ELECTRONIC TEXT

Elementary Logic: A Brief Introduction, Fourth Edition
By Michael Pendlebury
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1 The URL of the Department’s home page at the time of publication was http://www.wits.ac.za/academic/humanities/socialsciences/8641/philosophy.html.
ELEMEN TARY LOGIC: 
A Brief Introduction

Fourth Edition

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University of the Witwatersrand, Johannesburg
December 2013
Preface

The first three editions of this text were published in booklet form by the Department of Philosophy at the University of the Witwatersrand, Johannesburg ("Wits"). I prepared these editions of the text for students in some of the courses that I taught at Wits between 1997 and 2003. The Department carried on using the third edition after I moved from Wits to North Carolina State University at the end of 2003. At the beginning of 2013, I was surprised and gratified to learn that during 2012 the Department had supplied over 1,500 copies of the text to students in various courses. This prompted me to offer to prepare a new edition and seek to get it published in a form that would make it unnecessary for the Department to print and distribute booklets. On the advice of Dr. David Martens, Head of the Department, I decided that it would be best to publish it as an online electronic text, because this would be the most effective way to make it accessible to students at Wits and elsewhere. I am grateful to Dr. Martens and the Wits Philosophy Department for agreeing to publish the fourth edition on the Department’s website.

The biggest change I have made in the fourth edition is to add a fourteen-page section on analogical arguments (section 4.4) to the chapter on deductive validity and nondeductive strength (Chapter 4). The second biggest change I have made is to expand the material on formal validity that constituted the first section in the chapter on propositional operators in the third edition so that it also covers syllogistic logic (as it should) and give it a chapter of its own (Chapter 5) before the chapter on syllogistic logic. In addition to these two major changes, I have made numerous improvements in substance, clarity, and style throughout the text, and have changed or adjusted many examples to increase their shelf life.

Although I believe it is possible for many readers to learn something worthwhile from this text on its own, it was designed primarily to serve as an aid to systematic teaching in the classroom. I do not believe that the text (or even a very effective course based on it) can produce robust critical thinkers, and it aims only to lay some foundations on which students can build by applying the basic concepts and skills that it covers to all their reading and thinking.

I am grateful to Barbara Aarden, Rashad Bagus, Colin Hossack, Darrel Moellendorf, James Pendlebury, Brian Penrose, and Mary Tjiattas for useful assistance, advice, or ideas with respect to the first three editions; and to David Austin, Damien Bruneau, David Martens, Thomas Pendlebury, Ken Peters, and Mary Tjiattas for useful assistance, advice,
or ideas with respect to the fourth edition. I am also grateful to the Wits
students who took courses in which I prescribed the first three editions
between 1997 and 2003 for exposing some of the limitations of those
editions.

MP
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INTRODUCTION

This text is an elementary introduction to applied logic. As such, it is centrally concerned with the identification, clarification, analysis and (most importantly) the assessment of arguments. The text has two main aims, which cannot be completely separated. One is to give readers a practical appreciation of some basic essentials of logical theory. The other, which is probably more important for most students, is to develop some key basic concepts and skills that should help them to improve their ability to understand and evaluate texts that involve significant reasoning, and to enhance their powers of clear, critical and constructive thinking.

I have tried to write in clear and accessible English, but have also tried not to oversimplify. For, if a text in applied logic is too easy and does not encourage serious thought about the topics it covers, then it will inevitably fail to develop the student’s capacity for critical reading and thinking. You should therefore be warned that it is not possible to come to terms with the following material simply by reading it over once. It must be worked through and understood paragraph by paragraph, and page by page. It will also frequently be necessary to refer back to earlier passages in order to make sense of something under discussion. Except on an initial skimming of a section to get an overview of its contents, your goal should always be to understand as much as possible before proceeding to the next paragraph, page or section.1 This might require several re-readings, as well as serious attempts to work through problems and examples with the help of pencil and paper. It is always best to study material in the text in advance of classes covering that material. Finally, as an essential check on your understanding, you should attempt all the exercises at the end of each section before proceeding to the next section. You should also deal immediately with any shortcomings in your understanding which these exercises reveal by reviewing appropriate parts of the section concerned, and, if necessary, seeking assistance. A great deal of the material covered in the text is cumulative, and it is often difficult to follow later sections without an adequate grasp of earlier sections.

1 If you use a dictionary (which is a good thing to do), please note that ordinary dictionaries are often unreliable on technical concepts of specialized disciplines. This includes the basic concepts of logic. In the case of these concepts, you should not depend upon a dictionary, but on the definitions and explanations given in this text.
Chapter 1
IDENTIFYING ARGUMENTS

1.1 Arguments, Premises, and Conclusions

An argument in the logical sense is a piece of reasoning in support of a conclusion. In order to keep things simple, let us restrict our attention to the central case of what may be described as propositional arguments\(^1\) that are expressed in language. This allows us to identify an argument with a group of two or more statements one of which — the conclusion — is advanced by the speaker or writer\(^2\) on the strength of the others, which are known as premises.

Let us use the following pedestrian example of an argument to help clarify some of these terms.

