1

Arguments and Validity

1A LOGIC AS THE STUDY OF ARGUMENTS

This book is an introduction to deductive logic. The scientific study of logic began with Aristotle in the fourth century B.C. His impressive work, combined with other influences, is the foundation of a long tradition of logic that still continues. This tradition has taken diverse forms, but typically emphasizes the formal analysis of reasoning. Its technical language is the language of common discourse with certain modifications. This type of logic may be called "formal" logic; it is now more often called "Aristotelian logic" or "traditional logic".

Out of Aristotelian logic, and under the influence of mathematics, there developed a logic, even more formal, with special symbolism like that of mathematics. This is called "symbolic logic" or "mathematical logic". Since the creative work of De Morgan and Boole in the mid-nineteenth century, symbolic logic has flourished vigorously.

The first three chapters of this book are a general introduction, presenting concepts common to traditional and symbolic logic (without use of the special symbols of symbolic logic). With chapter 4, we follow mainly the line of traditional logic and continue that emphasis to chapter 35, (the last chapter) where we cross the bridge "From Aristotelian to Symbolic Logic".

1A1 Some Basic Concepts. Logic has sometimes been defined as "the science of reasoning". But this definition is too broad. Some psychologists study reasoning scientifically, investigating such subjects as the development of reasoning in the child, individual differences in reasoning ability, conditions favorable or unfavorable to reasoning, and so on. These studies are important, but are not in the province of logic. Logic is concerned rather with the evaluation of reasoning as it is expressed, particularly

in arguments. In another way, the proposed definition of logic is too narrow (as we use the term). In application to concrete argument in ordinary discourse, logical judgments may lack scientific precision, so that logic in practice is an art rather than a science, just as the practice of medicine is an art though based upon medical science. A more complicated definition will serve better as our starting point, though it will require clarification here and in later chapters.

> **Def. 1. Logic*** is the science (and art) of evaluating and constructing arguments and systems of reasoning and studying their components, making use of such concepts as those of sentences, propositions, definitions, terms, etc.

For the present, we define just two of the terms in this definition: *proposition* and *argument*.

> **Def. 2.** A **proposition** is a sentence (or a clause that may be used as one) that, as taken with a specific meaning, is true or false.[1]

That every proposition is true or false is one formulation of the **law of excluded middle.** That no proposition is both true and false is the **law of contradiction.**

The sentence "If he is not at home, he is on his way home", as used in a given context, is a proposition to a person who understands English. It contains two clauses; with "if" deleted, each of these clauses is also a proposition. Any change in wording makes a different sentence and a different proposition. A change in meaning without change in wording makes a different proposition with the same sentence. Thus we have a different proposition if "he" means Hosiah Q. Terwilliger than if it means his brother Zachary. The one proposition might be true and the other false.

To a person who understands English, the following sentences would be propositions:

> (a) "George Washington was the first president of the United States".

> (b) "Abraham Lincoln was the second president of the United States".

> (c) "Some people are fond of cats and some people are fond of dogs".

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*The key word in a definition is emphasized by boldfacing.

(d) "Exactly at noon (E.S.T.), 1 January 1940, there were exactly one trillion cockroaches on the planet Earth".

To a person who does not understand English or to a young child who does not know the meaning of all or some of the words in the above sentences, these sentences would not be propositions. It should be noted that it is not necessary to *know* that a sentence is true or to *know* that it is false in order to determine that the sentence is a proposition. All one has to know is that it is *either* true or false. Hence, sentence (d) above is a proposition, since the sentence is either true or false.

Sentences that function as questions, commands, or exclamations are not propositions, since they are neither true nor false. The following sentences are *not* propositions:

(e) "What is your name?"

(f) "Please shut the door."

(g) "Great balls of fire!"

Sentences that are propositions are generally declaratives, but not all declaratives are propositions. A declarative sentence that is not understood by a person is not a proposition to that person. Such declarative sentences may not be understood by a person because they are in a language not known by that person or because some word or words in the sentence are not understood. Also the declarative sentence may not be understood because the sentence literally has no meaning. Such nonsense sentences are not propositions, since they are neither true nor false.

