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 $B \nsubseteq A$. (The notation $B \not\subset A$ is generally not used, since $B \nsubseteq A$ 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 $n = 1, 2, \ldots$ 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

WolframAlpha subset product problem

More things to try: = subset product problem = subset {1,2,3} = word subset qewgyeewcqbjqwef

Courant, R. and Robbins, H. *What is 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 Schroeppel, 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 ›