Basic Concepts

NOTE: These lecture notes are designed only to emphasize the central points in each section of our text. *They are not a replacement*. It is essential that you study the corresponding discussions in the text and then go to the Web Tutor and work the problems at the end of each section.

A *statement* is a sentence that is (or at least can be) either true or false.

- Statements are used to *convey* (good or bad) information.
- Examples
  - Hillary Clinton is president.
  - 7 is a prime number.
  - The King of France is bald.
    - Note this sentence arguably is neither true nor false but *could be*.
- Compare with other types of statements
  - Interrogatives (questions): Used to *elicit* information.
    - What time is it?
  - Imperatives (commands): Used to guide or compel behavior.
    - Do your homework.
    - Shut the door!

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.

- A *deductive* 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.
- An *inductive* argument is one in which the premises are intended to make the conclusion *probable*, without guaranteeing it.

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

1.1 — Validity and Soundness

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

Alternatively:

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

Five observations about validity

1. An argument can have one or more false premises and still be valid.
    - The question is whether the conclusion would have to be true *if* the premises were.
2. An invalid argument can be true premises; in fact, it can have true premises and a true conclusion!
    - The question is whether the truth of the premises *guarantees* the truth of the conclusion.
3. If an argument is valid and has a false conclusion, it *must* have a false premise.
    - By definition, a *valid* argument *must* have a true conclusion if its premises are true.
4. A valid argument can have false premises and a true conclusion.
    - *To illustrate*: All Texas senators are women. Hillary Clinton is a Texas Senator. Therefore, Hillary Clinton is a woman.
5. We do not usually need to know the truth values (truth or falsehood) of the premises and conclusion of an argument to know whether or not it is valid.
    - *To illustrate*: All widgets are whirligigs. All whirligigs are futzbinders. Therefore, all widgets are futzbinders.

An argument is *invalid* if it is not valid. Hence, an invalid argument is one whose premises can be true and its conclusion false.

An argument is *sound* if it is (i) valid and (ii) has true premises.

- It follows that the conclusion of a sound argument must be true.

An argument is *unsound* if it is not sound.

- It follows that the conclusion of a sound argument must be true.
- We can express this as an equation:

Sound = Valid + All Premises True

- So an unsound argument is *either* invalid *or* has at least one false premise.