Examples of declarative sentences that are neither true nor false, due to lack of meaning, are:

(h) "The square root of minus one snores redly."

(i) "Square curves float singingly sideward."

In this chapter we focus our attention on arguments. We need a definition such as the following:

Def. 3. An **argument** is a sequence of propositions that offers one or more propositions in the sequence as grounds or evidence for another proposition in the sequence.

An argument may or may not claim to give conclusive evidence for its conclusion. (See section 1B below).

An argument may also be considered as the verbal expression of a process of reasoning. An argument may be one compound proposition, for example, "I had \$25 and spent just \$2.50, so I have \$22.50 left."

An argument is not one simple proposition. It contains two or more propositions, but not any set or sequence of propositions constitutes an argument. Nor does "an argument" in logic means a dispute between two people. Of course it is correct English—even if it is gossip—to say: "Mr. Jones had an argument with his wife". But this is not the way the word "argument" is used by a logician.

An argument is also not a sequence of propositions that recounts a series of events (narration), such as "The airplane skidded past the end of the runway. It hit a tree and exploded in a ball of orange flame. There were no survivors".

An argument is not a sequence of propositions that explains the nature of an idea or an object (exposition), such as "A dictionary is a book that explains the words of a given language. The words are listed alphabetically. The pronunciation, etymology, and grammatical usage of each word is also given".

Also an argument has to be distinguished from propositions that picture a setting, scene, object, or person (description), such as "The UFO was saucer shaped and about twenty feet in diameter. It was surrounded by a pulsating soft, white glow. Around its circumference were a row of portholes that emitted from its interior a dull red light".

An argument is often called an "inference", the latter term emphasizing the process of thought by which a conclusion is reached (i.e., inferred). The term "inference" is also applied to the conclusion of an argument, thought of as the result of the process.

> **Def. 4.** A **conclusion** of an argument is a proposition that is inferred from one or more propositions.

The other propositions in the argument, the propositions that are supposed to serve as evidence for the truth of the conclusion, are called "premisses".[2]

> **Def. 5.** A **premiss** of an argument is a proposition offered as grounds or evidence for the conclusion.

Every argument has a conclusion and at least one premiss. An argument may have any finite number of premisses. Some examples of arguments, though not necessarily good arguments, are:

(a) "Only if a solution is acid will blue litmus paper turn red when immersed in it. This piece of blue litmus paper turned red when I dipped it in this liquid. Therefore, this liquid is acid."

(b) "Jones and Smith are the only people who could have committed the murder; but Green testified that he and Smith were at the movies at the time of the murder, and Black testified that he was with Jones at the race track at the time of the murder. So either Green or Black is lying."

(c) "My girlfriend is redheaded and bad tempered; therefore all redheaded girls are bad tempered."

1A2 Identifying Conclusion and Premiss. One must identify the conclusion in an argument. This is absolutely necessary in order to analyze an argument. The conclusion is what the argument is trying to prove, so that if one does not identify the conclusion as such he misses the whole "point of the argument". The conclusions of the above arguments are, respectively:

(a) This liquid is an acid.

(b) Either Green or Black is lying.

(c) All redheaded girls are bad tempered.

Finding the conclusion is not a matter of luck. The English language often makes use of certain words and phrases to indicate to the reader or listener that a conclusion immediately follows. The following list gives some of the more common words and phrases that may introduce a conclusion:

Therefore . . .	This entails that . . .
So . . .	This proves that . . .
Consequently . . .	I conclude that . . .
Hence . . .	I deduce that . . .
It follows that . . .	I infer that . . .
This implies that . . .	One may infer that . . .

The presence of one of the expressions above does not guarantee that there is an argument. In "He liked the book, so he bought it", the second clause does not state an inference from the first. It narrates an event, of which the first clause gives a psychological explanation.

Once the conclusion of an argument is identified, the rest of the sentences are either premisses or material that has no logical relevance to the conclusion. The task of identifying the premisses may be aid by the following

words and phrases which may immediately precede them, (three stars indicate premisses, three dots the conclusion):

> . . . , for ***
> . . . , because ***
> Since ***, . . .
> . . . , since ***
> . . . . The evidence is that ***
> . . . . I deduce this from the fact that ***
> . . . . I infer this from the fact that ***

Again the individual words do not guarantee existence of an argument, but if there *is* an argument, they introduce premisses.

