Overview of Today's Lecture

- Administrative Stuff (lots of it)

  - Syllabus (handout)

    * Course Website

    * Readings *&* Supplemental Materials

    * What, When, Where, Why?

    * Grades, Assignments, Exams, and all that. . .

    * Group Work and Individual Work

    * Blackboard & TurningPoint Cloud/ResponseWare

    * Logic Software (more on this later in the course)

- Introduction to the Course & Chapter 1 of Forbes

  - What Logic is *Not*

  - Sentences, Propositions, and Arguments

  - Actual, Possible, and Necessary Truth

  - Deductive Validity of Arguments (*The* Central Topic of Part I)

What Logic is *Not*

- Often, people will say: "That person is logical" or "That decision is logical", etc. What they *mean* is that the person/decision/etc is *reasonable* or *rational*. Logic (in our sense) has little to do with this.

- Logic is not about people or how they think or how they ought to think. How people *actually* think is a *psychological* question. How people *ought* to think is an *epistemological* (or perhaps *ethical*) question.

- Logic is abstract. It is not about concrete entities. In this sense, it is like mathematics. But, it is more basic and fundamental than mathematics.

- Logic is not about debating or arguing. It is also not about persuading or convincing people of things (or any human activities, for that matter).

- Logic is not empirical (like physics). Nor is it subjective (like, perhaps, matters of taste). It isn't mysterious or unclear either. So, what *is* it?

Background 1: Propositions and Sentences

- *Propositions* are the basic units of logical analysis. They are expressed by declarative sentences like "Snow is white."

- Not all sentences express propositions (*e.g.*, "What time is it?").

- Propositions are not identical to declarative sentences that express them. Consider: "Snow is white" and "Schnee ist weiß."

- Propositions are either true or false (not both). *True* and *False* are called *truth-values*. Propositions have exactly one truth-value. The truth-value of a proposition is *objective*.

- That is, whether a proposition is true or false (in a given situation) does not depend on what anyone thinks about *that* proposition or on how that proposition happens to be expressed.

- Even if a proposition is *about* something subjective, its truth-value remains objective (*e.g.*, Branden believes that the Yankees will win.)

Background 2: Actual, Possible, and Necessary Truth

- Some propositions are actually true (Snow is white), and some are not (Al Gore is President of the United States in 2007).

- Other propositions are not *actually* true, but still *possibly* true. Al Gore is not *actually* our President in 2007, but he *might have been*. As such, it is *possibly* true that Al Gore is President in 2007.

- Some propositions are not even *possibly* true. For instance:

  1. My car has traveled faster than the speed of light.

  2. $2 + 2 = 5$.

  3. Branden weighs 200 lbs and Branden does not weigh 200 lbs.

- (1) violates the laws of physics: it is *physically impossible*. (2) violates the laws of arithmetic: it is *arithmetically* impossible.

- (3) violates the laws of *logic*: it is *logically* impossible.

- This is the kind of impossibility that interests the logician. In slogan form, we might call this "the strongest possible kind of impossibility."

- Some propositions are not only *actually* true, but (logically) *necessarily* true. These *must* be true, on pain of *self-contradiction*:

  – Either Branden weighs 200lbs or he does not weigh 200lbs.

  – If Branden is a good man, then Branden is a man.

- Logical possibility and logical necessity are central concepts in this course. We will make extensive use of them.

- We will look at two precise, formal logical theories in which the notion of logical necessity will have a more precise meaning.

- But, before we get into our formal theorizing, we will look informally at the *following-from* relation between propositions.

- As we will see, understanding the following-from relation will require a grasp of the notions of logical necessity (and logical truth).

Bakckground 3: Arguments, Following-From, and Validity

- An *argument* is a collection of propositions, one of which (the *conclusion*) is supposed to *follow from* the rest (the *premises*).

    All men are mortal. [premise]

    Socrates is a man. [premise]

    Therefore, Socrates is mortal. [conclusion]

- If the conclusion of an argument *follows from* its premises, then the argument is said to be *valid* (otherwise, it's *in*valid).

☞ **Definition**. An argument $\mathscr{A}$ is *valid* if and only if:

  Rendition #1. It is (logically!) *necessary* that *if* all of the premises of $\mathscr{A}$ are true, *then* the conclusion of $\mathscr{A}$ is also true.

  Rendition #2. It is (logically!) *impossible* for both of the following to be true simultaneously: (1) all of the premises of $\mathscr{A}$ are true, *and* (2) the conclusion of $\mathscr{A}$ is false. [For us, this will be *equivalent* to #1.]

Background 4: Validity, Soundness, and "Good" Arguments

- A "good" argument is one in which the conclusion follows from the premises. But, intuitively, there is more to a "good" argument (all things considered) than mere validity.

- Ideally, arguments should also have (actually) *true premises*. If the premises of an argument are (actually) false, then (intuitively) the argument isn't very "good" — even if it is valid. *Why not*?

☞ **Definition**. An argument $\mathscr{A}$ is *sound* if and only if *both*:
  (*i*) $\mathscr{A}$ is valid, *and* (*ii*) all of $\mathscr{A}$'s premises are (actually) true.

- So, there are two components or aspects of "good" arguments:

  – Logical Component: Is the argument valid?

  – Non-Logical Component: Are the premises (actually) true?

- This course is only concerned with the *logical* component.

Is it *possible* that all of $\mathscr{A}$'s premises are true, *but* $\mathscr{A}$'s conclusion is false?

YES   NO

$\mathscr{A}$ is *in*valid. $\mathscr{A}$ is valid.

$\mathscr{A}$ is *un*sound.   Are all of $\mathscr{A}$'s premises *actually true*?

YES   NO

$\mathscr{A}$ is *sound*. $\mathscr{A}$ is *un*sound.