LOGICAL REASONING CHEAT SHEET

Essential Formulas, Truth Tables, Fallacies, and Verbal Rules for Competitive Exams

1. PROPOSITIONAL LOGIC

Logical Connectives:

- **Negation** (NOT): $\neg P$ or $\sim P$
- **Conjunction** (AND): $P \wedge Q$
- **Disjunction** (OR): $P \vee Q$
- **Conditional** (If...then): $ParrowQ$
- **Biconditional** (If and only if): $PrightarrowQ$

Truth Table Master Reference:

P	Q	$P \wedge Q$	$P \vee Q$	$ParrowQ$	$PrightarrowQ$
T	T	T	T	T	T
T	F	F	T	F	F
F	T	F	T	T	F
F	F	F	F	T	T

Implication Equivalence:

- Conditional: $ParrowQ$
- **Contrapositive**: $\neg Qarrow\neg P$ (*Logically Equivalent*)
- **Converse**: $QarrowP$ (*NOT equivalent*)
- **Inverse**: $\neg Parrow\neg Q$ (*NOT equivalent*)
- Alternative form: $ParrowQ \equiv \neg P \vee Q$

2. LOGICAL LAWS & EQUIVALENCES

- **De Morgan's Laws:**

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

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

- **Double Negation:** $\neg(\neg P) \equiv P$
- **Commutative:** $P \wedge Q \equiv Q \wedge P$
- **Distributive:**

$$P \wedge (Q \vee R) \equiv (P \wedge Q) \vee (P \wedge R)$$

$$P \vee (Q \wedge R) \equiv (P \vee Q) \wedge (P \vee R)$$

- **Absorption:** $P \wedge (P \vee Q) \equiv P$

3. CATEGORICAL SYLLOGISMS

Standard Statements (AEIO):

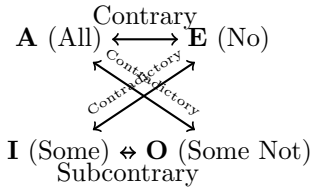
A (Universal Affirmative): All A are B. ($A \subseteq B$)

E (Universal Negative): No A are B. ($A \cap B = \emptyset$)

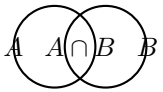
I (Particular Affirmative): Some A are B. ($A \cap B \neq \emptyset$)

O (Particular Negative): Some A are not B.

Square of Opposition:



Venn Diagram Rules:



4. RULES OF INFERENCE

Modus Ponens: $\frac{ParrowQ,\ P}{\therefore Q}$

Modus Tollens: $\frac{ParrowQ,\ \neg Q}{\therefore \neg P}$

Hypothetical Syllogism: $\frac{ParrowQ,\ QarrowR}{\therefore ParrowR}$

Disjunctive Syllogism: $\frac{P \vee Q,\ \neg P}{\therefore Q}$

5. INFORMAL FALLACIES

- **Ad Hominem:** Attacking the person instead of the argument.
- **Straw Man:** Oversimplifying/misrepresenting an argument to easily refute it.

- **Appeal to Authority:** Claiming truth because an unqualified authority asserted it.
- **False Dilemma:** Presenting only 2 options when more exist.
- **Begging the Question:** Circular reasoning where conclusion is assumed in premise.
- **Post Hoc Ergo Propter Hoc:** Assuming cause because one event followed another.

6. CRITICAL REASONING HEADS

- **Strengthening an Argument:** Provide evidence that supports the link between premise and conclusion or eliminates alternative causes.
- **Weakening an Argument:** Expose flawed assumptions, point out counterexamples, or present alternative explanations.
- **Assumption Identification:** Find unstated premise required for conclusion to hold (Use the *Negation Test*).