**MATHEMATICAL LOGIC:**

**Statements and notations:**

A proposition or statement is a declarative sentence that is either true or false (but not both). For instance, the following are propositions:

* Paris is in France< (true)
* London is in Denmark< (false)
* 2 < 4 < (true)
* 4 = 7< (false)

However the following are not propositions:

* what is your name?< (this is a question)
* do your homework< (this is a command)
* this sentence is false< (neither true nor false)
* x is an even number< (it depends on what x represents)
* **Socrates< (it is not even asentence)**

**The truth or falsehood of a proposition is called its truth value. Connectives:**

Connectives are used for making compound propositions. Generally used five connectives are –

* OR (V)
* AND (K)
* Negation/ NOT (**¬**)
* Implication / if-then (**→**)
* If and only if ( ¤).

**Well formed formulas (wff):**

The strings that produce a proposition when their symbols are interpreted must follow the rules given below, and they are called wffs(well-formed formulas) of the first order predicate logic. A predicate name followed by a list of variables such as P(x, y), where P is

predicate name, and x and y are variables, is called an atomic formula.

**A well formed formula of predicate calculus is obtained by using the following rules.**

1. An atomic formula is a wff.
2. If A is a wff, then **¬**A is also a wff.
3. If A and B are wffs, then (A V B), (A ٨ B), (A → B) and (A ¤ B) are wffs.
4. If A is a wff and x is any variable, then (x)A and ($x)A are wffs.
5. Only those formulas obtained by using (1) to (4) are wffs.

**Wffs are constructed using the following rules:**

* 1. *True* and *False* are wffs.
  2. Each propositional constant (i.e. specific proposition), and each propositional variable (i.e. a variable representing propositions) are wffs.
  3. Each atomic formula (i.e. a specific predicate with variables) is a wff.
  4. If *A, B,* and *C* are wffs, then so are *A*, (*A B*), (*A B)*, *(A B),* and *(A B)*.
  5. If *x* is a variable (representing objects of the universe of discourse), and *A* is a wff, then so are *x A* and  *x A* .

For example, "The capital of Virginia is Richmond." is a specific proposition. Hence it is a wff by Rule 2.

Let B be a predicate name representing "being blue" and let x be a variable. Then B(x) is an atomic formula meaning "x is blue". Thus it is a wff by Rule 3. above.

By applying Rule 5. to B(x), xB(x) is a wff and so is  xB(x).

Then by applying Rule 4. to them x B(x) x B(x) is seen to be a wff. Similarly if R is a predicate name representing "being round". Then R(x) is an atomic formula. Hence it is a wff.