

### A Definition of Logic

Biology is the study of living things. Its subject matter is the incredible variety of living things on this planet. Logic is the study of arguments. Its subject matter is the incredible variety of arguments we use daily. As a biologist examines particular living things, a philosopher of biology may try to develop an understanding of what life is. Likewise, as logicians examine individual arguments, a philosopher of logic may try to develop an understanding of what arguments are. Let's begin with two simple examples:

- A.     1. I am a student in this Phil 2101 class.  
           2. If I am a student in this Phil 2101 class, then I am enrolled in UMM.  
           3. Hence, I am enrolled in UMM.
- B.     1. I am a logic teacher.  
           2. If I am a logic teacher, then I am a teacher.  
           3. Hence, I am a teacher.

The most basic fact about these arguments is that they require language. Without language we would have no logic, so logic is a variety of language. The next most obvious fact of the above examples is that they are expressed in **sentences** (our text uses the term "statement" on p. 1). Both arguments have three sentences: two premises and one conclusion. Each sentence is a distinct grammatical string of words. If we understand an argument as simply a group of sentences, then the arguments in A. and B. are distinct. If we look at meaning, as opposed to grammar, these two arguments are distinct in another sense. Sentences A1. and A3 are true for each of you, but false for me, while B1. and B3. are true for me and false for each of you. Interestingly, sentences A2. and B2. express conditions which are true for all of us.

This analysis misses something very important about these two arguments: they share the same identical structure. Logicians have named this argument **modus ponens** (p. 322):

- C. 1. p  
       2. if p, then q  
       3. hence, q.

The second premises of both A. and B. are conditionals, their antecedents are repeated in the first premises while their consequents are repeated in the conclusions. This structure is made clear in C by using variables for sentences. If you look at A2 and B2, you will see that C2 highlights the general fact that A2 and B2 are conditional sentences and the repetition of the antecedent and consequent of that conditional is matched in the overall arguments. In this manner, C. outlines the **form** (p. 52) of the argument used in both A. and B. and you can now appreciate that this same argument can be made by substituting any sentences consistently for p and q. It doesn't matter if p is "The moon is made of green cheese" or q is "My mother is the President of the United States".

A key function of the generalization in C. is to outline the **truth value connection** between the premises and conclusion. The conditional in C2 claims that if p is true, then q is true and since premise 1 states that p is true, then the conclusion must follow: q is true. This form exhibits a truth value connection between the premises and the conclusions such that if the premises are true, then the conclusion must be true. This is a valid inference. We can know this without determining whether any sentence really is true or false. In the first chapter of the Hurley text, you will learn the difference between **validity** (p.41) and **soundness** (p.44) of deductive arguments. Logic will give you tools to determine validity (defined as if the premises are true, then the conclusion must be true) but not soundness, i.e., whether the argument is valid and the premises are in fact true. You will learn various ways to determine validity on the basis of the form of the premises and conclusions involved.

This allows us to define logic as follows: sentences, due to their logical form, have connections between them such that if one has a truth value (true or false), then as a consequence the truth value of certain others are known. Logic is this discovery that truth values flow between sentences due to the hidden structure of language, in such a way that no single sentence has a true value without other sentences having their truth value determined. Logic is this interconnectedness.