Sometimes the conclusion can only be determined after the premisses are located. For example:

(d) "Charles is not at home, since he did not answer the phone when I called, and he never fails to answer the phone when he is at home".

In this example, the words "since" and "and" each precede a premiss. The pattern is: ". . . , since *(premiss)*, and *(premiss)*." Therefore the first clause, "Charles is not at home", must be the conclusion. Note that the conclusion of an argument may be in any position. It may be the first or last sentence of the argument or it may be somewhere in the middle.

1A3 Distinguishing Arguments from Causal Explanation. The word "because" generally occurs in a causal explanation rather than an argument. Examples in which "because" occurs in an argument and is used to indicate a premiss are:

(a) "Bill is taller than Harry, because Bill is taller than John and John is taller than Harry".

(b) "We are in an economic recession, because unemployment has steadily been increasing, the stock market has been declining, and business is very sluggish".

The following are examples in which "because" occurs in an explanation and does not indicate a premiss:

(c) "Mr. Smith is absent from class today because he is ill."

(d) "Hitler did not listen to the advice of his Generals, but opened a second front in Russia. Also, the Nazi's production of war materials was significantly less than that of the Allies. Consequently, the Nazis lost the war".

(e) "Bertrand Russell opposed the first World War since he was a pacifist".

These are causal explanations, not arguments, so they have neither premisses nor conclusions. Such explanations attempt to give the cause or causes of an event, not evidence for the truth of a proposition. Causes may be physical, psychological, social, economic, etc.

The word "Consequently" in (d) does not indicate a conclusion, and "since" in (e) does not indicate a premise. In an explanation the aim is not to prove a proposition true, but to explain why some event did or did not take place. Thus example (c) is not intended to give evidence of Mr. Smith's absence, but to explain it.

The expression "because of" *never* immediately precedes a premise, because it requires a noun, noun-phrase, or pronoun as object. Almost invariably the presence of the expression "because of" indicates that an explanation is being given. The following two examples are explanations:

(f) "Because of the death of his parents, Howard missed two weeks of school".

(g) "The center of the hurricane struck the island with its full fury, because of it thousands died".

Statements of causal relations and causal explanations as such are not arguments, but like other proposition, they are either true or false. It is possible for an explanation or causal statement to be a premiss or conclusion in an argument. For example, in the following argument evidence is given for an explanation, which is the conclusion of the argument.

(h) "Mr. Smith's wife called me this morning and informed me that he is in the hospital with the flu. Therefore, Mr. Smith is absent from class today because he is ill".

It is important to note that a description of an argument (or explanation) is a *description* only, not an argument (or explanation). Consider the following examples:

(i) "When Frank Murdock was charged with the murder of Harry Smith, he argued that he was innocent. He claimed that he had no motive for the killing and that he was having dinner with Smith's wife at the time of the murder".

(j) "The book explained that General Custard was defeated because he was a vain, glory-seeking person, who could not conceive of being defeated by a few thousand Indians".

Examples (i) and (j) are descriptions. Example (i) is a description (or report) of an argument. Example (j) is a description (or report) of an explanation.

1B DEDUCTIVE—INDUCTIVE; VALID—INVALID

The main concern of logic is to distinguish between correct and incorrect reasoning. Correct reasoning consists of arguments in which the conclusion follows in some sense from the premisses.

The correctness of reasoning is judged by different standards of strictness. Logicians have commonly divided arguments into two kinds (which may not be exhaustive): deductive and inductive.[3] A deductive argument is judged in the strictest possible way, that is, by the standard of validity. Inductive arguments are judged in less strict ways.

> **Def. 6.** A **valid argument** is an argument whose conclusion follows necessarily from its premisses.[4]

An example of a valid argument is:

> "There are over seventy students in this classroom; therefore, there are over ten students in this classroom".

Definition 6 is met since the truth of the proposition "there are over ten students in this classroom" follows by necessity from the truth of the proposition "there are over seventy students in this classroom".

