Homework 2

1. (3 points) Use DeMorgan’s Law to write the negations of each of the following statements. First write the statement as a compound proposition using propositional variables, apply DeMorgan’s Law to find the negation of the compound proposition, and then convert this back to English.
   (a) Mary will drive to Chicago or fly to Dallas.
   (b) John will major in Math and will not major in Chemistry.

2. (6 points) Establish each of the following logical equivalences using the equivalences given in Tables 6–8, Section 1.3. Follow the approach used in class and in Examples 7 and 8, p. 30. Do not use truth tables. Be sure to justify each step.
   (a) \( ((\neg p \land (p \lor q)) \rightarrow q) \equiv T. \)
   (b) \( ((p \rightarrow q) \land (p \rightarrow r)) \equiv p \rightarrow (q \land r). \)

   Note: The equivalence in (b) above is already listed in Table 7; ignore this fact and derive it from first principles, using the other equivalences in Tables 6–8.

3. (4 points) Derive the CNF and DNF formulas for the compound proposition \( p \oplus q \). Show your work.

4. (5 points) p. 36, #50. For parts (a) and (b), you may use truth tables. Note that in part (c), “Exercise 49” should really be “Exercise 45”.

   You will find it helpful to first read the paragraphs just above Exercises 43 and 46 and also review the solutions to Exercises 43 and 45 (given in the text).

5. (2 points) p. 78, #4 parts (a) through (d). It is sufficient to just state the name of the inference rule that applies in each case..
6. (5 points) p. 79, #10 parts (a), (b), (f). For each part, discuss the inference rules used to arrive at the conclusion(s). If no conclusion can be reached, then just state that this is the case.

7. (5 points) p. 78, #6.
Express the given statements using the propositional variables listed below. Then give a stepwise proof that the conclusion follows from the premises, justifying each step clearly. (See Examples 6 and 7 on pages 73–74, as well as the examples done in class.)
Let \( r \) stand for “It is raining”, \( f \) for “It is foggy”, \( s \) for “The sailing race will be held”, \( d \) for “The lifesaving demonstration will be held”, and \( t \) for “The trophy will be awarded”.

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Homework Cover Page

Please fill in and staple to the front of your homework

Name (print): ________________________________

Student ID #: __________________

Homework #: _________

Discussion Section registered for (check one):

○ Sec. 11 (4:40–5:30 p.m.)

○ Sec. 12 (5:45–6:35 p.m.)