Assignment 3: Due Friday, February 15 @ 5pm (by email or delivered to my office)

I. The Syntax and Semantics of Propositional Logic

Assume the following basic translations of English sentences into propositional variables:

p	=	*Mary is at home.*	r	=	*Fred left.*
q	=	*Sue is at home.*	s	=	*Stuart is in the kitchen.*

A. Give the English sentences that correspond to the following formulas of propositional logic:

(1) ~s & r

(2) ~(p v q)

(3) ~(p & s) → q

(4) ~q & ((s v ~r) → ~s)

B. Provide a truth table for each propositional logic formula in Part A.

C. Give the propositional logic translations for the following English sentences:

(5) Stuart is not in the kitchen and Fred didn't leave.

(6) If Sue is at home or Fred didn't leave, then Stuart is not in the kitchen.

(7) It's not the case that Mary and Sue are both at home.

(8) Neither Mary nor Sue is at home.

D. Provide a truth table for each formula that you identified in Part C.

II. Representing Semantic Ambiguity in Propositional Logic

Assume the following basic translations of English sentences into propositional variables:

p = *I talked to Fred.* q = *I talked to Barney.*

The following English sentence is semantically ambiguous:

(9) I didn't talk to Fred and Barney.

Provide unambiguous paraphrases for the two interpretations associated with (9). Then, provide the propositional logic translations for each of your paraphrases (one formula per paraphrase). Finally, provide the truth tables for each of the propositional logic formulas that you identified. (If you have done this correctly, then your truth tables will differ in at least one row.)

III. A New Logical Connective

Consider the sentence in (10):

(10) There is homework due next week **unless** it is the last week of class.

Assume the following basic translations of English sentences into propositional variables:

p = *There is homework due next week.*
q = *It is the last week of class.*

We currently have no connective corresponding to *unless* in our vocabulary for Propositional Logic. So let us introduce a new connective, ⇁, such that the sentence in (10) gets the translation in (11):

(11) p ⇁ q

Your task is to give the semantics of this connective by giving a truth table for it. In other words, you have to fill in the values marked as ?? below:

A	B	A ⇁ B
T	T	??
F	T	??
T	F	??
F	F	??

To do this, consider how the truth value for the entire sentence in (10) depends upon the truth values of its two component sentences.

IV. A Puzzle about English Conditional Sentences

Assume the following basic translations of English sentences into propositional variables:

p = *Darwin was wrong.* q = *God exists.*

A. Give the propositional logic translation for the English sentence in (12). Then, provide a truth table for the formula that you identified.

(12) It's not true that if Darwin was wrong, then God exists.

B. Using the truth table method that we discussed in class, determine whether any entailment relations hold between the propositional logic translations for: i) (12) and its antecedent, ii) (12) and the negation of its antecedent, iii) (12) and its consequent, and iv) (12) and the negation of its consequent. In order to do this, you will have to add some new columns to your truth table from Part A.

In other words, this part asks you only to consider whether any entailment relations exist amongst the specified propositional logic formulas. For the moment, do not consider whether any entailment relations exist amongst the corresponding English sentences.

Also, a terminological note: remember that the "antecedent" of a conditional sentence is the embedded sentence that immediately follows *if*, while the "consequent" of a conditional sentence is the embedded sentence that immediately follows *then*.

C. Do the entailment relations that you identified in Part B correctly represent your intuitions about the information that is conveyed by the English sentence in (12)? If not, then in what ways do they fail to accurately represent the information conveyed by (12)? What does (12) convey?

In other words, this part asks you to consider whether the truth-conditional meaning of your propositional logic translation for (12) indeed matches the literal meaning of the actual English sentence—do you judge the English sentence to have the same entailments as its propositional logic translation? If you feel that they do not match, then you should explain the differences as precisely as you.