> **Def. 7.** An **invalid** (in-VAL-id) **argument** is an argument that is not valid, i.e., an argument whose conclusion does not follow necessarily from its premisses.

Here are some alternative ways to say that an argument is valid:

(i) A valid argument is an argument such that if its premisses are true, then its conclusion must be true.

(ii) The conclusion follows necessarily from the premisses.

(iii) The conclusion validity follows from the premisses.

(iv) The conclusion is validity inferred (from the premisses).

(v) The premisses gives conclusive evidence for the conclusion.

(vi) The premisses together entail the conclusion.

(vii) The premisses logically imply the conclusion.

(viii) The premisses would, if true, prove the conclusion.

Def. 8a. A **deductive argument** is an argument which its maker is claiming to be valid.

Def. 8b. (Short form of def. 8a). A **deductive argument** is an argument that claims to be valid.

Def. 9. Deduction is inference from premisses to conclusion in a deductive argument.

Def. 10. Deductive logic is the branch of logic concerned with deductive arguments and auxiliary matters such as definition.

A person arguing deductively claims that if certain premisses are true, the conclusion must be true. He also asserts or at least supposes that the premisses (and hence the conclusion) are true.

A principle task of deductive logic is the development of methods (rules, etc.) for evaluating claims of validity.

A valid argument is almost always a deductive argument, that is, an argument that claims to be valid. But any argument may be evaluated as if it were deductive. If a person claims that the conclusion of his argument follows necessarily from the premisses, it is a deductive argument. If in fact this claim is correct, then it is a valid argument, regardless of the truth of the premisses or conclusion.

If this claim is not correct, the argument is still a deductive argument, though invalid. Validity is an objective matter, but being deductive is a subjective matter, depending upon the intention of the maker of the argument.

In respect to validity all arguments are either "good" (valid) or "bad" (invalid). That is to say, the conclusion follows necessarily from the premisses or it does not. From the standpoint of inductive reasoning, however, arguments are not claimed to be valid.

Def. 11a. An **inductive argument** is an argument for which its maker merely claims that if the premisses are true, the truth of the conclusion is sufficiently likely for the purpose at hand.

Def. 11b. (Short form of def. 11a). If a person claims that the truth of the conclusion is made likely enough (for a certain purpose) by the premisses, the argument is **inductive.**

An inductive argument claims that its premisses serves as evidence giving the conclusion a certain degree of probability, or raising it to some level of probability, perhaps not quantified. Inductive arguments differ in the degree or kind of likelihood they assert, as well as in the extent to which their claims are justified.

It might happen that an argument asserted as inductive has a conclusion that follows necessarily from the premises. Such an argument, though inductive because of what its maker claims, would be in fact valid, and could be called a "valid inductive argument" by someone who recognized both aspects.

Any argument, regardless of its claims, may be judged from the deductive standpoint, and is then valid or invalid. But to evaluate an inductive argument as invalid is not to evaluate it from its own standpoint. From the inductive standpoint an argument is judged as good or bad according to whether or not the premises give evidence for the conclusion sufficient for the purpose at hand. There are different criteria for judging inductive arguments, depending on circumstances and purposes. For example, a jury should decide that A owes B money if the evidence makes it more probable than not. On the other hand, a jury should not convict a person of a crime unless there is proof "beyond reasonable doubt".

Since this book treats deductive logic primarily, it will usually be assumed that the arguments considered are intended to be valid; hence, they are deductive arguments. In the treatment of informal fallacies, later in this book, the line between deductive and inductive arguments may not be sharply drawn.

A very common but false distinction between deductive and inductive arguments is that a deductive argument has general premises and a specific conclusion, and an inductive argument has specific premises and a general conclusion. This distinction is false and has no merit whatsoever. The distinction between deductive and inductive argument has nothing to do with the kinds of propositions in the argument. The distinction between deductive and inductive arguments is based on what is claimed for the argument. If one claims that the conclusion must be true, if the premises are true, then the argument is deductive. If one claims that the truth of the conclusion is likely enough for the purpose at hand, based on the truth of the premises, then the argument is inductive.

