Guide 13 – First Order Logic

* First-order logic:
  + Also known as predicate logic.
  + Uses quantified variables over non-logical objects.
    - “for all”
    - “there exists”
  + Allows use of sentences that contain variables.
* Propositional logic:
  + Does not use quantifiers or relations or non-logical objects or predicates.
    - Relations – property that assigns truth values to finite tuples of elements.
  + Foundation of first-order logic.
  + Propositions (true or false) and argument flow.
  + Compound propositions formed by using logical connectives.
  + Atomic propositions are without logical connectives.
* Quantification:
  + Specifies the quantity of specimens in the domain of discourse that satisfy an open formula.
  + “for all” and “there exists” are the two most common ones.
  + Quantifier – language element that generates a quantification.
  + In predicate logic – universal quantification and existential quantification.
* Logical connectives:
  + Also known as logical operator, sentential connective, or sentential operator.
  + Is a symbol or word used to connect 2 or more sentences in a grammatically valid way such that the value of the compound sentence depends only on the original sentences and the meaning of the connective.
  + Most common are binary connectives and negation (unary connective).
* Variables:
  + Propositional variables 🡪 true or false.
  + General variables – element, feature, or factor that is liable to vary or change.
* Resolution:
  + A rule of inference leading to a refutation theorem-proving technique for sentences in propositional logic and first-order logic.
  + Iterative application tells whether a propositional formula is satisfiable and for proving first-order formula is unsatisfiable.
  + In propositional logic:
    - A single valid inference rule that produces a new clause implied by two clauses containing complementary literals.
      * Literal – propositional variable or negation of a propositional variable.
      * Complementary literals – if one literal is the negation of the other. (a and not a)