedia of Integer Sequences."

REFERENCED ON WOLFRAM|ALPHA

Subset

CITE THIS AS:

Weisstein, Eric W. "Subset." From *MathWorld*--A Wolfram Web Resource.

<https://mathworld.wolfram.com/Subset.html>

SUBJECT CLASSIFICATIONS

Foundations of Mathematics › Set Theory › Sets ›

MathWorld Contributors › Librik ›

[About MathWorld](#) | [MathWorld Classroom](#) | [Contribute](#) | [MathWorld Book](#)

14,005 Entries | Last Updated: Thu Oct 12 2023 | ©1999–2023 Wolfram Research, Inc. | [Terms of Use](#)

[wolfram.com](#) | [Wolfram Language](#) | [Mathematica](#) | [Wolfram Demonstrations](#) | [Wolfram for Education](#)

Created, developed and nurtured by Eric Weisstein at Wolfram Research