Definition 1. *Tautology is a compound statement that is true for all circumstances. In other words, the truth value of a tautology is always True.*

Example 1. *The statement "I am either dead or alive" is a tautology. Since this statement is always true. Its expression can be written as*

$$p \vee \neg p$$

where p=I am dead. The truth value table of this formula is as shown below

p	$\neg p$	$p \vee \neg p$
0	*1*	*1*
1	*0*	*1*

Definition 2. *An **argument** is a series of statements(**premises**) and ending with a **conclusion**.*

Definition 3. *An argument **valid** if and only if when all the premises are true, the conclusion is necessarily true. In other words, an argument is valid if and only if it is equivalent to a tautology.*

An argument is not valid if and only if it is not equivalent to a tautology.

Theorem 1. *Logic inference rules*

Modus Ponens $p \to q$ p $\therefore q$	*Modus Tollens* $p \to q$ $\neg q$ $\therefore \neg p$	*Disjunctive Syllogism* $p \vee q \mid p \vee q$ $\neg q \mid \neg p$ $\therefore p \mid \therefore q$
Addition $p \mid q$ $\therefore p \vee q \mid \therefore p \vee q$	*Simplification* $p \wedge q \mid p \wedge q$ $\therefore p \mid \therefore q$	*Proof by contradiction* $\neg p \to F$ $\therefore p$
Hypothetical Syllogism $p \to q$ $q \to r$ $\therefore p \to r$	*Conjunction* p q $\therefore p \wedge q$	*Proof by divided into two cases* $p \vee q$ $p \to r$ $q \to r$ $\therefore r$
Resolution $p \vee q$ $\neg p \vee r$ $\therefore q \vee r$ *called* ***resolvent***		