Warmup

1. What is the negation of "Either Dortmund or Frosted won the Kentucky Derby"?

2. What is the truth table for the proposition $P \Rightarrow Q$?

3. Put the following statements in "If P, then Q" form:

    (a) A number n must be divisible by 6 in order to be divisible by 12.

    (b) For a number n to be divisible by 5 it is sufficient for its last digit to be 0.

Rules of Inference

1. Prove DeMorgan's Laws by using truth tables.

2. Show the following equivalences using truth tables:

    (a) $\mathbf{T} \wedge p \equiv p$
    (b) $\mathbf{F} \wedge p \equiv \mathbf{F}$
    (c) $\mathbf{T} \Rightarrow p \equiv p$
    (d) $\mathbf{F} \Rightarrow p \equiv \mathbf{T}$

3. All humans are mortal, for that is the way of life. All mortals like strawberries, for they are very tasty. Supposing that Odin is not mortal, which of the following *must* be true?

   (a) Odin is human.
   (b) Odin is not human.
   (c) Odin likes strawberries.
   (d) Odin does not like strawberries.
   (e) All humans like strawberries.
   (f) All stawberries like humans.

4. Prove that the proposition associated with Modus Tollens $(((p \Rightarrow q) \wedge \neg q) \Rightarrow \neg p)$ is a tautology.

5. Take the following premises for granted:

   (a) The rebellion will fail if Palpatine is not defeated.
   (b) Palpatine can be defeated only if Luke joins the dark side or Darth Vader has a change of heart.
   (c) The rebellion did not fail.
   (d) Luke did not join the dark side.

   Prove, citing the proper rules of inference, that Darth Vader had a change of heart.