Some Big Ideas, Week 2

Jan 27 – Jan 31, 2025

⊙ **Definition:** A ***proposition*** or ***statement*** is a sentence that is true or false, but not both.

⊙ **Notation:** If p and q are propositions, then

- $\sim p$ or $\neg p$ means "not p", also called the ***negation*** of p.
- $p \vee q$ means "p or q", also called the ***disjunction*** of p and q.
- $p \wedge q$ means "p and q", also called the ***conjunction*** of p and q.
- $p \to q$ means "p implies q", also called the ***conditional***. p is the ***hypothesis*** and q is the ***conclusion***

⊙ **Definition:** The ***truth table*** for a logical expression displays the truth values for the expression corresponding to all possible combinations of truth values for the propositions in the expression.

⊙ **Notation:** If expressions P and Q are logically equivalent, then we denote this with $P \equiv Q$.

⊙ **DeMorgan's Laws:** If P and Q are logical expressions, then

- $\neg(P \wedge Q) \equiv \neg P \vee \neg Q$
- $\neg(P \vee Q) \equiv \neg P \wedge \neg Q$

⊙ **Definition:** The ***biconditional*** "p if-and-only-if q" means $(p \to q) \wedge (q \to p)$.
We will often abbreviate to "p iff q".

⊙ **Definition:** The ***contrapositive*** of a conditional statement "If p then q" is the statement "If $\neg q$ then $\neg p$".

⊙ **Definition:** The ***converse*** of a conditional statement "If p then q" is the statement "If q then p".

⊙ **Definition:** The ***inverse*** of a conditional statement "If p then q" is the statement "If $\neg p$ then $\neg q$".

Some of the resources I used in constructing the Big Ideas notes this semester are: Ernst: *Introduction to Proof via Inquiry-Based Learning*; Epp: *Discrete Mathematics with Applications, 4th edition*; Levin: *Discrete Mathematics, An Open Introduction, 4th edition*; Sundstrom: *Mathematical Reasoning, Writing and Proof, Version 3.*

Check the ***Tentative Weekly Syllabus*** on the course webpage for the specific sections relevant for this week.