A deductive argument may have general premises and a specific conclusion, general premises and a general conclusion, specific premises and a specific conclusion, or specific premises and a general conclusion. An inductive argument may also have all of the above combinations.

Example (k) is a deductive argument having general premises and a specific conclusion. Example (l) has the same premises and conclusion as (k) but it is an inductive argument.

> (k) "Most tigers are dangerous animals; therefore it follows by necessity that this tiger is a dangerous animal".

> (l) "Most tigers are dangerous animals; therefore it is likely that this tiger is a dangerous animal".

Table 1.1: Classification of Arguments

ARGUMENT	Deductive Argument (*claims validity*)	Inductive Argument (*claims probability*)
Valid (i.e., conclusion follows necessarily)	Valid Deductive Argument	Valid Inductive Argument (exceptional case)
Invalid (i.e., not valid)	Invalid Deductive Argument	Invalid Inductive Argument (good or bad as conclusion is more or less probable).

(1) (= def. 6) A **valid** argument is an argument whose conclusion follows necessarily from its premisses.

(2) A **valid** argument is an argument such that *if* its premisses are true, then its conclusion *must* be true.

(3) (cf. def. 8a) If a person claims that the truth of the conclusion is *made necessary* by the premisses, the argument is **deductive.**

(4) (= def. 11b) If a person claims that the truth of the conclusion is made *likely enough* (for a certain purpose) by the premisses, the argument is **inductive.**

(5) In rare instances an inductive argument may happen to be valid.

(6) Inductive arguments are properly judged from the inductive point of view, that is, by the sufficiency of evidence relative to the purpose at hand.

1C THE RELATIONSHIP BETWEEN VALIDITY AND TRUTH

1C1 Principles of Validity. A valid argument is one in which the truth of the conclusion follows necessarily from the truth of the premisses. For an argument to be valid, it is not necessary that the premisses be true or that the conclusion be true.

For example, consider the argument: The floor of my study is a rectangle twenty feet long and ten feet wide; therefore it has two hundred square feet of floor space. This is a valid argument; that is, if the premisses are true, then the conclusion must be true. However, the correctness of the multiplication does not guarantee the truth of the premisses or conclusion.

From the definition of a valid argument (def. 6) follows the principle:

> *a.* If an argument is valid, it is logically impossible that the premisses be true without the conclusion being true.[5]

From principle *a* three useful principles follow:

b. If an argument is valid and the premisses are true, then the conclusion must be true.

c. If an argument is valid and the conclusion is false, then at least one of the premisses must be false.

d. If the premisses of an argument are true and the conclusion is false, then the argument must be invalid.

1C2 Combinations of Truth-Value and Validity.

Def. 12. The **truth-value** of a proposition is truth if it is true, or falsity if it is false.

Combining mechanically the possibilities of validity or invalidity of an argument with truth or falsity of premise and truth or falsity of conclusion, we obtain eight combinations. (For the sake of simplicity, we show argument as having only one premiss. But a conjunction of premisses may be taken as a single premiss.)

COMBINATION	1	2	3	4	5	6	7	8
Argument	Valid Arguments				Invalid Arguments			
Premiss	True	(True)	False	False	True	True	False	False
Conclusion	True	(False)	True	False	True	False	True	False

Important: Of these eight combinations, only number 2 is impossible. This follows from 1C1, principle *a,* or from the definition of a "valid argument". If the truth of the conclusion follows necessarily from the truth of the premiss, the conclusion of a valid argument must be true, if the premiss is true. However, it is possible to find examples of the seven other combinations. Examples will be given of numbers 1, 3, 4, and 5.

