MTE PROJECT OF
LOGICAL REASONING

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TOPIC:

"The Evolution of Logic"

Logic is a deep subject, at the core of much work in philosophy, mathematics and computer science. The term 'logic' came from GREEK word 'logos', which is sometimes translated as 'sentence', 'reason', 'rule' etc. The GREEK word, 'logos' means thought. There are many thought processes such as 'reasoning', 'remembering', 'imagining'. Reasoning is a thought process in which inference takes place. Logic is the science of reasoning. Actually, logic is the study of the principle of correct reasoning. Critical thinking is an evaluation process which uses logic to separate truth from false, reasonable from unreasonable facts. It has so many importance in today's world in the field of mathematics, computer science etc. Through the

development and evolution of logic it has so many significant values in that modern, scientific and technical world.

The Evolution of Logic examines the relations between logic and philosophy over the last 150 years. There are three phases of the evolution of logic according to the development of logic. Logic underwent a major renaissance beginning in the nineteenth century. But the logic was first developed by Aristotle in 384-322 BCE known as Ancient logic or Aristotelian logic. Also, Stoics, Thales, Pythagoras was involved in that era with Aristotle. Aristotelian logic became widely accepted in science and mathematics and remained in the wide use in the west until the early 19th century. Aristotelian logic introduces temporal modal logic, hypothetical syllogism and inductive logic. There are two important stage of the development of the logic known classical logic and symbolic logic. In this era of Aristotle there were some predecessors. Some of them were Fred Flintstone, geometry, sophists, pre-Socratic philosophers, Socrates & Plato. Development in the sector of Syllogistic logic, laws of non-contradiction and excluded middle, modal logic. Also, some logic spread in a wider sense, such as definitions, fallacies, inductive reasoning, etc. In this basis for the "traditional logic" that dominated until the early 20th century. In the scholastic period, mnemonic names for the valid moods canvassed in the Prior Analytics were devised. Two first-figure valid moods were considered perfect and not in need of any further validation: BARBARA

and CELARENT. Aristotle may also be credited with the formulation of several metalogical theses, most notably the Law of Noncontradiction, the Principle of the Excluded Middle, and the Law of Bivalence. These are important in his discussion of modal logic and tense logic. Aristotle referred to certain principles of propositional logic and to reasoning involving hypothetical propositions. He also created to non-formal logical theories: techniques and strategies for devising arguments and a theory of fallacies.

In the evolution of logic in the first phase after Aristotle the most famous name is Stoic. The great innovations of logic occurred in the time of Megarian-Stoic. They developed an alternative account of the syllogism, and, in the course of so doing, elaborated a full propositional logic which complements Aristotelian term logic. There are fragmentary records of debates over the truth-conditions for various propositional connectives, which include accounts of material implication, strict implication, and relevant implication. And also developed propositional logic modal logic and determinism.

The second phase was in the era of Medieval logicians. The important name in them are Jean Buridan, William of Ockham. They developed the Ancient logic in many ways. After that era the first name in the development of modern symbolic logic is G.W Leibnitz.

Historically, medieval logic is divided into the old logic. The tradition stretching from Boethius (c. 480–525) until Abelard (1079–1142), and the new logic, from the late twelfth century until the Renaissance. The division reflects the availability of ancient logical texts. Before Abelard, medieval logicians were only familiar with *Aristotle's* Categories *and* On Interpretation *and Porphyry's* Isagoge *or* Introduction to the Categories and not the *Prior Analytics*, where Aristotle develops the theory of the syllogism — though they did know something of his theory through secondary sources. Once the *Prior Analytics* reappeared in the West in the middle of the twelfth century, commentaries on it began appearing in the late twelfth and early thirteenth centuries.

The fourteenth century is the apex of medieval logical theory, containing an explosion of creative work. Supposition theory is developed extensively in its second phase by logicians such as William of Ockham, Jean Buridan, Gregory of Rimini, and Albert of Saxony. Buridan also elaborates a full theory of consequences, a cross between entailments and inference rules. From explicit semantic principles, Buridan constructs a detailed and extensive investigation of syllogistic, and offers completeness proofs. Nor is Buridan an isolated figure. Three new literary genres emerged: treatises on syncategorematic, which attempted to codify their behaviour and the inferences they license; treatises on sentences called 'sophisms' that are puzzling or

challenging given background assumptions about logic and language; and treatises on insoluble, such as the Liar Paradox. In logic, William of Ockham wrote down in words the formulae that would later be called De Morgan's Laws, and he pondered ternary logic, that is, a logical system with three truth values; a concept that would be taken up again in the mathematical logic of the 19th and 20th centuries. Since the beginning of the modern era most of the contributions to logic have been made by mathematicians. Leibniz envisioned the development of a universal language to be specified with mathematical precision. The syntax of the words is to correspond to the metaphysical make-up of the designated entities. The goal, in effect, was to reduce scientific and philosophical speculation to computation. Although this grandiose project was not developed very far, and it did not enjoy much direct influence, the Universal Characteristic is a precursor to much of the subsequent work in mathematical logic.

The ground of the development third phase was laid in the middle of 19th century by the algebraists such as George Boole. And it was developed by the other logicians after on. In the 19th century that means in the third phase the symbolic and mathematical logic developed with a remarkable speed with the whole history of the logic. In the third phase along with George Boole, Gottlob Frege, Bertrand Russell have a huge contribution. George Boole invented mathematical logic. He symbolized a syllogism as a

series of equation and validate it algebraically. He also introduced Boolean algebra and developed it. After George Boole, Gottlob Frege invented classical symbolic logic. This overcame the gap between Aristotelian and Stoic logic in a higher synthesis. Frege tried to show that arithmetic was reducible to logic: every arithmetic truth can be formulated using just notions of logic and proved using just axioms and inference rules of logic. Frege made brilliant use of his logical insights when developing his philosophical programmes concerning mathematics and language. He held that arithmetic and analysis are parts of logic, and made great strides in casting number theory. Bertrand Russell is another name of third phase who tried to put classical logic on firmer basis. A major response was the multi-volume Principia Mathematica by Russell and Whitehead, which attempts to recapture the logicism programme by developing an elaborate theory of types. Antinomies are avoided by enforcing a vicious circle principle that no item may be defined by reference to a totality that contains the item to be defined. Principia Mathematica used a better notation and tried to avoid "Russell's Paradox." • This became the standard formulation of classical symbolic logic, which gradually replaced traditional logic to became the new orthodoxy. After Russel there were some evolution happened in the sector of non-classical logic, informal logic, inductive logic, metalogic, philosophy logic.

In our next review we'll elaborately described the phases of evolution and the contributions of logicians, which will show the evolution of logic properly.