Definition 1. *Compound propositions are made of primitive propositions.*

Definition 2. *Logic connectives and their symbols are*

negation	*not*	$\neg$
conjunction	*and*	$\wedge$
disjunction	*or*	$\vee$
exclusive OR	*either…or…*	$\oplus$
implication	*if…then…*	$\rightarrow$
equivalent	*if and only if*	$\leftrightarrow$

p	$\neg p$
0	1
1	0

p	q	$p \wedge q$
1	0	0
1	1	1
0	0	0
0	1	0

p	q	$p \vee q$
1	0	1
1	1	1
0	0	0
0	1	1

p	q	$q \oplus q$
1	0	1
1	1	0
0	0	0
0	1	1

p	q	$p \rightarrow q$
1	0	0
1	1	1
0	0	1
0	1	1

p	q	$p \leftrightarrow q$
1	0	0
1	1	1
0	0	0
0	1	0

Definition 3. *Two statements are logically equivalent to each other if they have the same truth table.*

Theorem 1. ***Law of substitution****: If two statements are logically equivalent, one can substitute the other.*

Definition 4. *Logic substitution rules*

Commtative	$p \wedge q \Leftrightarrow q \wedge p$	$p \vee q \Leftrightarrow q \vee p$
Associative	$(p \wedge q) \wedge r \Leftrightarrow q \wedge (p \wedge r)$	$(p \vee q) \vee r \Leftrightarrow q \vee (p \vee r)$
Distributive	$p \wedge (q \vee r) \Leftrightarrow (p \wedge q) \vee (p \wedge r)$	$p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$
Identity	$p \wedge T \Leftrightarrow p$	$p \vee F \Leftrightarrow p$
Negation	$p \vee \neg p \Leftrightarrow T$	$p \wedge \neg p \Leftrightarrow F$
Double Negation	$\neg(\neg p) \Leftrightarrow p$	
Idempotent	$p \wedge p \Leftrightarrow p$	$p \vee p \Leftrightarrow p$
Universal Bound	$p \vee T \Leftrightarrow T$	$p \wedge F \Leftrightarrow F$
De Morgan's	$\neg(p \wedge q) \Leftrightarrow (\neg p) \vee (\neg q)$	$\neg(p \vee q) \Leftrightarrow (\neg p) \wedge (\neg q)$
Absorption	$p \vee (p \wedge q) \Leftrightarrow p$	$p \wedge (p \vee q) \Leftrightarrow p$
Conditional	$(p \rightarrow q) \Leftrightarrow (\neg p \vee q)$	$\neg(p \rightarrow q) \Leftrightarrow (p \wedge \neg q)$

Definition 5. *Logic inference rules*

Modus Ponens $p \to q$ p $\therefore q$	*Modus Tollens* $p \to q$ $\neg q$ $\therefore \neg p$	*Disjunctive Syllogism* $p \vee q \mid p \vee q$ $\neg q \mid \neg p$ $\therefore p \mid \therefore q$
Disjunctive Addition $p \mid q$ $\therefore p \vee q \mid \therefore p \vee q$	*Conjunctive Simplification* $p \wedge q \mid p \wedge q$ $\therefore p \mid \therefore q$	*Rule of contradiction* $\neg p \to F$ $\therefore p$
Hypothetical Syllogism $p \to q$ $q \to r$ $\therefore p \to r$	*Conjunctive Addition* p q $\therefore p \wedge q$	*Dilemma* $p \vee q$ $p \to r$ $q \to r$ $\therefore r$