Computer Science 243
Spring 2025
Homework 1

Due: beginning of class, Wednesday, 2/5/25   **Points: 50**

Answer the following questions and show your work. Your final submission must be completely your own work.

1. [3 points each] Given the following propositions:

   s: It is snowing.
   g: You go sledding.
   m: You wear mittens.

   Express the following statements in propositional logic:

   a. It is snowing and you wear mittens.
   b. If it is not snowing, you do not go sledding.
   c. If it is snowing, you go sledding or wear mittens, but not both.
   d. You go sledding whenever it is not snowing.
   e. You go sledding and wear mittens if and only if it is snowing.

2. [3 points each] Assume the following proposition is true:

   If I am a senior at W&M, then I have declared a major.

   a. State the converse of this proposition.
   b. State the inverse of this proposition.
   c. State the contrapositive of this proposition.
   d. For each of the above, state whether it is always true, sometimes true, or never true.

3. [12 points] Construct a truth table for each of the following compound propositions:

   a. [4 points] $(\neg p \rightarrow q) \leftrightarrow (p \oplus \neg q)$
   b. [8 points] $((p \rightarrow r) \rightarrow q) \wedge (\neg q \vee \neg r)$

4. [11 points] Answer the following questions concerning logic circuits:

   a. [3 points] What compound proposition does the following circuit represent (do not simplify)?
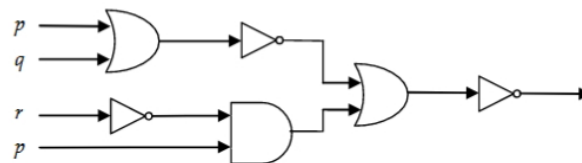
   b. [8 points] Is the above satisfiable? Prove your answer with a truth table (using the unsimplified compound proposition).