COT 3100 Final Exam - Part C - 40 pts (5/2/2023)
Topics: Recitation Topics, Logic, Sets

Last Name: _____ , First Name: _____

1) (10 pts) Trusty Tortoise and Roger Rabbit are taking a (same) journey. Trusty Tortoise travels at an average speed of 3 miles an hour and never stops on the journey. Roger Rabbit will spend 10 minutes traveling at an average speed of 8 miles an hour before taking a 20 minute break, and alternating this pattern. Depending on the distance of the journey, sometimes Trusty Tortoise completes the journey faster than Roger Rabbit, and other times Roger Rabbit completes the journey faster than Trusty Tortoise. There's a maximum distance D for which Roger Rabbit either wins or ties the race. For all distances greater than D, Trusty Tortoise wins. What is the value of D? Please prove your answer.

D = _____

2) (5 pts) Let r and s be the roots of the quadratic equation $x^2 - 4x + 7 = 0$. Without finding either r or s, determine the quadratic equation with roots 2r and 2s.

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3) (10 pts) Use the Laws of Logic to prove that the two following logical expressions are equivalent:

(a) $(p \vee r) \wedge (p \rightarrow \big(p \wedge (p \vee r)\big)) \wedge (q \rightarrow p)$

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

For the purposes of grading, if you use two rules in one step (such as Commutative with another step), please indicate BOTH reasons on that line.

Step	Reason

4) (5 pts) Let A = {2, 3, 5} and B = {1, 2, 7}. Please explicitly list each element in the following sets:

(1 pt) A – B = { }

(2 pts) A x B = { }

(2 pts) $\wp(A)$ = { }

5) (10 pts) Prove or disprove the following assertion for finite arbitrary sets A, B and C:

$$A - C \subseteq (A - B) \cup (B - C)$$