Lesson 46 – Truth Tables

(A) Review of Propositions

a. Prepare truth tables for conjunctions (and, $\vee$) and disjunctions (or, $\wedge$)
b. Work through Cirrito, Chap 14, Exercise 14.1.3, p419, Q1-4

(B) Truth Tables

a. Purpose: To help us evaluate the truth value of compound propositions

b. Ex. #1 ➔ Consider the following summary table from our last lesson:

p	*q*	negation	conjunction	Inclusive disjunction	Exclusive disjunction
T T F F	T F T F				

c. Ex. #2 ➔ Are the statements $\neg(p \wedge q)$ and $\neg p \wedge \neg q$ the "same" (which means "logical equivalence" ➔ i.e. they have the same truth values? In other words, can we apply the "distribution" of the negation in logic as we do in algebra?
   i. To see, we will construct truth tables for both statements and then compare the truth values of all possible outcomes

ii. Truth table for $\neg(p \wedge q)$ ➔

p	q	$(p \wedge q)$	$\neg(p \wedge q)$

iii) Truth table for $\neg p \wedge \neg q$ ➔

p	q	$(p \wedge q)$	$\neg(p \wedge q)$

d. Ex. #3 ➔ Are the statements $\neg(p \wedge q)$ and $\neg p \vee \neg q$ logical equivalence?
   i. Truth table for $\neg(p \wedge q)$ ➔

p	q	$(p \wedge q)$	$\neg(p \wedge q)$

iii) Truth table for $\neg p \vee \neg q$ ➔

p	q	$\neg p$	$\neg q$	$\neg p \vee \neg q$

(C) Work through Haese & Harris, Ex. 15C, p504, Q1,2,3,5

*(D)**Tautologies and Logical Contradictions***

a. A tautology is a compound statement that is true for all possibilities in a truth table

i. Ex ➔ $p \vee \neg p$

b. A Logical Contradiction is a compound statement that is false for all possible values in a truth table

i. Ex ➔ $p \wedge \neg p$

c. Work through Haese & Harris, Ex. 15C, p505, Q6

*(E) **Truth Tables for 3 propositions***

a. Construct a truth table for $(p \vee q) \wedge r$

b. Work through Haese and Harris, Ex 15D, p506, Q1,2,3

p	q	r	$(p \vee q)$	$(p \vee q) \wedge r$