ASSIGNMENT: 3

Q1. If the compound statement p→ (~p ∨ q) is false then the truth value of p and q are respectively.

  a. T, T   b. T, F

  c. F, T   d. F, F

Q2. Reduce to Conjunctive Normal Form (CNF):

$$\neg\,(\neg p \lor q) \lor (r \to \neg s)$$

Q3. Let's consider a propositional language where

      A ="Alice comes to the party",

      B ="Bob comes to the party",

      C ="Charlie comes to the party",

      D ="Daniel comes to the party".

  Formalize the following sentences:

1. "Daniel comes to the party if and only if Charlie comes and Alice doesn't come"

2. "If Daniel comes to the party, then, if Charlie doesn't come then Alice comes"

3. "Charlie comes to the party provided that Daniel doesn't come, but, if Daniel comes, then Bob doesn't come"

4. "A necessary condition for Alice coming to the party, is that, if Bob and Charlie aren't coming, Daniel comes"

5. "Alice, Bob and Charlie come to the party if and only if Daniel doesn't come, but, if neither Alice nor Bob come, then Daniel comes only if Charlie comes"

Q4. Given the premises "p ∧ q" and "q → r", does it entail "p → r"?

Q5. Consider the following statements:

      p → q: If it is sunny, then it is hot.
      q → ¬r: If it is hot, then it is not raining.
      r: It is raining outside.

  Are these statements consistent or inconsistent? If inconsistent, provide a proof of contradiction.

Q6. What is soundness and completeness? Based on these concepts suppose we have the following premises:

      If it is sunny, then the ground is dry. (s → d)
      The ground is not dry. (¬d)

Determine whether the conclusion "It is not sunny" (¬s) can be inferred using the Modus Tollens rule. Explain whether the logical system is sound and/or complete based on this example.