Leonel Garay
CS-225: Discrete Structures in CS
Homework 1, Part 2

Exercise Set 2.2: Problem #11

p	q	r	$q \rightarrow r$	$p \rightarrow (q \rightarrow r)$	$p \wedge q$	$(p \wedge q) \rightarrow r$	$(p \rightarrow (q \rightarrow r)) \leftrightarrow ((p \wedge q) \rightarrow r)$
T	T	T	T	T	T	T	T
F	F	F	T	T	F	T	T
F	F	T	T	T	F	T	T
T	F	F	T	T	F	T	T
F	T	F	F	T	F	T	T
T	T	F	F	F	T	F	T
F	T	T	T	T	F	T	T
T	F	T	T	T	F	T	T

Exercise Set 2.2: Problem #15

p	q	r	$q \rightarrow r$	$p \rightarrow q$	$p \rightarrow (q \rightarrow r)$	$(p \rightarrow q) \rightarrow r$
T	T	T	T	T	T	T
F	F	F	T	T	**T**	**F**
F	F	T	T	T	T	T
T	F	F	T	F	T	T
F	T	F	F	T	**T**	**F**
T	T	F	F	T	F	F
F	T	T	T	T	T	T
T	F	T	T	F	T	T

Answer: Nonequivalence, because the values are different.

Exercise Set 2.2: Problem #20

b. Today is New Year's Eve and tomorrow is not January.

c. The decimal expansion of *r* is terminating and *r* is irrational.

e. *x* is nonnegative and *x* is not positive nor 0.

g. *n* is divisible by 6 and *n* is not divisible by 2 or *n* is not divisible by 3

Exercise Set 2.2: Problem #39

If a security code is not entered, then this door will not open.

Exercise Set 2.2: Problem #41

If this triangle has two 45-degree angles, then it is a right triangle.

Exercise Set 2.2: Problem #43

If Jim does homework regularly, then he will pass the course.
If Jim did not pass the class, then he did not do his homework regularly.

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Exercise Set 2.2: Problem #45

If this program produces error messages during translation, then it is not correct.

Exercise Set 2.2: Problem #50

a. $(p \rightarrow (q \rightarrow r)) \leftrightarrow ((p \wedge q) \rightarrow r)$
$(p \rightarrow (\sim q \vee r)) \leftrightarrow ((p \wedge q) \rightarrow r)$
$(\sim p \vee (\sim q \vee r)) \leftrightarrow ((p \wedge q) \rightarrow r)$
$(\sim p \vee (\sim q \vee r)) \leftrightarrow (\sim(p \wedge q) \vee r)$
$(\sim(\sim p \vee (\sim q \vee r)) \vee (\sim(p \wedge q) \vee r)) \wedge (\sim(\sim(p \wedge q) \vee r) \vee (\sim p \vee (\sim q \vee r)))$

b. $(\sim(\sim p \vee \sim(\sim(\sim q) \wedge \sim r)) \vee \sim(\sim(\sim(p \wedge q) \wedge \sim r)) \wedge (\sim(\sim(\sim(p \wedge q)) \wedge \sim r)) \vee (\sim p \vee \sim(\sim(\sim q) \wedge \sim r))))$
$(\sim(\sim p \vee \sim(q \wedge \sim r)) \vee \sim((p \wedge q) \wedge \sim r)) \wedge (((p \wedge q) \wedge \sim r) \vee (\sim p \vee \sim (q \wedge \sim r)))$ By Double Negative
$(\sim(\sim(\sim(\sim p) \wedge \sim(\sim(q \wedge \sim r)))) \vee \sim((p \wedge q) \wedge \sim r)) \wedge (((p \wedge q) \wedge \sim r) \vee (\sim(\sim(\sim p) \wedge \sim(\sim(q \wedge \sim r)))))$
$((p \wedge (q \wedge \sim r)) \vee \sim((p \wedge q) \wedge \sim r)) \wedge (((p \wedge q) \wedge \sim r) \vee \sim(p \wedge (q \wedge \sim r)))$ By Double Negative
$(\sim(\sim(p \wedge (q \wedge \sim r)) \wedge \sim(\sim((p \wedge q) \wedge \sim r)))) \wedge (\sim(\sim((p \wedge q) \wedge \sim r) \wedge \sim(\sim(p(\wedge (q \wedge \sim r))))$
$(\sim(\sim(p \wedge (q \wedge \sim r)) \wedge ((p \wedge q) \wedge \sim r))) \wedge (\sim(\sim((p \wedge q) \wedge \sim r) \wedge (p \wedge (q \wedge \sim r)))$ By Double Negative