I. Administrative

A. Problem sets – due Tuesday, 17 November

B. Questions?

II. Logic and Form

A. What is logic?

1. Logic as a subject matter is the study of logics, understood as models of acceptable inference patterns

2. These models have various characteristics:

   a. They focus on distinguishing patterns of acceptable reasoning (or argument) from patterns that are not acceptable, relative to a specification of elements that are the focus of the logic (following)

   b. The model will provide systematic standards for determining when a piece of reasoning is acceptable, e.g., when it is valid, if deductive.

   c. These rules will involve the content of the elements but reduce the rest of the content to formal schema – example

      i. The goal is to create a model that is as general as possible

      ii. The content of the elements can be specified functionally, e.g., conjunction in propositional logic

      iii. Bottom line: the emphasis is on form over content (9.1)
B. What is form?

1. Form is contrasted with content, and is understood at the level of propositions
   
   a. The content of a proposition is what that proposition is about, and it typically involves things (concrete or abstract) and their properties
   
   b. The form of a proposition is the structured way in which the content elements are related, and it is closely associated with the syntax of the sentence (or sentences) used to express the proposition

2. The form of a complex proposition (i.e., a proposition that comprises other constituent propositions) is indicated by the elements in its expression that organize the constituent propositions along with its syntactical structure

3. One can access the form by replacing all of the propositional expressions (i.e., all of the parts of the sentence that individually have truth values) with symbols; what elements remain of the original expression and the way they structure the symbols constitute the form of the proposition (Example)

III. Propositional Logic

A. Propositional Form (9.2)

1. Propositions are chunks of meaning that can be evaluated for truth and falsity—they are claims
   
   a. They can be simple (e.g., “It is cold outside”), in which case there is only one part of the proposition that has a truth value
   
   b. Or they can be complex (e.g., “It is cold outside and it is windy also”), in which case there is more than one part that has a truth value
   
   c. It isn’t always clear whether you are dealing with a simple proposition or a complex one; nor is it always clear what the character is of a complex proposition

2. One way to get at the form of a proposition is to replace the parts that are true or false with variable symbols, e.g., $p, q, r$
a. This can be done at different levels – any sentence at all, no matter how complex, can be replaced by $p$

b. You can also dig down into the sub-structure of a sentence, if it is made up of parts that are themselves sentences. When doing this, be sure to leave in the connecting terms (e.g., ‘and’, ‘or’, ‘not’, ‘if … then’), and don’t fiddle with the overall order

c. Be sure to replace different propositions with different variables; that is, do not use the same variable to represent different propositions

d. So “It is cold outside” would become $p$ and “It is cold outside and it is windy also” would become $p$ and $q$.

3. One can also go in the other direction: given a propositional form, one can replace the variables with propositional expressions

a. Here again, one need not take a propositional variable to stand for a simple proposition; thus, one could replace the variable $p$ with a complex proposition since, after all, the complex proposition does itself express a single truth value

b. Further, going in this direction one can replace different propositional variables with the same proposition

   i. So $p$ and $q$ can be “It is cold outside and it is cold outside”

   ii. Compare: $x + y = 4$, where $x = y = 2$.

4. Together, you get the following rule: “Different variables may be replaced with the same proposition, but different propositions may not be replaced with the same variable” (p. 116)

5. **Examples:** Write out three propositional forms for the following sentences:

   a. MSU is in the Sweet Sixteen, and Kentucky is in the Sweet Sixteen, and Duke is in the Sweet Sixteen.

   b. He’s lucky and he’s good or he’s good. (9.3, 9.4)
B. Validity, Invalidity, and Propositional Form

1. “An argument form is valid if and only if it has no substitution instances in which the premises are all true and the conclusion is false” (120)

2. "An argument is valid if it is an instance of a valid argument form” (120)
   
   a. Thus, all arguments that are instances of a valid argument form are valid.
   
   b. This is so because all arguments that are instances of valid argument forms are arguments that cannot have false conclusions if their premises are all true.

3. Not all valid arguments are valid by virtue of their logical form. For example, P1: The ball is red all over. C: Therefore, the ball isn’t blue.

4. Thus:

5. *Examples*

   a. Donald owns a tower in New York and a palace in Atlantic City. Therefore, Donald owns a palace in Atlantic City.

   b. Donald owns a tower in New York. Therefore, Donald owns a tower in New York and a casino in Las Vegas.

   c. Donald owns a tower in New York. Therefore, Donald owns a tower in New York and Donald owns a tower in New York. (9.5, 9.6)
C. Propositional Connectives

1. These are devices, often terms, that can be used to build more complex propositions out of simpler ones. We consider several of these.

2. **Conjunction**

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<thead>
<tr>
<th>Connective</th>
<th>English Equiv.</th>
<th>Function</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Conjunction -- &amp;</td>
<td>‘and’, ‘but’, ‘moreover’, ‘hence’, ‘therefore’, etc.</td>
<td>conjoins two propositions; the complex proposition is true just in case both of the conjoined propositions are true</td>
<td>• <em>propositional conjunction vs. non-propositional conjunction</em>—it isn’t always clear which of these you’re dealing with</td>
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a. **Examples:**

i. A Catholic priest married John and Mary.

ii. The winning presidential candidate rarely loses both New York and California.

3. **Disjunction**

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<tbody>
<tr>
<td>Disjunction – v</td>
<td>‘or’ – others?</td>
<td>disjoins two propositions; the complex proposition is true just in case at least one of the disjoined propositions is true</td>
<td>• <em>inclusive disjunction from exclusive disjunction</em>, where the latter is the “soup or salad” <em>or</em>; in here, we will interpret disjunction <em>inclusively</em>—see handout</td>
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4. **Negation**

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| Negation – ~ | ‘not’, ‘un-’, ‘it is not the case that’, etc. | operates on a single proposition and negates it, where the complex proposition is true just in case the negated proposition is false | • ‘not’ can operate at different locations in a sentence  
  • it can also be involved in a sentence in a way that is not expressible in propositional logic |

a. **Method for identifying non-propositional negation:**

i. You can get at whether you are dealing with propositional negation by taking the negation term out and then tacking ‘It is not the case that’ onto the front of the proposition

ii. If the result means the same as the original, it is propositional negation; otherwise, it is not

b. **Examples of non-propositional negation:**

i. It might not be cold tomorrow.

ii. I believe that I won’t finish this lecture on time.

5. **Conditional** (9.7, 9.8)

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| Conditional – ⊃ | ‘if … then’ is the primary counterpart; also, ‘provided’ and ‘only if’ – see handout | operates on two propositions, where the complex proposition is true just in case the antecedent (the “if” part) is false or the consequence (the “then” part) is true – this can be defended (a) by equivalence argument (see handout) or (b) by truth tables | • There are different types of conditionals in English: indicative, subjunctive, conditional imperatives, conditional questions, conditional promises, etc.; we focus on indicative conditionals here  
  • it can also be involved in a sentence in a way that is not expressible in propositional logic |