CSC175 Practice Assignment 3 Spring 2019 Name Solutions

1) Given the following propositions, write out the English sentences for the given the symbolic forms.

p = Jim likes mathematics q = Jim likes computer science r = Jim likes Sudoku puzzles

a) $q \vee \sim r$ Jim likes computer science or Jim doesn't like Sudoku puzzles.
b) $\sim p \leftrightarrow \sim q$ Jim doesn't like mathematics if and only if Jim doesn't like computer science.
c) $(p \wedge r) \rightarrow q$ If Jim likes mathematics and Sudoku puzzles, then Jim likes computer science.

2) Given the following English sentences which are compound propositions, label each simple proposition with a variable and then give the symbolic form. Each simple proposition should NOT include the word "not" in it.

p = 209 is a prime number q = 347 is a prime number r = 111 is a prime number

a) 209 is not a prime number and 347 is a prime number. $\sim p \wedge q$
b) If 111 is a prime number, then 347 is not a prime number or 209 is a prime number. $r \rightarrow (\sim q \vee p)$
c) 347 is a prime number and 111 is not a prime number if and only if 209 is a prime number or 347 is not a prime number. $(q \wedge \sim r) \leftrightarrow (p \vee \sim q)$
d) 347 is a prime number if 111 is not a prime number. $\sim r \rightarrow q$

3) Write the negation of each compound proposition as an English sentence.

a) If mom wants to go to Disneyland then dad will pay for it.
Mom wants to go to Disneyland and dad will not pay for it.
b) The kids want to go to Disneyland and dad does not want to pay for it.
The kids do not want to go to Disneyland or dad does want to pay for it.
c) If dad wants to go to the Super Bowl, then the kids can't go to Disneyland or mom needs a second job.
Dad wants to go to the Super Bowl and the kids can go to Disneyland and mom doesn't need a second job.

4) Find the complete truth table for each compound sentence. Be such to order the columns as shown in discussion and in the videos. Use the table builder in the INSERT tab.

a) $p \wedge \sim q$

p	q	$\sim q$	$p \wedge \sim q$
T	T	F	F
T	F	T	T
F	T	F	F
F	F	T	F

b) $(p \vee q) \rightarrow \sim p$

p	q	$p \vee q$	$\sim p$	$(p \vee q) \rightarrow \sim p$
T	T	T	F	F
T	F	T	F	F
F	T	T	T	T
F	F	F	T	T

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

p	q	r	$\sim q$	$\sim q \vee r$	$p \wedge (\sim q \vee r)$
T	T	T	F	T	T
T	T	F	F	F	F
T	F	T	T	T	T
T	F	F	T	T	T
F	T	T	F	T	F
F	T	F	F	F	F
F	F	T	T	T	F
F	F	F	T	T	F

d) $(p \vee q) \leftrightarrow (r \wedge \sim s)$

p	q	r	s	$\sim s$	$p \vee q$	$r \wedge \sim s$	$(p \vee q) \leftrightarrow (r \wedge \sim s)$
T	T	T	T	F	T	F	F
T	T	T	F	T	T	T	T
T	T	F	T	F	T	F	F
T	T	F	F	T	T	F	F
T	F	T	T	F	T	F	F
T	F	T	F	T	T	T	T
T	F	F	T	F	T	F	F
T	F	F	F	T	T	F	F
F	T	T	T	F	T	F	F
F	T	T	F	T	T	T	T
F	T	F	T	F	T	F	F
F	T	F	F	T	T	F	F
F	F	T	T	F	F	F	T
F	F	T	F	T	F	T	F
F	F	F	T	F	F	F	T
F	F	F	F	T	F	F	T

5) Use a truth table to determine if $(p \wedge q) \rightarrow q$ is a tautology, contradiction, or neither. Show the complete truth table and explain why you believe your answer is correct.

It is a tautology because the result of the truth table shows that the result is always true.

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

6) Use a truth table to determine if $\sim(\sim p \wedge q)$ is equivalent to $p \vee \sim q$. Show the complete truth table and explain why you believe your answer is correct.

The two compound propositions are equivalent because the results of the truth table in both columns are the same.

(Note: this is a result of both DeMorgan's Law and involution.)

p	q	$\sim p$	$\sim q$	$\sim p \wedge q$	$\sim(\sim p \wedge q)$	$p \vee \sim q$
T	T	F	F	F	T	T
T	F	F	T	F	T	T
F	T	T	F	T	F	F
F	F	T	T	F	T	T

7) Name the law (or laws if two are used) from pages 58-59 that is used in each equivalence. (DO NOT CREATE A TRUTH TABLE.)

a) $p \wedge (\sim q \vee s) \Leftrightarrow p \wedge (s \vee \sim q)$ Commutative Law
b) $(q \vee r) \vee p \Leftrightarrow q \vee (r \vee p)$ Associative Law
c) $(s \rightarrow t) \wedge (t \rightarrow p) \Rightarrow (s \rightarrow p)$ Chain Rule (Syllogism)
d) $\sim(p \vee \sim r) \Leftrightarrow (\sim p \wedge \sim(\sim r)) \Leftrightarrow (\sim p \wedge r)$ DeMorgan's Law and involution (double negative)
e) $(q \rightarrow \sim p) \Leftrightarrow (\sim q \vee \sim p) \Leftrightarrow \sim(q \wedge p)$ Conditional Equivalence and DeMorgan's Law