(a) Example of combination 1 (Valid argument, true premiss, and true conclusion):

<div align="center">

Valid Argument

</div>

True Premiss: *More than 500 living humans are males.*
<div align="center">*Therefore*</div>

True Conclusion: *More than 400 living humans are males.*

(b) Example of combination 3 (Valid argument, false premiss, and true conclusion):

	Valid Argument
False Premiss:	*All living humans are males.*
	Therefore
True Conclusion:	*At least one living human is a male.*

(c) Example of combination 4 (Valid argument, false premiss, and false conclusion):

	Valid Argument
False Premiss:	*Less than six living humans are males.*
	Therefore
False Conclusion:	*Less than ten living humans are males.*

(d) Example of combination 5 (Invalid argument, true premiss, and true conclusion):

	Invalid Argument
True Premiss:	*More than ten living humans are males.*
	Therefore
True Conclusion:	*More than fifty living humans are males.*

Exercises for Chapter 1

EX 1A, I (for Subsections, 1A1, 1A2). Write the letter for the most appropriate answer.

_____ 1. According to the authors, logic is: (a) just an art. (b) just a science. (c) a science and an art. (d) neither a science nor an art.

_____ 2. A proposition is a (an): (a) sentence that starts with a capital letter and ends with a period. (b) interrogative sentence. (c) sentence, taken with a specific meaning, that is true or false. (d) imperative or interrogative sentence.

_____ 3. Every argument has: (a) at least two premisses and a conclusion. (b) at least two conclusions and a premiss. (c) exactly one premiss and exactly one conclusion. (d) one conclusion and at least one premiss.

_____ 4. A proposition in an argument that is offered as grounds or evidence for the conclusion is called a (an): (a) declarative sentence. (b) inference. (c) premiss. (d) expository sentence.

_____ 5. In logic, an argument is often called a (an): (a) altercation. (b) a verbal controversy. (c) debate. (d) an inference.

_____ 6. An argument *cannot* be: (a) one simple proposition. (b) a sequence of propositions. (c) one compound proposition. (d) a set of proposition offered as a reason for believing in another proposition.

_____ 7. The word in the following list that is least likely to introduce a conclusion in an argument is: (a) *so.* (b) *hence.* (c) *since.* (d) *consequently.*

_____ 8. The word or phrase in the following list that is least likely to introduce a premiss in an argument is: (a) *since.* (b) *because.* (c) *hence.* (d) *the evidence is that.*

_____ 9. The conclusion of an argument: (a) is always the first sentence of the argument. (b) is always the last sentence of the argument. (c) must be a sentence that comes in the middle of the argument. (d) may occur anywhere in the argument.

_____ 10. In the sentence, "He refused military service because of his principles", the word "because" precedes: (a) a premiss. (b) a conclusion. (c) neither a premiss nor a conclusion. (d) a phrase that functions as a premiss and a conclusion.

EX 1A, II (for Subsections 1A1). Identify the propositions by writing "P" in the appropriate space.

_____ 1. The square root of 1,456 is 45.88.

_____ 2. Look out!

_____ 3. The proposition "There are fewer than ten anteaters in the world that weigh over 400 pounds" is false.

_____ 4. Meet me tonight at 8 P.M.

_____ 5. How many angels can dance on the head of a pin?

_____ 6. The last word that George Washington spoke was "country".

_____ 7. The month of April runs faster than purple Monday.

_____ 8. If the proposition "More than ten students are in this room" is true, then the proposition "More than fifty students are in this room" must be true.

_____ 9. There are only two living people in the world who have a last name of "Zilch".

_____ 10. Help me with my homework.

EX 1A, III (for Subsections 1A3). Only some of the following numbered passages are arguments. If the passage is an argument, write "A" in the blank, and place brackets "[ ]" around the conclusion and parentheses "( )" around each premiss. If it is not an argument write "No" in the blank.

_____ 1. The defendant is guilty of murder, since three witnesses testified that they saw him commit the crime; it was proved that he had an excellent motive for killing the victim; and finally, he freely confessed to the crime.

_____ 2. The District Attorney claimed that the defendant is guilty of murder. He pointed out that three witnesses have testified that they saw him commit the crime. He said that the defendant had an excellent motive for killing the victim. And he closed with the remark that the defendant had freely confessed to the crime.

_____ 3. When the earth is directly between the sun and the moon, then earth's shadow is thrown on the moon. The earth's shadow on the moon is curved; therefore the earth must be a sphere.

_____ 4. This liquid is an acid, because it turns blue litmus red and it reacts with zinc, liberating hydrogen gas.

_____ 5. In their trip around the sun, the Leonids approach the earth every thirty-three years. Good displays of meteoric showers were produced in 1833 and in 1866. Since then showers have been faint.

