Lesson 1

(1) Determine which of the following sentences are propositions. Give a brief reason for your answer.
   (a) Seven is two more than five.
   (b) Stop whining!
   (c) There is a black hole at the center of every galaxy.
   (d) This sentence has five words.

(2) Construct truth tables for each of the following.
   (a) $\neg q \longrightarrow p$.
   (b) $(p \vee q) \longrightarrow r$. (You will need eight rows for this one.)

(3) Let s be the proposition *It is snowing*, f be the proposition *It is below freezing*, and r be *It is raining*. Convert the following English sentences into statements using the symbols s, f, r and logical connectives.
   (a) It is snowing or it is not below freezing.
   (b) If it is snowing, then it is not raining and it is below freezing.

(4) Use a truth table to verify the equivalence: $p \longrightarrow \neg q \equiv \neg p \vee \neg q$.
Explain why the truth table shows that the propositions are equivalent.

(5) Use a truth table to show that the statements $p \longrightarrow (q \longrightarrow r)$ and $(p \longrightarrow q) \longrightarrow r$ are not logically equivalent.
Explain why the truth table shows that the propositions are not equivalent.

(6) How many logical connectives are possible involving the n simple propositions: $p_1, p_2, \ldots, p_n$?

(7) (**bonus**) Give a proof of the following equivalence following the pattern of proof shown in the examples in section 2.6 of the text: $\neg p \longrightarrow (p \longrightarrow q) \equiv \mathbf{T}$.