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People

Aristotle Created the first treatises on logic.

Gottfried Leibniz (17th century) Conceived the idea of using symbols for logic.

George Boole & Augustus De Morgan (19th century) Founded modern subject of symbolic logic.

Terms

Statements A statement (or proposition) is a sentence that is true or false **but not both**.

Logical Equivalence Two *statement forms* are called logically equivalent if, and only if, they have identical truth values for each possible substitution of statements for their statement variables. Two *statements* are logically equivalent if, and only if, they have logically equivalent forms when identical component statement variables are used to replace identical component statements.

Tautology A tautology is a statement form that is always true. A statement whose form is a tautology is a tautological statement.

Contradiction A contradiction is a statement form that is always false. A statement whose form is a contradiction is a contradictory statement.

Symbols

$\vee$ or (disjunction)

$\wedge$ and (conjunction)

$\neg$ **or** $\sim$ not (negation)

$\oplus$ exclusive or ("xor")

$\equiv$ logical equivalence

Notes

- $\vee$ and $\wedge$ are coequal in order of operation; $\neg$ has a higher precedence.
- Statement form example: $\neg\left(p \wedge q\right)$.
- Statement example: It is neither raining nor pouring.
- Checking for logical equivalence:
  - Illustrate that the truth values in each row of the truth table are equivalent.
  - Write concrete statements showing you can substitute two statements to make one of the statement forms true and the other false.
- Double Negative Property: $\neg(\neg p) \equiv p$.
- De Morgan's Laws:
  - $\neg\left(p \wedge q\right) \equiv \neg p \vee \neg q$.
  - $\neg\left(p \vee q\right) \equiv \neg p \wedge \neg q$. Ex: "The bus was late or Tom's watch was slow." This is changed to: "The bus was not late and Tom's watch was not slow."