(A) Mary has got an A on all her work for the course other than the upcoming final exam. Furthermore, she has always performed well on exams. She will, therefore, pass the course.

The conclusion of this argument — in other words, what is being argued for — is that Mary will pass the course. This claim is advanced on the strength of two premises, viz.,

(1) Mary has got an A on all her work for the course other than the upcoming final exam, and

(2) Mary has always performed well on exams.

To say that these claims are the premises of argument (A) is just another way of saying that they are offered in support of its conclusion, or,

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\(^1\) In other words, arguments made up entirely of propositions. (This may exclude some arguments involved in practical deliberation about what to do.) The concept of a proposition is explained in section 1.2.

\(^2\) In what follows I will often use "speaker" alone or "author" alone as shorthand for "speaker or writer."
alternatively, that they are the reasons given for believing that the conclusion is true.

Before saying more about this, let me emphasize that we are not directly concerned with arguments in the sense of disputes between people with conflicting beliefs or viewpoints. The parties to such a dispute may advance arguments in the logical sense. If so, the resources that we will consider could be used to evaluate those arguments. But their dispute does not itself qualify as an argument in the logical sense.

The premises and conclusion of an argument can be signalled in various ways. The most simple of these involves the use of certain words and expressions which, in appropriate contexts, function as explicit premise and conclusion indicators. The use of the word “therefore” to identify the conclusion of argument (A) is a good example of this. Note, however, that this argument could also be expressed as follows.

\[(Aa) \quad \text{Mary will pass the course, since she has got an A on all her work for the course other than the upcoming final exam, and she has always performed well on exams.}\]

This contains no explicit conclusion-indicator, but it is easy to identify the premises and conclusion of the argument by means of the premise-indicator “since,” which appears after the conclusion and before the premises. As this example also illustrates, the conclusion of an argument — the claim that is being argued for — need not be stated last.

It is important to recognize that a logical conclusion is not the same as a literary conclusion. The literary conclusion of a narrative (or story) does come last, but it is not usually a claim that the author wishes to establish. It is, rather, an event or a series of events that is supposed to end the narrative by drawing it together into a complete and coherent whole. The term “conclusion” as applied to a paper is ambiguous between the literary and logical notions. A final section or paragraph that “wraps up” and completes a paper is a conclusion in the literary sense. The main claim that is being argued for in the paper (if there is one) is its logical conclusion. The logical conclusion of a paper may or may not be stated in its final paragraphs, but it could also appear elsewhere.\(^3\)

To return to arguments, notice that the conclusion of an argument could appear in the middle of that argument as well as at the beginning or

\(^3\) Incidental paper-writing advice: It is often a good idea to state the logical conclusion of a paper at the beginning as well as at the end in order to make it completely clear to the reader where you are going. This is sometimes unnecessary in shorter papers, but can be very useful in longer papers.
the end. Consider this example:

(B) Only females can be pregnant. Thus my best friend is not pregnant, since he is a man.

The conclusion of (B), signalled by the conclusion-indicator “thus,” is that the speaker’s best friend is not pregnant. The premises are that only females can be pregnant and that the speaker’s best friend is a man. This second premise is explicitly signalled by the premise-indicator “since.” The claim that only females can be pregnant is not signalled as a premise in the same way, but must be taken as a premise because of its position before the conclusion-indicator “thus,” and because it is obviously intended to provide support for the conclusion.

Some of the most common English expressions that are used to signal premises and conclusions of arguments are included on the following list.

**PREMISE- AND CONCLUSION-INDICATORS**

(conclusion) since (premises)
(conclusion) for (premises)
(conclusion) because (premises)
(conclusion) as (premises)
(conclusion) for the following reasons (premises)
(premises) therefore (conclusion)
(premises) so (conclusion)
(premises) hence (conclusion)
(premises) thus (conclusion)
(premises) consequently (conclusion)
(premises) it follows that (conclusion)

Students are advised to extend this list themselves on the basis of arguments that they encounter in this text and elsewhere.

It is important to notice that the above expressions do not always signal premises and conclusions of arguments. In the statement

(3) He was so hot that you could boil water on his head,

the “so” functions as a comparative adverb, not a conclusion-indicator. And

(4) I hit him because he insulted my parrot

is not an argument but an explanation of behaviour.

To complicate things further, the premises and conclusion of an argument are often not signalled explicitly, as in
(C) Lefty did it. He was the only one there at the time; he loves using a flick-knife; he hated Rocky’s guts; and he warned Rocky that he would cut him to pieces if he messed with Suzy again.

It is nonetheless obvious that the conclusion of (C) is that Lefty committed the crime, and that the other statements in (C) should be understood as premises, i.e., as reasons offered in support of the conclusion.

Other cases can be much more difficult to interpret, and may require careful reflection about questions such as the following.

What is the author assuming or taking for granted? (Premises)
What is she trying to persuade her readers or audience to accept? (Conclusion)
What may be seen to support (or be understood as a reason for believing) something? (Premises)
What statement may be seen as supported by (or advanced on the strength of) the rest of the argument? (Conclusion)

Part of the strategy suggested here is that one should prefer an interpretation on which the argument is stronger or otherwise more attractive. This plays an important part in our interpretation of argument (C). In some cases it is not possible to identify the premises and conclusion of an argument without independent access to the author’s intentions, but in this text I will try to stick to examples with natural interpretations that do not require special information about the author.

