

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

Last Name: \_\_\_\_\_, First Name : \_\_\_\_\_

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

1) (10 pts) Use the laws of logic to show that the two following expressions are logically equivalent:

$$(a) (q \rightarrow p) \vee (r \wedge (\bar{r} \wedge (\overline{p \vee r})))$$

$$(b) p \vee \bar{q}$$

Note: You may not use all of the rows shown below.

Step	Reason
1. $(q \rightarrow p) \vee (r \wedge (\bar{r} \wedge (\overline{p \vee r})))$	Given
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	

2) (10 pts) Use the rules of inference (and potentially the laws of logic) to make the following argument:

$$s \rightarrow (r \vee \bar{p})$$

$$\bar{q}$$

$$t \rightarrow u$$

$$\bar{p} \rightarrow q$$

$$u \rightarrow s$$

$$t$$

-----

$$r$$

Step	Reason
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	

**Fall 2019 COT 3100 Exam #1 (9/27/2019) (Note: Out of 75 points) - Page 3, 4**

**Last Name:** \_\_\_\_\_ , **First Name :** \_\_\_\_\_

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

3) (10 pts) Let  $n$  be a positive integer such that  $10 \mid (n - 9)$ . Prove that  $8 \mid (n^2 - 1)$ . In your proof, you may use the result that for all integers  $a$ ,  $a(a+1)$  is an even integer.

4) (10 pts) A school offers three clubs: Art Club, Debate Club and Chess Club. There are 22 students who are either in Art Club or Debate Club and there are 25 students who are either in Debate Club or Chess Club. However, there are no students in both Art and Chess Club. If there are 16 students who are in Debate Club, how many students are in at least one of the three clubs? In order to receive full credit, you must utilize the Inclusion-Exclusion Principle for two and three sets formally. You may draw Venn Diagrams to assist you in coming up with your solution and such a diagram may earn a small amount of partial credit, but most of the credit is earmarked for formally using the Inclusion-Exclusion Principle.

**Fall 2019 COT 3100 Exam #1 (9/27/2019) (Note: Out of 75 points) - Page 5, 6**

**Last Name:** \_\_\_\_\_ , **First Name :** \_\_\_\_\_

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

5) (8 pts) Prove or Disprove: For arbitrary sets, A, B, C and D,

if  $(A \cup B) \subseteq (C \cap D)$ , then  $A \subseteq C \wedge B \subseteq D$ .

6) (8 pts) Prove or Disprove: For arbitrary sets, A, B, C,

if  $A \cap B \cap C = \emptyset$ , then  $(A \subseteq \bar{B}) \vee (A \subseteq \bar{C})$

**Fall 2019 COT 3100 Exam #1 (9/27/2019) (Note: Out of 75 points) - Page 7**

**Last Name:** \_\_\_\_\_ , **First Name :** \_\_\_\_\_

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

7) (10 pts) Determine the ordered pair, (a, b), that satisfies the following pair of equations:

$$\log_{16}a^2 + \log_8b^3 = 11$$

$$\log_8a^6 + \log_{16}b^{10} = 32$$

Note: You may express a and b as a some base raised to an exponent instead of a single value, if you wish.

8) (6 pts) Jessica is going from Orlando to Miami and she takes a 15 minute break at Vero Beach. Her goal is to average 60 miles per hour for the whole trip. The distance between Orlando and Vero Beach is 100 miles and the distance between Vero Beach and Miami is 140 miles. If her average driving speed from Orlando to Vero Beach is 50 miles per hour, how fast must her average speed be driving from Vero Beach to Miami to achieve her goal? (**Note: I don't actually advise driving this fast ever!!!**)

9) (3 pts) What holiday does Universal Studio's Halloween Horror Nights celebrate?

---