_____ 6. Before 1890 no starlings existed in North America. In 1890 sixty starlings were released in New York City and in 1891 forty more were released. Because of these two events, we now have thousands of starlings in North America.

_____ 7. Evergreens are divided into two groups, the conifers and the broadleave evergreens, so if an evergreen is not a conifer it must be a broadleave evergreen.

_____ 8. The frustration of the South, strong sectional interests, unscrupulous politicians trying to take advantage of the aftermath of the war—from all these things follows the assassination of President Lincoln.

_____ 9. A meteor in flight may look larger than it really is because of its intense glow.

_____ 10. It seems highly probable that the continents were once together in one large land mass, since it is possible to fit the continents together like the pieces of a jigsaw puzzle.

_____ 11. If the given torque is greater than the torque required by the device being driven, acceleration will take place until the motor torque and the load torque are equal. Conversely, if the torque required is greater than the given torque, the shaft will slow down until the required torque and the given torque are equal.

adapted from *Grolier Encylopedia*,
Vol. 14, p. 190, 1960.

_____ 12. If the first switch is closed and the second switch is open the red light is on; but if the second switch closed, then regardless of whether the first switch is open or closed the red light is out. Also if both switches are open the red light is on. It follows that the second switch being open is a necessary but not a sufficient condition for the red light being on.

_____ 13. It looks like a duck, it waddles like a duck, it smells like a duck, and it quacks like a duck, so it's probably a duck.

_____ 14. We know that the argument is valid and we know that the conclusion is false, hence it must be the case that at least one of the premisses in the argument is false.

_____ 15. It is very hot in this room since the air conditioner broke down.

_____ 16. The school janitor just informed me that the boiler is being repaired and will not be fixed until tomorrow. Hence, the school will have no hot water until tomorrow.

_____ 17. Mr. Slyfoot will make a good United States senator, since he is hardworking, highly patriotic, and almost completely honest.

_____ 18. Mr. Slyfoot stands a good chance of winning the election, since the popularity polls two months before the election show him leading his opponent 53 percent to 40 percent.

_____ 19. Mr. Slyfoot lost the election, because he was indicted for embezzlement one week before the election.

_____ 20. For want of a nail the shoe is lost, for want of a shoe the horse is lost, for want of a horse the rider is lost, for want of a rider the message is lost, for want of a message the battle is lost, for want of a battle the Kingdom is lost. So for want of a nail a Kingdom is lost.

(Cf. George Herbert, 1640)

EX 1B (for Section 1B). Place the appropriate letter in each blank. If "All of the above are correct" is true, no other answer is acceptable.

_____ 1. Which statement is true? (a) All deductive arguments are valid. (b) A deductive argument is one which claims to be valid. (c) All inductive arguments are invalid. (d) An inductive argument is an argument that claims to be invalid.

_____ 2. Which statement is false? (a) Any argument may be evaluated as if it were deductive. (b) From the standpoint of inductive reasoning arguments are not claimed to be valid. (c) An inductive argument is an argument with a conclusion that states that some event will probably not occur. (d) The main concern of logic is to distinguish between correct and incorrect reasoning.

_____ 3. Which statement is true? (a) All deductive arguments go from general premises to a specific conclusion. (b) All inductive

arguments go from specific premises to a general conclusion. (c) In deductive arguments the conclusion always comes last. (d) All of the above statements are false.

_____ 4. Which statement is false? (a) The same argument may be evaluated as deductie or inductive. (b) The same criterion is always used for evaluating inductive arguments, regardless of circumstances or purposes. (c) For an argument to be valid it is not sufficient that the premises make the conclusion highly probable. (d) A valid argument is almost always a deductive argument.

_____ 5. An alternative way of saying that an argument is valid is to say: (a) Its premises entail its conclusion. (b) The conclusion is a valid inference. (c) The premises logically imply the conclusion. (d) All of the above are correct.

_____ 6. A deductive argument is an argument: (a) that is valid. (b) in which its conclusion follows necessarily from the premises. (c) that its maker is claiming to be valid. (d) that infers a specific conclusion from general premises.

