Translating Compound Propositions

Going from English to symbols and visa versa.

English to Symbols
- Determine the major connective = commas will help you.
- Each component simple proposition translate to a letter, p, q, or r.
  - Underline each simple proposition and label it with a letter or negation of the letter.
  - Locate each connective and replace it with the symbol for that connective.
  - Use parentheses or other signs of enclosure to group what comes before and after the major connective.

Example
- It is raining if and only if the ground is wet and the sky is dark.
  - It is a bi-conditional. Put ↔ under "if and only if."
  - Under "it is raining" put p.
  - Under "the ground is wet" put q.
  - Under "the sky is dark" put r.
  - Put under the connective "and".
  - Use parentheses to enclose the conjunction.
  - Translation: p ↔ (q ∧ r)

Another Example
- If 2 > 4 and 7 is even, then 13 is odd or 6 + 3 = 8.
  - Basic connective is "if – then" symbol →
  - p: 2 > 4; q: 7 is even; r: 13 is not even; and s: 6 + 3 = 8
  - Translate the "and" the "or".
  - Use parentheses to enclose the conjunction and also the disjunction.
  - Translation: (p ∧ q) → (~r ∨ s)

Going the Other Way
- p: Today is Thursday; q: 8 is not even; r: Logic makes sense
- Translate into English: ~(p → (q→ ¬r))
  - Start with the phrase "it is not true that" to negate the whole proposition.
  - Start translating → with the word "if"
  - Write p and follow it with the word "then"
  - A comma is needed because of the parentheses.
  - Write q followed by "if and only if"
  - Write the negation of r.
  - Translation: It is not true that, if today is Thursday then, 8 is not even if and only if logic does not make sense.

Determine the truth value
- If p is true, q and r are false determine the truth value of ~(p ∧ ¬q) → (~r ∨ q).
  - Under each letter put "T" or "F".
  - Negate q and r.
  - Determine the truth value of the conjunction and then negate it.
  - Determine the truth value of the disjunction.
  - Determine the truth value of the conditional.
Translating Compound Propositions

Determining the Truth Value

\[ \neg(p \land \neg q) \rightarrow (\neg r \lor q) \]

<table>
<thead>
<tr>
<th>(T)</th>
<th>(\neg F)</th>
<th>(\neg F)</th>
<th>(F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\neg T)</td>
<td>(\rightarrow)</td>
<td>(F)</td>
<td>(T)</td>
</tr>
</tbody>
</table>

In-class Assignment 10 - 2