CS-208:Artificial Intelligence
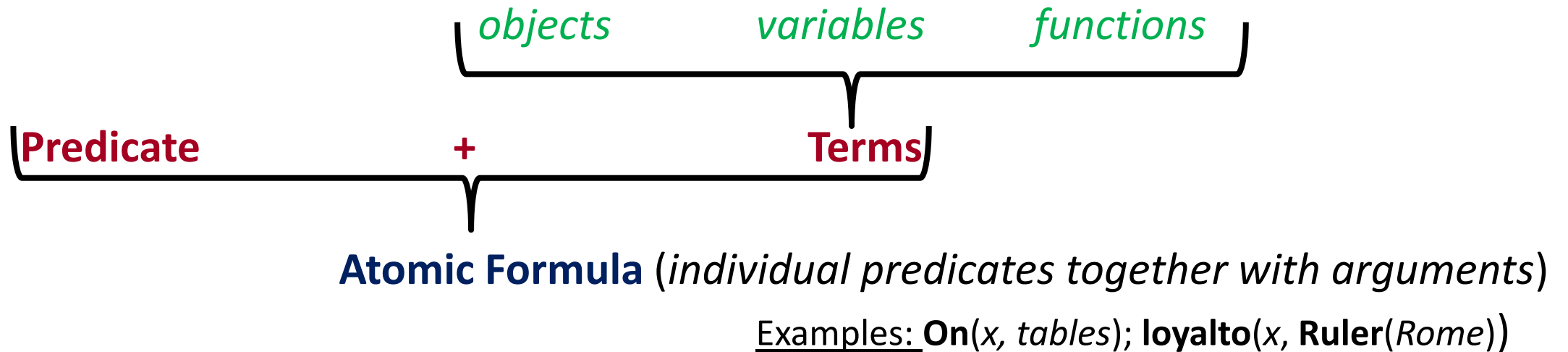# Topic -14 Mathematical Logic

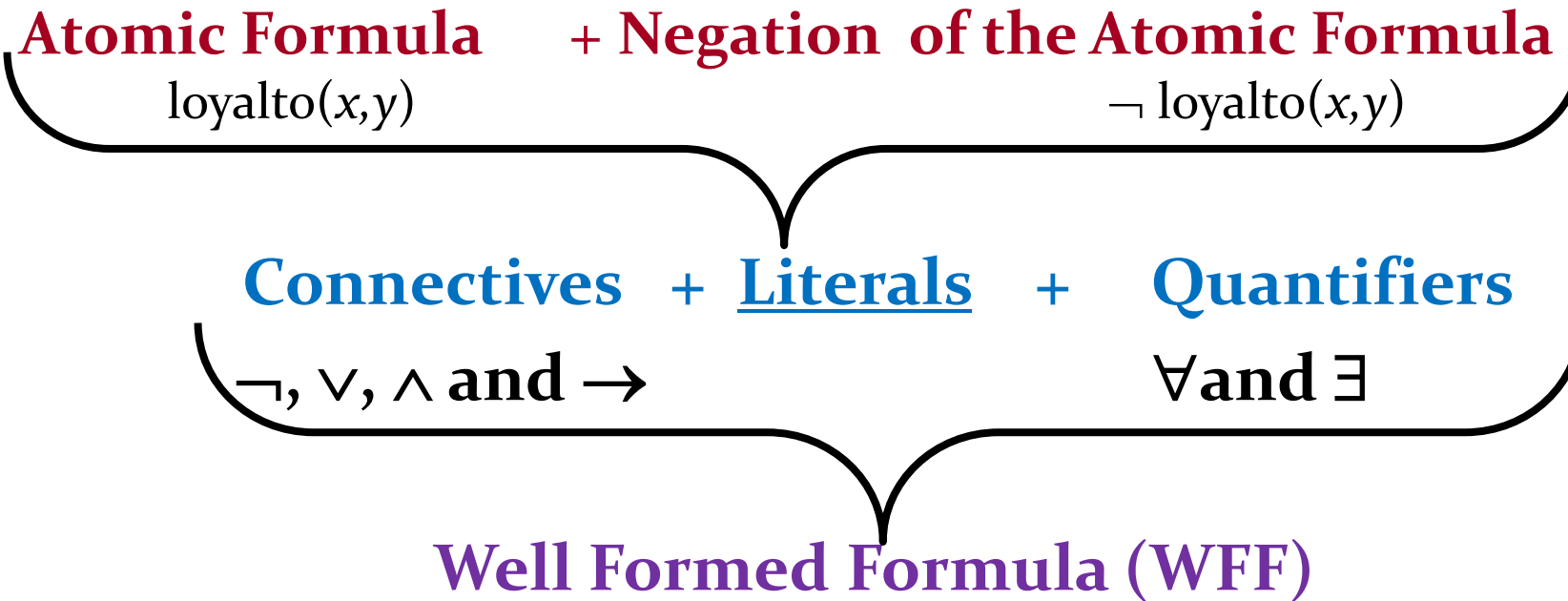# Revisiting Basics of Predicate Logic

Predicates *are function that map object arguments into True or False.*

Terms *are only things that appear as arguments to predicate.*

- Domain's Objects are Terms
- Variables ranging over a domain's object are Terms
- Functions are Terms. (The arguments to functions and the value returned are objects)

objects *variables* *functions*

Predicate **+** **Terms**

Atomic Formula (*individual predicates together with arguments*)

Examples: **On**(*x, tables*); **loyalto**(*x*, **Ruler**(*Rome*))

Atomic Formula + **Negation of the Atomic Formula**

loyalto(x,y) $\neg$ loyalto(x,y)

Connectives + **Literals** + **Quantifiers**

$\neg, \lor, \land$ **and** $\rightarrow$ $\forall$ **and** $\exists$

Well Formed Formula (WFF)

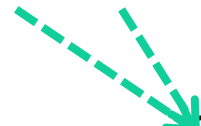**Literals** *are atomic formula and negated atomic formula*

Universal **Quantifier**: *(for all)* $\forall$

Existential Quantifier: *(there exist)* $\exists$

Well Formed Formulas abbreviated by WFFs are defined recursively as follows:

- Literals are WFF.

- WFF connected together by connectives ($\vee, \wedge, \neg$ and $\rightarrow$) are WFF.

- WFF surrounded by quantifiers($\forall$ and $\exists$) are also WFF.

A $\wedge$ B is called Conjunction

Conjuncts

A $\vee$ B is called Disjunction

Disjuncts

Modus Ponens: *If there is an axiom of the form A→B and another axiom of the form A then B logically follows.*

Modus Tolens: *If there is an axiom of the form A→B and another axiom of the form ¬A then ¬ B logically follows.*

Resolution: *If there is. an axiom of the form A ∨ B and another axiom of the form ¬B ∨ C then A ∨ C logically follows.*

The expression A ∨ C is called the **resolvent** *of A ∨ B and ¬B ∨ C*