What is discrete mathematics?

Discrete mathematics is the part of mathematics devoted to the study of discrete objects. Discrete mathematics is the branch of mathematics dealing with objects that can assume only distinct, separated values. The term "discrete mathematics" is therefore used in contrast with "continuous mathematics," which is the branch of mathematics dealing with objects that can vary smoothly (which includes calculus). Whereas discrete objects can often be characterized by integers, continuous objects require real numbers.

Discrete mathematics or finite mathematics is the branch of mathematics in which the mathematical organizations are fundamentally isolated, that is, the notion of continuity does not apply to them. The formulas of continuity do not apply to it. This is why the name has become Discrete mathematics. Most or all of the objects studied in Discrete mathematics are computational sets, such as integers, finite graphs, and statistical languages.

What is a proposition?

An assertion is a statement. A proposition is an assertion which is either true or false (but not both).

The Following are propositions:

- ►4 is a prime number
- ► $3 + 3 = 6$
- ► The moon is made of cheese.

The following are not propositions:

- ► $x+y > 4$. Is this true or false? It depends on the value of x and y, the statement takes a true or false value.
- ► $x=3$. You cannot associate a truth value to this because it simply assigns a value to x.
- ► Are you leaving? This is not an assertion, it is a question.
- ► Buy 4 Books this is not an assertion, it is an order.

The negation

The **negation** of statement p is "not p." The negation of p is symbolized by "~p or ¬p." The truth value of ~p is the opposite of the truth value of p.

p:	The number 9 is odd.	true
~p:	The number 9 is not odd.	false

Construct a truth table for the negation of p.

Solution:

p	~p
T	F
F	T

Given:	a: A triangle is not a polygon.
	b: A square is a rectangle.
Problem:	Which of the following is the negation of "A triangle is not a polygon"?

Disjunction

A disjunction is a compound statement formed by joining two statements with the connector OR. The disjunction "p or q" is symbolized by p ∨ q. A disjunction is false if and only if both statements are false; otherwise it is true. The truth values of p ∨ q are listed in the truth table below.

p	q	p∨q
T	T	T
T	F	T
F	T	T
F	F	F

or

Let p and q be propositions. The disjunction of p and q, denoted by p∨q, is the proposition “p or q.” The disjunction p∨q is false when both p and q are false and is true otherwise.

p	q	p∨q
T	T	T
T	F	T
F	T	T
F	F	F

Example

Given:	r: x is divisible by 2.
	s: x is divisible by 3.
Problem:	s?

Each statement given in this example represents an open sentence, so the truth value of r∨s will depend on the replacement values of x as shown below.

If x = 6, then r is true, and s is true. The disjunction r∨s is true.

Example: Complete a truth table for each disjunction below.

1. a or b
2. a or not b
3. not a or b

a	b	a∨ b
T	T	T
T	F	T
F	T	T
F	F	F

a	b	~b	a ∨ ~b
T	T	F	T
T	F	T	T
F	T	F	F
F	F	T	T

a	b	~a	~a ∨ b
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

Conjunction

A **conjunction** is a compound statement formed by joining two statements with the connector AND. The conjunction "p and q" is symbolized by p∧q. A conjunction is true when both of its combined parts are true; otherwise it is false.

we complete the last column according to the rules for conjunction listed above.

p	q	p∧q
T	T	T
T	F	F
F	T	F
F	F	F

or

Let p and q be propositions. The conjunction of p and q, denoted by p∧q, is the proposition "p and q." The conjunction p∧q is true when both p and q are true and is false otherwise.

p	q	p∧q
T	T	T
T	F	F
F	T	F
F	F	F

Example

Given:	r: The number x is odd.
.	s: The number x is prime.
Problem:	Can we list all truth values for r∧s in a truth table? Why or why not?

The truth value of r ∧ s will depend on the value of variable x. But there are an infinite number of replacement values for x, so we cannot list all truth values for r ∧ s in a truth table. We can, however, find the truth value of r ∧ s for given values of x as shown below.

- ►If x = 3, then r is true, s is true. The conjunction r ∧ s is true.
- ► If x = 9, then r is true, s is false. The conjunction r ∧ s is false.
- ► If x = 2, then r is false, s is true. The conjunction r ∧ s is false.
- ► If x = 6, then r is false, s is false. The conjunction r ∧ s is false

Example : Construct a truth table for each conjunction below:

1. x and y
2. ~x and y
3. ~y and x

Solution:

x	y	x∧y
T	T	T
T	F	F
F	T	F
F	F	F

x	y	~x	~x∧y
T	T	F	F
T	F	F	F
F	T	T	T
F	F	T	F

x	y	~y	~y∧x
T	T	F	F
T	F	T	T
F	T	F	F
F	F	T	F