Keyword Definition:

- **Proposition:** statement or idea that can be either true or false

- **Negation:** expressing the opposite or denial of a statement

- **Conjunction (^) :** are words that join together words, phrases, or sentences to create more complete and meaningful ideas. Both conditions must be true for the compound statement to be true. They act like glue, helping us express relationships between different parts of a sentence. (“And”, “But”, Despite the fact that, Although)

- **Disjunction (v)** is like saying "either this or that (or both). . Only false when both statements are false. There are 2 types of disjunction:
    - **Inclusive Disjunction (using "or")**: Inclusive disjunction means that at least one of the options is true, but it could be both. For example: *"You can have tea or coffee." (You can choose one or both beverages.)*
    - **Exclusive Disjunction (using "either...or")**: Exclusive disjunction means that only one of the options can be true, but not both. For example: *"You can choose either the red shirt or the blue shirt." (You can pick one, but not both.)*

- **Implication (→)** is a statement that expresses a logical relationship between two propositions, typically using "if...then" or "implies" to indicate that the truth of the first proposition (the antecedent) leads to or requires the truth of the second proposition (the consequent). P is usually behind the "If" keyword.“P -> Q”

  Statement is only considered false when the hypothesis (x) is true, and the conclusion (y) is false. In all other cases, the implication is considered true.. How to identify P and Q ? *P is the statement that comes after "if," and Q is the statement that comes after "then."*

    - **The contrapositive of an implication** is a related statement formed by negating both the antecedent and the consequent and reversing their order. In symbolic form, it's represented as "~Q → ~P." Change position and make it opposite
    - **Inverse: The inverse of an implication** is a related statement formed by negating both the antecedent and the consequent without changing their order. In symbolic form, it's represented as "~P → ~Q." Make them all opposite
    - **The converse of an implication** is a related statement formed by reversing the order of the antecedent and the consequent without negating them. In symbolic form, it's represented as "Q → P." Change position only, no opposite change

Popular Keyword for condition operator:

p is hypothesis - q is conclusion

If p, then q. *q if p* *q whenever p.* *p only if q.* *p is sufficient for q,*

q is necessary for p, *p implies q.*

- **Biconditional (←>)** often denoted by "if and only if" or "if,". It means that if one condition is true, the other condition must also be true, and if one condition is false, the other condition must also be false. Here's a simple explanation: *"A biconditional statement is true if both conditions have the same truth value. If one is true, the other must be true, and if one is false, the other must be false.". They need to be the same True or False both to make the statement true. p ⇔ q means "p if and only if q."*

How to create Truth Table

! How many rows in the Truth Table ? it's 2^n where n is the number of different variables in a statement. For example q ^ p , there are 2 variables, so 2^2 = 4 rows. Negation is not counted as a new individual variable so q and -q are counted as 1.

For True and False Filling Patterns in each square:
Patterns start from the left of the final product. With the pattern "double" from the previous pattern. For example, T & F, TT & FF, TTTT & FFFF, TTTTTTTT & FFFFFFFF.

1 2 4 8

Pay Attention: for the negation value, fill them out after finishing the original proposition variable.!

Start from the "Left of Condition Column"
<–- Then go from Right to Left <–- (Double Patterns)
8 <- 4 <- 2 <- 1 <-

p	q	r	Condition… etc
T	T	T	
T	T	F	
T	F	T	
T	F	F	
F	T	T	
F	T	F	
F	F	T	
F	F	F	