Some Big Ideas, Week 2

Jan 30 – Feb 3, 2023

These are some of the Big Ideas that we will discuss this week. The sections from the optional texts listed on the Weekly Syllabus on the course website provide more background and fill in additional details.

⊙ **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.

· $p \rightarrow q$ 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 $(p \rightarrow q) \wedge (q \rightarrow p)$.
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 $\neg q$".