_____ 7. A valid argument is an argument: (a) that has a true conclusion. (b) that has true premises and a true conclusion. (c) whose conclusion follows necessarily from the premises. (d) that cannot have a false conclusion.

_____ 8. An inductive argument: (a) can never be valid. (b) quite frequently is valid. (c) is rarely valid (and then accidently). (d) is always valid.

_____ 9. An inductive argument is an argument: (a) in which the premisses make the truth of the premisses sufficiently likely. (b) which claims that if the premises are true then the truth of the conclusion is sufficiently likely for the purpose at hand. (c) where the conclusion does not follow from the premisses. (d) which claims that the conclusion is possibly true.

_____ 10. A deductive argument is an argument that claims: (a) to be valid. (b) that its conclusion follows necessarily from its premisses. (c) that the premises entail the conclusion. (d) all of the above are correct.

EX IC, I (for Section IC). Place the most appropriate letter in each blank. If "Any of these" is true, no other answer is acceptable.

_____ 1. It is impossible for a valid argument to have: (a) a true conclusion and false premises. (b) false premises and a false conclusion. (c) true premisses and a false conclusion. (d) true premisses and true conclusion.

_____ 2. It is possible for an invalid argument with just one premiss to have: (a) a false premiss and a false conclusion. (b) a false premiss and a true conclusion. (c) a true premiss and a true conclusion. (d) Any of these.

_____ 3. If the conclusion of a valid argument is false, then the premiss (assuming that there is only one) must be: (a) true. (b) false. (c) neither true nor false. (d) meaningless.

_____ 4. Every valid argument has: (a) true premisses and a true conclusion. (b) at least one true premiss. (c) a true conclusion. (d) a true conclusion, if it has all true premisses.

_____ 5. If the premisses of a valid argument are true, then the conclusion: (a) must be true. (b) must be false. (c) may be either true or false. (d) is meaningless.

_____ 6. If a deductive argument has true premisses and a false conclusion, then the argument: (a) is valid. (b) is invalid. (c) may be either valid or invalid. (d) is meaningless.

_____ 7. From which of these conditions, if any, can the _invalidity_ of an argument be inferred? (a) True premisses and a false conclusion. (b) True premisses and true conclusion. (c) False premisses and a false conclusion. (d) None of the above.

_____ 8. From which of these condition, if any, can the _validity_ of an argument be inferred? (a) True premisses and a false conclusion. (b) True premisses and true conclusion. (c) false premisses and a false conclusion. (d) None of the above.

_____ 9. If an argument has true premisses and a true conclusion then the argument is: (a) deductive. (b) valid. (c) invalid. (d) valid or invalid.

_____ 10. It is impossible for an invalid argument to have: (a) true premisses and a false conclusion. (b) true premisses and true conclusion. (c) false premisses and a false conclusion. (d) None of the above is impossible.

EX 1C, II Problems. For each of the following arguments, judge whether the premiss is true or false, whether the conclusion is true or false, and

whether the argument is valid or invalid. Write the appropriate letter in each blank: T = True, F = False, V = Valid, Inv = Invalid.

1. No reptiles are mammals, therefore no mammals are reptiles.
   _____Argument, _____Premiss, _____Conclusion.

2. Caesar crossed the Rubicon, since Lions are carnivorous.
   _____Argument, _____Premiss, _____Conclusion.

3. I have eight fingers on my left hand and six fingers on my right hand; therefore I have a total of fourteen fingers on two hands.
   _____Argument, _____Premiss, _____Conclusion.

4. Most Americans are over seventy years old, hence it follows that some Americans are over seventy years old.
   _____Argument, _____Premiss, _____Conclusion.

5. The word "love" has five letters, hence all five-letter words are expressions of love.
   _____Argument, _____Premiss, _____Conclusion.

6. The number 13 is a prime number, so it must be the case that no number less than 13 is prime.
   _____Argument, _____Premiss, _____Conclusion.

7. Some dogs do not weigh over forty pounds, since all house cats do weigh over forty pounds.
   _____Argument, _____Premiss, _____Conclusion.