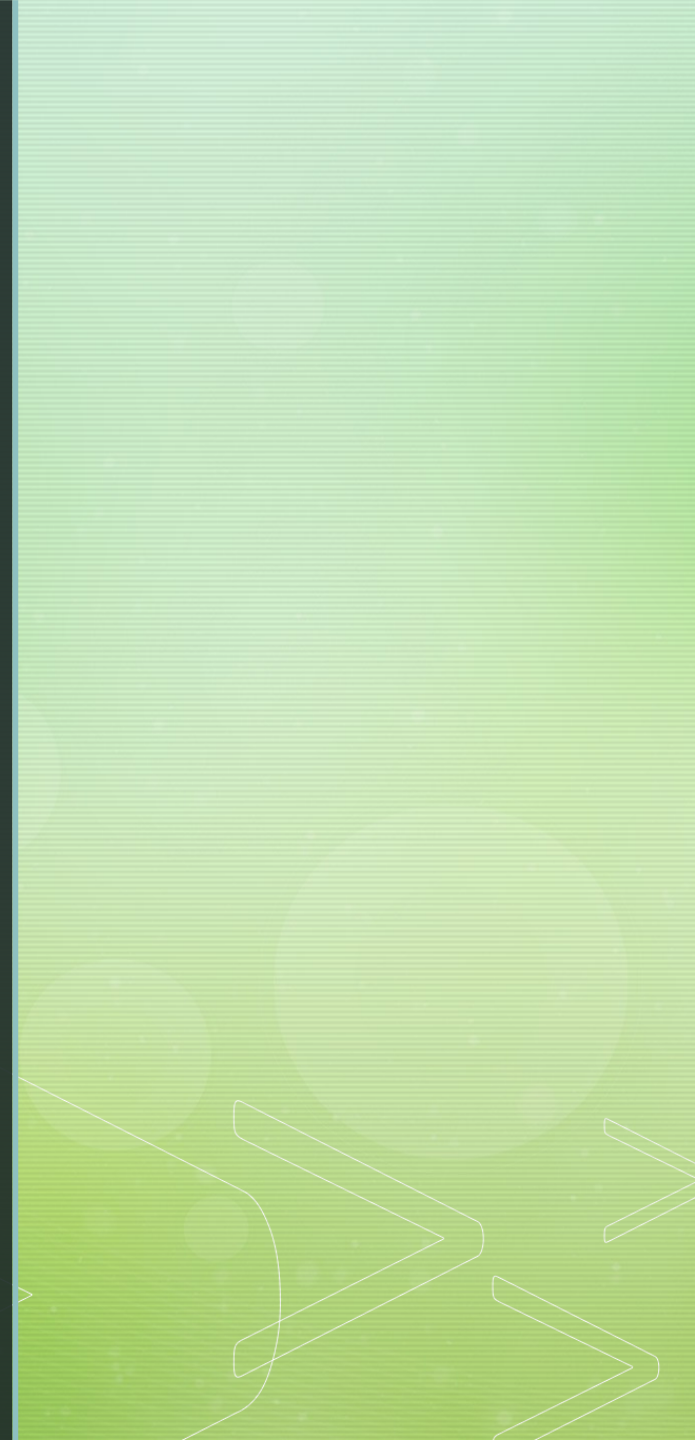


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Propositional Equivalence



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Equivalence	Name
$P \wedge T \Leftrightarrow P$ $P \vee F \Leftrightarrow P$	Identity Laws
$P \vee T \Leftrightarrow T$ $P \wedge F \Leftrightarrow F$	Domination Laws
$P \vee P \Leftrightarrow P$ $P \wedge P \Leftrightarrow P$	Idempotent Laws
$\neg (\neg P) \Leftrightarrow P$	Double Negation Law
$P \vee Q \Leftrightarrow Q \vee P$ $P \wedge Q \Leftrightarrow Q \wedge P$	Commutative Law

Equivalence	Name
$ \begin{aligned} & (P \vee Q) \vee R \\ \Leftrightarrow & P \vee (Q \vee R), (P \wedge Q) \wedge R \\ \Leftrightarrow & P \wedge (Q \wedge R) \end{aligned} $	Associative Law
$ \begin{aligned} & P \vee (Q \wedge R) \\ \Leftrightarrow & (P \vee Q) \wedge (P \vee R) \end{aligned} $	Distributive Law
$ \begin{aligned} \neg(P \wedge Q) & \Leftrightarrow \neg P \vee \neg Q \\ \neg(P \vee Q) & \Leftrightarrow \neg P \wedge \neg Q \end{aligned} $	De Morgan's Laws
$P \Rightarrow Q \Leftrightarrow \neg P \vee Q$	Implication Equivalence
$P \Rightarrow Q \Leftrightarrow \neg Q \Rightarrow \neg P$	Contrapositive Law

Note: equivalent expressions can always be substituted for each other in a more complex expression - useful for simplification.

Logic in Proof

- A **theorem** is a proposition that can be proved to be true.
- An argument that establishes the truth of a theorem is called a **proof**.
- An **argument** is a process by which a conclusion is drawn from a set of propositions.
- The given set of propositions are called **premises or hypotheses**.
- The final proposition derived from the given propositions is called a **conclusion**.

Logic in Proof....

- An argument is said to be logically **valid argument** if and only if the conjunction of the premises implies the conclusion.

- In other words, a valid argument is one when:

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$$P_1 \wedge P_2 \wedge P_3 \dots \dots \wedge P_n \rightarrow C$$

is a tautology: