SECTION 1

BEGINNING

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§1.1
GETTING STARTED

Your study of elementary symbolic logic will begin in a rather non-traditional manner, non-traditional in the sense that in Section 1 you are asked to uncover some basic ideas of logic on your own initiative. No textbooks, no libraries, and no internet; however, you can – and indeed you should – consult with your classmates and your instructor.

Logic, like other subjects you may study, has a well-developed body of knowledge and a distinctive subject matter. Regrettably, logic is rarely taught in high schools with the result that when students are introduced to logic, they occasionally find themselves at sea in a storm of new words and symbols, none of which appear to have any obvious link to their previous studies. Because of this, logic is apt to be viewed as abstract and complicated. This highly unenthusiastic view of logic results from the lack of exposure to logic as a subject matter, and it may well make your initial encounter with logic more alarming than necessary. On the other hand, when familiarity has finally driven alarm out of the house, you will find that logic is very straightforward and readily understandable.

There is a delicious irony in the negative characterization of logic because all of you assume the truth of fundamental logical precepts every day, and have done so virtually all of your life. Certainly, your implicit recognition of logical principles began long before you encountered any formal schooling. A very small child understands that it is not possible to play at home and at a friend’s house across the street at the same time. In a similar manner, suppose a youngster owns a dog named Zeno and he has learned in kindergarten what ‘mammal’ means. He asks his teacher
"Is Zeno a mammal?" The slightly elliptical reply is "All dogs are mammals." The child will very likely make the correct inference that Zeno is indeed a mammal.

The assumption and application of logical principles permeates much of your daily life. If you are attempting to convince someone that the evidence in a courtroom trial did (or did not) justify the verdict, you will be utilizing principles of logic. If you argue that someone else’s favorite politician is maintaining an inconsistent position on the distribution of wealth and industrial productivity, you will be utilizing principles of logic. If you are creating a proof in Euclidean geometry, you will be utilizing principles of logic. If you are seeking to develop evidence to support the claim of tectonic plate movement, you will be assuming principles of logic.

The way in which we see and understand our world is shaped to some extent by elementary logical principles that seem to be hard-wired into the human brain. If logic permeates every aspect of what we would like to call rational discourse, why does it seem challenging when first encountered. Part of the answer is that when logic is initially introduced in a school’s curriculum it presents a distinctively new discipline. Another part of the answer is that in your daily activities when you construct and evaluate the merits of arguments, make inferences, collect and organize evidence, you normally do not think about the nature and principles of argument and inference. Put in a slightly different way, you are using logic rather than thinking about logic. In short, you routinely construct and appraise arguments, appealing to logical principles spontaneously and naturally; and incidentally, more often than not, you do it correctly. No doubt, this will lead you to a question: if we use principles of logic in ordinary discourse and frequently do so correctly, what is the point of studying logic? The earlier examples were extremely simple, but consider the following argument.

If triangle ABC is isosceles and side BC is the shortest side, then side AB equals side AC. If triangle ABC is isosceles and M is the midpoint of side BC, then angle BAM equals angle CAM. If angle BAM equals angle CAM, side AB equals side AC, and side AM equals side AM, then triangles AMC and AMB are congruent. M is the midpoint of side BC. Side AM is equal to side AM. If triangles AMC and AMB are congruent, then angle ABC is equal to angle ACB. Therefore, if triangle ABC is isosceles and BC is the shortest side, then angle ABC is equal to angle ACB.
The above argument is complicated, and consequently reliable intuitive judgments about its merit are beyond the abilities of most of us. For example, it may not be apparent to you that the logical correctness of this argument has *nothing whatsoever* to do with geometry. The problems encountered in assessing an intricate argument immediately point to at least two important benefits gained from studying logic. First, logic will develop – wherever possible – mechanical techniques for evaluating the correctness of arguments, thereby eliminating appeals to intuitive judgments. Second, assessing the correctness of an argument is one thing, but constructing a proper argument is quite a different issue. Logic provides techniques to guide us in correctly exploring the logical implications of given assumptions.

In the next two sections you will be asked to examine and reflect on a number of examples and questions about them. The objective is to see what basic concepts of logic you can uncover on your own. The examples are admittedly contrived and stylistically stilted, but the point is to begin with extremely simple examples and then see if you can use them to extract some of the principal ideas of logic.

Read each of the items in Section 1.2 and try to answer the questions about them that are posed in Section 1.3. The best way to approach this task is first to read quickly through the two sections, and then go back and read them carefully and analytically. The questions posed in Section 1.3 provide a framework for organizing your thoughts about the examples in Section 1.2. You will be surprised at how many of the basic concepts of logic can be uncovered on your own.

§1.2
EXAMPLES TO CONSIDER

1. Six is larger than thirty-four and thirty-four is larger than eighteen. Consequently, six is larger than eighteen.

2. All vessels with three masts are vessels with lateen sails; hence, all xebecs are vessels with lateen sails because all xebecs are vessels with three masts.

3. The balloon rose into the air because it was filled with helium and helium is lighter than air.
4. John is a sibling of Bill, and Bill is a sibling of Mary. Therefore, John is a sibling of Mary.

5. If John’s Triumph has SU carburetors, then the carburetors have variable diameter fuel jets. John’s Triumph has SU carburetors. Therefore, the carburetors have variable diameter fuel jets.

6. All terrorists are people who have no regard for innocent human life. All politicians who wage war are people who have no regard for innocent human life. Therefore, all politicians who wage war are terrorists.

7. John is a friend of Bill, and Bill is a friend of Mary. Therefore, John is a friend of Mary.

8. Nevada is larger than Ohio. Therefore, Nevada must be larger than Delaware, because Ohio is larger than Delaware.

9. If the coding system used by the English in the Second World War was unbreakable, then German cryptographers would not be able to break the English code. Indeed, German cryptographers were not able to break the code. So, the English coding system was unbreakable.

10. Every Border Collie has black spots on the roof of its mouth. My dog has black spots on the roof of its mouth. So, it is likely that my dog is a Border Collie.

11. If Nevada is larger than Ohio and Ohio is larger than Delaware, then Nevada is larger than Delaware.

12. If some felines are tigers, then some pets are tigers. Some felines are tigers. Therefore, some tigers are pets.

13. All dogs are animals and all Labrador Retrievers are animals; so all dogs must be Labrador Retrievers.

14. All undergraduates are accomplished musicians and all accomplished musicians are students; therefore, all undergraduates are students.

15. All reptiles are animals and all snakes are animals; therefore, all snakes are reptiles.
16. If John Smythe is the person who brutally murdered Alicia Songbird, then Smythe’s DNA will be found on Songbird’s body. In fact, Smythe’s DNA was found on Songbird’s body. Therefore, Smythe is the person who brutally murdered Alicia Songbird.

17. The sum of 1, 2, 4, 7, and 14 equals 28. Therefore, 28 is a perfect number.

§1.3
QUESTIONS ABOUT THE EXAMPLES

Section 1.5 contains duplicates of the contents in Section 1.2 and Section 1.3. Consequently, you may remove Section 1.5 without disturbing the earlier materials. Using the duplicate examples, you can cut them into individual strips and freely rearrange their order on your desk. In order to answer some of the questions in Section 1.3 try rearranging the examples into groups sharing common characteristics.

1. Which of the examples do you think are arguments? Which of the examples do you think are not arguments? What meaning are you attributing to ‘argument’?

2. Do you think there are uses of the word ‘argument’ in ordinary English that are not of any interest in a logic course?

3. Assuming that you identified some of the examples as arguments, are you willing to call any of them good arguments? If so, what meaning are you attributing to ‘good argument’? Is it possible that there is more than one sense of ‘good’ applicable to arguments? If so, can you identify other meanings?

4. Are you willing to label any of the arguments bad arguments? If so, what meaning are you proposing for ‘bad argument’? Can an argument be considered ‘bad’ in more than one sense? If so, can you specify another possible meanings of ‘bad argument’?

5. Assuming you identified more than one of the arguments as bad, is any one of them so manifestly and patently bad that no additional explanation is needed or necessary to establish that fact?
6. Logic is (in part) concerned with the analysis of arguments, but clearly if logic is to qualify as a science the interest in arguments must be more general than listing and assessing specific, individual arguments. How do you think generality can be introduced into logic?

7. Do any of the arguments bear important similarities to any of the other arguments?

8. Does anything strike you as surprising about example #14?

9. When you read #2, and assuming that you do not know the meaning of 'xebec', did you consult a dictionary? What bearing does the meaning of 'xebec' have (or not have) on your assessment of #2? If you learned that 'xebec' is not a meaningful word would that change your assessment?

10. Do any of the arguments strike you as significantly different from the others? If so, explain the distinctive difference.

§1.4
NEXT STEPS

It is very likely that you were successful in uncovering some basic ideas and concerns of logic based on the examples and questions in the previous two sections. The remainder of your logic course will build extensively on your initial discoveries.

Section 1 contained a number of appeals to your intuitions to distinguish good and bad arguments. One of the goals of a logic course is to replace appeals to intuition with clear and concise techniques enabling you to prove that arguments are good or bad whenever that is possible. Of course, using 'good' and 'bad' to report on arguments without precise definitions is not acceptable. We will be considerably more careful and exact about the meaning of fundamental ideas. We will develop techniques you may use to evaluate some arguments, and we will expand your skills in constructing defensible arguments. We will also touch on the relation of logic to other disciplines. In Section 2, many of the ideas you identified here will be considered again with the objective of providing more detailed and precise definitions.
§1.5
QUICK REFERENCE – EXAMPLES AND QUESTIONS

The following are copies of the examples and questions in Sections 1.2 and 1.3. The examples have been formatted to make it easier to cut them into strips and then to reorganize them into groups following the questions in Section 1.3.

EXAMPLES FROM SECTION 1.2

1. Six is larger than thirty-four and thirty-four is larger than eighteen. Consequently, six is larger than eighteen.

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QUESTIONS FROM SECTION 1.3

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