Spring 2025 COT 3100 Sections 1/2 Exam #1 – 1/30/2025

Last Name: _____ , First Name: _____

Circle Lab: 11-T 8 am 12-R 8 am 13-T 9 am 14-R 9 am 15-F 8 am 16-F 9 am

1) (8 pts) Fill in the following truth table. **Please use T for true and F for false. (All responses that use 0/1 or are difficult to distinguish between T/F will automatically receive 0 points.)**

p	q	r	$p \rightarrow \bar{q}$	$q \vee \bar{r}$	$(p \rightarrow \bar{q}) \rightarrow (q \vee \bar{r})$
F	F	F			
F	F	T			
F	T	F			
F	T	T			
T	F	F			
T	F	T			
T	T	F			
T	T	T			

2) (10 pts) Use the rules of inference to prove the following argument:

Given: $(a)\ p \vee q$, $(b)\ s$, $(c)\ \overline{s \wedge \bar{p}}$, $(d)\ q \rightarrow p$, $(e)\ \bar{p} \vee r$, show that r, logically follows via the Rules of Inference and Laws of Logic (which are 2 way rules of inference).

Number	Step	Reason
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Note: You may not use all of the rows.

3) (12 pts) Prove the following assertion. Let the universe for x be $\mathbb{R} - \{1,2\}$. Let the universe for y be $\mathbb{R} - \{-2\}$. (x can be any real number except for 1 or 2. y can be any real number except for -2.)

$$\forall x \exists y [\frac{2}{x-1} + \frac{y}{x-2} = 0]$$

4) (12 pts) Prove or Disprove: For all finite sets A, B and C:

if $A \subseteq B$ and $A \subseteq C$, then $B \subseteq A \cup \bar{C}$

5) (5 pts) Let A and B be sets such that |A| = 4 and |B| = 7, how many elements are there in $\wp(A \times B)$? Please express your answer in the form x^y, where x and y are positive integers and x is minimized.

6) (12 pts) Prove or Disprove: Let A, B, C and D be **non-empty sets**.

If $A \times C \subseteq B \times D$, then $A \subseteq B \ \wedge C \subseteq D$

7) (12 pts) Let A, B, C and D be sets for which the following is true:

$(A \cup B) \cap (C \cup D) = \emptyset$, $|A| = 13$, $|B| = 12$, $|C| = 27$, $|D| = 19$, $|A \cap B| = 8$, $|C \cap D| = 10$

Determine $|A \cup B \cup C \cup D|$. **Full credit will only be given if all intermediate steps and reasoning are shown. The final answer is only worth 1 point out of 12.**

8) (10 pts) A mine of ore is the shape of a cylinder with radius = 20 feet. Each day, 360π cubic feet of ore is mined. If the mine runs out of ore in 180 days, how deep, in feet (height of the cylinder) is the mine? (Note: If you forgot the formula for a volume of a cylinder, use logic to derive it via the formula for the area of a circle.)

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9) (9 pts) There are 12 notes in the Western musical scale. (Note: other scales have been created by other cultures and have a different number of notes.) These notes, in order, are C, C#, D, D#, E, F, F#, G, G#, A, A# and B. The next note after B is C, and then the cycle continues. (The notes with the sharp symbol, #, have alternative names as flats as well, but that's not needed to solve this problem.) For any two consecutive notes, let x and y denote their frequencies, with y > x. It turns out that $log_2 y - log_2 x = \frac{1}{12}$. The frequency of the note A corresponding to the A string on the violin and viola is 440 Hz. What is the frequency of the note C# that is the first C# with a higher frequency than 440? For full credit, please express the answer in the form $110(2^{\frac{m}{n}})$, where *m* and *n* are positive integers that share no common factors.

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10) (5 pts) James is driving 300 miles from his house in Orlando to a friend's place in Savannah. He leaves Orlando at 4 pm. For the first two hours of his trip, his average speed is 50 miles per hour. His average speed for the rest of the trip (all but the first two hours) is 48 miles per hour. At what time does he arrive in Savannah?

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11) (5 pts) Area high school Winter Park High School is better known by what acronym, locally?

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Scratch Page – Please clearly mark any work here you would like graded.