CSC 503 Homework Assignment 1

Out: August 28, 2018
Due: September 5, 2018
Unity ID: MISSING

The formulas of propositional logic implicitly assume the binding priorities of the logical connectives put forward in Convention 1.3. In the first set of problems, make sure that you fully understand those conventions by reinserting all omitted parentheses in the following two abbreviated statements.

1. **[10 points]** $p \rightarrow \neg q \vee \neg r \rightarrow \neg\neg q \rightarrow p \vee r$

2. **[10 points]** $r \vee p \rightarrow \neg\neg q \rightarrow \neg r \vee (q \rightarrow p)$

3. **[10 points]** Why is the expression $p \wedge q \vee r$ problematic? Use truth tables or interpretations to justify your answer.

4. **[10 points]** List all subformulas of the formula $((p \wedge p) \vee q) \rightarrow (((\neg r) \rightarrow r) \rightarrow (p \wedge q))$.

5. **[10 points]** Compute and present the complete truth table of the formula $(\neg p \vee q) \rightarrow (p \rightarrow \neg q)$.

Let ϕ_1 be the formula $(p \vee q) \rightarrow (q \rightarrow p)$.

6. **[5 points]** Is ϕ_1 satisfiable? Justify your answer.

7. **[5 points]** Is ϕ_1 valid? Justify your answer.

Let ϕ_2 be the formula $(q \wedge \neg r) \wedge (q \rightarrow r)$.

8. **[5 points]** Is ϕ_2 falsifiable? Justify your answer.

9. **[5 points]** Is ϕ_2 unsatisfiable? Justify your answer.

10. **[10 points]** Show that the entailment claim $p \vee (q \rightarrow r), \neg p \vee r \models p \rightarrow q$ is not correct. Justify your answer in terms of truth value assignments to the propositions p, q, and r.

11. **[10 points]** Does $\models (p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r)$ hold? Justify your answer.

12. **[10 points]** Are the sentences (A) $q \rightarrow p$, (B) $p \rightarrow r$, and (C) $r \rightarrow (p \wedge q)$ logically independent? Justify your answer formally.