Some Basic Concepts

Definition: Logic is the study of methods for evaluating whether the premises of an argument adequately support its conclusion.

Definition: An argument is a set of statements, one of which, called the conclusion, is affirmed on the basis of the others, which are called the premises.

Definition: A statement is a sentence that is either true or false.

- George Bush is president.
- College Station is in Nevada.
- Two and three are five.
- If anyone is a liberal, Barney is.

Compare with other types of sentences

- Interrogatives (questions)
  - Will the economy improve?
• Imperatives (commands)
  – Shut the door!

Comment: The class of statements arguably doesn’t quite correspond to the class of declarative sentences, as there are declarative sentences that appear to be neither true nor false, but are simply capable of being true or false, for example, “The present King of France is bald.”

Comment: In a well-constructed argument, the premises give good reasons for believing that the conclusion is true. (We will say more exactly what we mean by “good” a bit later.) But a poorly constructed argument is still an argument.

Examples of Poorly Constructed Arguments

• Heinrich lied. Therefore, we can never again trust anything that he says.

• Some students listen to hip hop. John listens to hip hop. Therefore, John is a student.

Comment: Arguments are typically used to persuade and to discover truth. These are usually compatible goals, but not always. Consider, for example, the use of mud-slinging arguments in political campaigns. Such arguments are often persuasive, but are rarely used with the intention of discovering truth or, at least, the whole truth about a given candidate. (Telling only part of the whole story is often an effective mud-slinging tactic, as conclusions that might well appear to follow from part of the story might not follow from the whole story.)
1.1 Validity and Soundness

**Definition:** An argument is *valid* if and only if it is *necessary* that if the premises are true, then the conclusion is true.

**Comment:** The idea behind these (equivalent) definitions is that, in a valid argument, the truth of the premises *guarantees* the truth of the conclusion. That is, it is not enough (for validity) for the premises, say, to make the conclusion highly probable, or beyond reasonable doubt. Rather, validity in the above sense (or *deductive* validity, as it is often called) is a purely logical notion. For an argument to be valid in the above sense, the connection between premises and conclusion must be so strong that it is not even *possible*, in the strongest sense, that the premises be true and the conclusion false — you must not even be able to *conceive* of circumstances in which that happens.

**Alternative Definition:** An argument is *valid* if and only if it is impossible for its conclusion to be false while its premises are true.

- All biologists are scientists. John is not a scientist. So, John is not a biologist.

- If Alice stole the diamonds, then she is a thief. But Alice did steal the diamonds. Hence, she’s a thief.

- Either Bill has a poor memory or he is lying. Bill does not have a poor memory. Therefore, Bill is lying.
Five Observations About Validity

1. An argument can have one or more false premises and still be valid.

All birds have beaks. Some cats are birds. So, some cats have beaks.

All students are democrats. George W. Bush is a student. Therefore, George W. Bush is a democrat.

Comment: The arguments are valid because, on the assumption the premises are true, the conclusion is true as well. Otherwise put, one cannot conceive of a situation in which the premises are true but the conclusion isn’t. Thus, to evaluate an argument for validity, try to imagine a situation — no matter how outlandish, as long as it is logically possible — in which the premises are true but the conclusion is false. If you cannot do it, then the argument is valid. (This test is still not really precise, since what one can or cannot imagine is a bit wooly. To get really precise, we’d have to start doing what logicians call model theory, which we begin to introduce in Chapter 7. But these informal notions will do well enough for our purposes here.)

Comment: Notice that it also follows from the definition of validity that arguments with impossible premises are valid! The reason for this is simply that, if it is not possible for the premises of an argument to be true, then it is not possible that the premises be true and the conclusion false. Hence, anything follows from impossible premises. This may seem odd at first, but in fact you already have a sense that it’s true. Suppose someone gives you an argument for a conclusion you find absurd. Then you might respond “If that’s true, then I’m a monkey’s uncle.” (Well, your grandfather might have responded that way.) The intuition that is reflected in this response is that, if something absurd were true, then anything would be true (and hence that the absurdity in question must be false). That is exactly what is captured in the logical principle that anything follows from a contradiction. (Don’t lose any sleep over this if it leaves your head spinning — it is not a critical point for our purposes.)
2. An argument can have true premises (and even true premises and a true conclusion) without being valid.

Some Americans are women Clint Eastwood is an American. Therefore, Clint Eastwood is a woman.

All planets revolve around the sun. Haley’s comet revolves around the sun. Therefore, Haley’s comet is a planet.

Some Americans are actors. Meryl Streep is an American. Therefore Meryl Streep is an actor.

Comment: Note that the last of these is not valid because it is not necessary that Meryl Streep be an actor. It is possible that she not be one; she could have chosen to be, say, a geologist instead. Here’s another way to think about it: if all you knew was that some Americans were actors and that Meryl Streep is an American, it would not be reasonable for you to conclude that Meryl Streep is an actor. The truth of the premises does not guarantee the truth of the conclusion.

3. Validity preserves truth. If the conclusion of an argument is false, at least one of the premises must be false as well.

4. Validity does not preserve falsehood. That is, an argument with false premises might have a true conclusion nonetheless.

All dogs are ants. All ants are mammals. So, all dogs are mammals.
All democrats are conservative. G. W. Bush is a democrat. So, G. W. Bush is conservative.

5. One can know whether an argument is valid or invalid even if one does not know the truth value of the conclusion and all of the premises.

All Schnitzers are BMWs. Emily Larson owns a Schnitzer. So, Emily Larson owns a BMW.

All reliabilists are foundationalists. Richard Foley is not a Foundationalist. So, Richard Foley is not a reliabilist.

Invalidity

It follows from the definition of validity that an argument is invalid argument is one where it is possible for its conclusion to be false while its premises are true.

- All dogs are animals. All cats are animals. Hence, all dogs are cats.

- If Pat is a wife, then Pat is a woman. But Pat is not a wife. So, Pat is not a woman.

- Phil likes Margo. Therefore, Margo likes Phil.
Soundness

Comment: In ordinary English, the word ‘valid’ is vague. It often just indicates overall approval of an argument. Other times it means something stronger, namely that an argument is sound.

Definition: A sound argument is a valid argument in which all of the premises are true; in a nutshell:

VALID + TRUE PREMISES = SOUND

- All collies are dogs. All dogs are animals. Hence, all collies are animals.

- If Mozart is a composer, then he understands music. Mozart is a composer. Hence, Mozart understands music.

Hence:

An unsound argument is either invalid or has at least one false premise.

It follows that there are three categories of unsound arguments:

Category 1: Valid but at least one false premise

- All birds are animals. Some grizzly bears are not animals. So, some grizzly bears are not birds.
**Category 2:** Invalid but premises are all true.

- All birds are animals. All grizzly bears are animals. So, all grizzly bears are birds.

**Category 3:** Invalid and at least one false premise

- All trees are animals. All bears are animals. So, all bears are trees.

**Four Points on the Terminology**

1. Arguments are neither true nor false.

2. Arguments can be valid/invalid, sound/unsound.

3. Statements cannot be valid/invalid, sound/unsound.

4. Statements are either true or false.