CS 291 Exam 1
February 12, 2021

Name: _____

1. (10 points) Use truth tables to show: $\neg(A \wedge B) \equiv \neg A \vee \neg B$

2. (10 points) Being clear about how you get from step to step, use stepwise equivalences to show that: $A \to (C \to B) \equiv C \to (A \to B)$

3. (15 points) Use Quine's method to show the following wff is a tautology:
   $(A \to (B \to C)) \equiv ((A \to B) \to (A \to C))$

4. (15 points) Use equivalences to turn the following wff into DNF:
   $(A \vee B) \wedge (C \rightarrow D)$

5. (10 points) Use equivalences to turn the following wff into CNF:
   $(A \wedge B) \vee E \vee F$

6. (15 points) Give a formal proof of the following tautology by using the CP rule. Do not use the IP rule in this proof.

   $(A \to (B \to C)) \to (B \to (A \to C))$

7. (20 points) Give a formal proof of the following tautology by using the CP rule and by using the IP rule at least once.

   $(B \to C) \to (A \wedge B \to A \wedge C)$

8. (5 points) Clearly define and distinguish what the terms *soundness* and *completeness* mean for a formal proof system.