Spring 2020 COT 3100 Exam #1 (9/27/2019) (Note: Out of 75 points) - Page 1,2

Last Name: ___________________ , First Name : _____________________

Please circle your lab section

Lab Section: 11(T4:30) 12(R4:30) 13(R5:30) 14(F3:30)

15(F8:30) 16(F 9:30) 17(F 12:30)

1) (8 pts) Complete the following truth table. Please use the convention 0 = false, 1 = true.

p	q	r	$p \vee q$	$\overline{p \vee q}$	$\overline{p \vee q} \vee r$	$q \wedge \bar{r}$	$(\overline{p \vee q} \vee r) \vee (q \wedge \bar{r})$
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

2) (10 pts) Look at rule #13 and rule #14 in the "Rules of Inference" section of the formula sheet. One of these two rules goes both ways (meaning that it is valid to replace the one way arrow, →, with a two way arrow, ↔). Which one is it? For this rule, use the laws of logic to prove that the two expressions in question are logically equivalent. For the other rule, where the two sides are NOT logically equivalent, give a truth setting that makes the left of the implication false and the right of the implication true.

Logical Equivalence is #13 or #14 (Circle your choice)

Use laws of logic to show equivalence of both sides of this formula below:

Rule where sides are logically inequivalent is #13 or #14

Truth setting where sides are different: p = ____ q = ____ r = ____

Work showing that for this truth setting left hand side is false and right hand side is true:

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Lab Section: 18(R9) 19(R10) 20(R11) 21(T2) 22(T3) 23(T4) 24(T5)

3) (10 pts) Prove the following statement over the universe of positive real numbers for x and y:

$$\forall x \exists y [\frac{x}{y} + \frac{y}{x} = 4]$$

Determine the number of values of y which make it true.

4) (10 pts) Prove of Disprove for finite sets A, B and C:

$$\text{if } A \cap B \cap C = \emptyset, \text{ then } A \cup B \cup C = (A - B) \cup (B - C) \cup (C - A)$$

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5) (8 pts) Prove or Disprove for finite sets A, B, C and D: if B – A = D – C, then B – D = A – C.

6) (8 pts) Jenny participates in a triathlon where the contestants run three miles, swim three miles and bike three miles. Her goal is to average 4.5 miles per hour over the course of the whole triathlon. If her average speed running was 8 miles per hour and her average speed swimming was 2 miles per hour, what is the least average speed she can maintain during the biking phase of the triathlon to achieve her goal?

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Lab Section: 18(R9) 19(R10) 20(R11) 21(T2) 22(T3) 23(T4) 24(T5)

7) (10 pts) Determine the following sum, giving your answer as a closed-form in terms of x and n. Assume that $x \neq 1$. $\sum_{i=0}^{n} ix^i$. You may use either of the two techniques shown in class to solve the problem.

8) (8 pts) Let the sequence a_1, a_2, a_3, …, be a geometric sequence such that $a_4 = 48$ and $a_7 = 384$. Define a sequence b_1, b_2, b_3, … such that for all positive integers n, b_n is the remainder when a_n is divided by 13. What is the value of b_{2020}? (Note: since it's possible to guess the correct answer, all credit will be awarded based on the work shown and how it justifies the answer.)

9) (3 pts) Who is Willie Mays Parkway named after?

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