PHI 103 - Propositional Logic
Lecture 1

Symbols and Translations

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**Statement**: any sentence that is bivalent (has one of two possible truth values).

**Proposition**: the meaningful *content* of a statement.
Propositional Logic
Part 1 - Symbols and Translations

I. Propositions -

A. **Simple** - a single, complete, statement -
   1. Dogs are mammals.
   2. Ray-Bans are expensive.
   3. Kato is a beautiful dog.
   4. *Rick and Morty* is a great TV show.

B. **Complex** - one or more conjoined statements -
   1. Both dogs *and* cats are mammals.
   2. *If* Kato is a dog, *then* he is a mammal.
   3. *Either* you like *Rick and Morty*, *or* you like *Family Guy*.
   4. You’ll like *Futurama* *if and only if* you like *The Simpsons*. 
Propositional Logic
Part 1 - Symbols and Translations

II. Symbols -

A. Propositions - use a capital letter to symbolize a proposition (use the first letter of the subject term) -

1. Simple -
   a. Dogs are mammals. = D
   b. Ray-Bans are expensive. = R
   c. Kato is a beautiful dog. = K
   d. Robot Chicken is a great TV show. = R

2. Complex -
   a. Both dogs and cats are mammals. = D and C.
   b. If Kato is a dog, then Kato is a mammal. = If K, then M.
   c. Either you like Robot Chicken, or you like Family Guy. = Either R or F.
Propositional Logic
Part 1 - Symbols and Translations

B. Operators (connectives) -
1. Negation ‘it is not the case that’ - tilde \( \sim \)
2. Conjunction ‘and’ - dot \( \cdot \)
3. Disjunction ‘or’ - wedge \( \lor \)
4. Material Implication (conditional) - ‘if, then’ - horseshoe \( \supset \)
5. Material Equivalence (biconditional) ‘if and only if’ - triple bar \( \equiv \)

C. Propositions -
1. \( D \) and \( C \). = \( D \cdot C \)
2. It’s not the case that \( K \). = \( \sim K \)
3. If \( K \), then \( M \). = \( K \supset M \)
4. Either \( R \) or \( F \). = \( R \lor F \)
5. \( S \) if and only if \( I \). = \( S \equiv I \)
Propositional Logic
Part 2 - Order of Operation and Punctuation

D. Punctuation - Identifying Order of Operations

1. Parentheses (first order)

Both Lucia and Kato are dead.

Lucia is dead and Kato is dead.

\[
L \land K
\]

a Well-Formed Formula

Lucia or Kato are not dead.

It’s not the case that Lucia or Kato is dead.

It’s not the case that L or K.

\[
\sim L \lor K
\]

not a Well-Formed Formula

\[
\sim (L \lor K)
\]

a WFF
Propositional Logic
Part 2 - Order of Operation and Punctuation

D. Punctuation - Identifying Order of Operations

1. Parentheses (first order)
2. Brackets [second order]

Lucia or Kato are dead, and so is Silver and Moose.
Lucia is dead or Kato is dead, and Silver is dead and Moose is dead.

\[ L \text{ or } K \text{ and } S \text{ and } M. \]

\[ (L \lor K) \cdot (S \cdot M) \quad \text{WFF} \]

It’s not true that, Lucia or Kato are dead and Silver and Moose are.

\[ \sim (L \lor K) \cdot (S \cdot M) \quad \text{not a Well-Formed Formula} \]

\[ \sim [ (L \lor K) \cdot (S \cdot M) ] \quad \text{WFF} \]
Propositional Logic
Part 2 - Order of Operation and Punctuation

D. **Punctuation** - Identifying Order of Operations

1. **Parentheses** (first order)
2. **Brackets** [second order]
3. **Braces** \{third order\}

\[
\sim\{ \sim[ ( L \lor K ) \cdot ( S \cdot M ) ] \equiv [ ( L \supset K ) \cdot ( S \cdot M ) ] \}
\]