It is important to notice that the strategy of choosing an interpretation that makes the argument look good should be applied only when one is choosing between alternative interpretations that have not been excluded by other considerations. For in Chapter 1 we are concerned with the identification of arguments rather than with their evaluation (which is dealt with later). There are both good and bad arguments. Indeed, there are cases of both kinds among the examples in Chapter 1 and the exercise sets that apply to it. The fact that interpretation and evaluation are not always completely separable does not imply that they are always completely inseparable. Keeping them separate as far as possible is simply good common sense.

In the exercise set following this section, you are asked to demonstrate

4 This strategy is especially important when one wishes to attack someone else’s reasoning. A “victory” against an opponent that fails to do justice to the strength of her position is hollow. See pp.42–43 (“Straw Man”) in section 2.3.
a practical understanding of the above material by re-expressing ordinary English arguments in standard form. To illustrate, consider argument (B), which is displayed on p.4. We express this argument in standard form as follows.

(Bs) 1. Only females can be pregnant.
2. My best friend is a man.
∴ My best friend is not pregnant.

In general, we put an argument into standard form by recording the premises in order as numbered statements (although a number is not required if the argument involves only one premise), and then recording the conclusion under a horizontal line after the conventional therefore sign "∴". In addition, we express each of the statements involved in the argument as an explicit, grammatical English sentence that can be adequately understood in its new position. For example, we do not express the second premise of (Bs) as "He is a man," since it would not be clear what the "he" refers to here. The conclusion of (Bs) could, however, be expressed as "He is not pregnant," because the prior occurrence of "my friend" in premise 2 makes it clear that "he" is intended to refer to the speaker's friend. Note also that premise-indicators and conclusion-indicators are not parts of the premises and conclusions that they signal. They should therefore be excluded from those statements when the argument is set out in standard form. The "thus" and "since" of (B) accordingly disappear in (Bs).

Consider, next, the one-premise argument

(D) The fact that nobody wants to die firmly establishes that the death penalty must be a deterrent to murder.

We set this out in standard form without numbering the premise, as follows.

(Ds) Nobody wants to die.
∴ The death penalty must be a deterrent to murder.

For a final, more difficult example of how to re-express an argument in standard form, consider the following argument, which I advanced on p.4 above while discussing argument (B).

(E) The claim that only females can be pregnant ... must be taken as a premise [of argument (B)] because of its position before the conclusion-indicator "thus," and because it is obviously intended to provide support for the conclusion.

This can be presented in standard form as follows.
1. The claim that only females can be pregnant appears before the conclusion-indicator “thus.”
2. The claim that only females can be pregnant is obviously intended to provide support for the conclusion.
\[\therefore \text{The claim that only females can be pregnant must be taken as a premise.}\]

It is important to notice that the second premise should not be formulated as “It is obviously intended to provide support for the conclusion” since it would be unclear what this “it” refers to. It would be even worse to render the first premise of (E) as “Its position before the conclusion-indicator ‘thus’,” because this is not a complete statement. It can, however, easily be rephrased in the form of a complete statement, as illustrated in the above standard-form version of the argument.

Exercise Set 1.1

Re-express the following arguments (interpreted in the most natural way) in standard form. As in all exercise sets, earlier exercises tend to be easier and later exercises progressively more challenging.

You may save time by using ellipses (i.e., sets of three dots — “...”) to mark missing text providing it is obvious from the original version of the argument what goes into the gap, e.g., the conclusion of argument (E) could be recorded as “The claim ... as a premise,” but the first premise could not be recorded as “The claim ... ‘thus’,” since it is not obvious from (E) itself how this should be completed.

(1) Liberalism has led to an unhealthy individualism and the fragmentation of community in the West, and it should therefore not be accepted as the best political philosophy for the new South Africa.

(2) Linguists attest that children learn languages much more quickly and speak them much more fluently if they start to learn them at an early age. So, if you want your children to learn a second language, you should expose them to it early in life.

(3) Reconciliation needed Black Consciousness to succeed because reconciliation is a deeply personal thing happening between those who acknowledge their unique personhood and who have it acknowledged by others. (Desmond Tutu in his Preface to Steve Biko, I Write What I Like, Ravan Press, Johannesburg, 1996, p.vi.)
(4) Since it is possible to know that one is in a mental state\(^5\) without knowing that one is in any particular bodily state\(^6\) it follows that one's body and mind are distinct things. (Simplified version of an argument advanced by Descartes (1596–1650).)

(5) It is only when agents could have acted otherwise that they are responsible for what they have done, for someone is not responsible for an action that it was not in his or her power to avoid.

(6) Men don't understand women. When I tell my boyfriend I've got a terrible headache, he offers me Aspirin instead of sympathy. When I'm upset over stuff at work, he gives me advice but not comfort. When he could make me melt with a bunch of flowers, he goes into debt to replace my perfectly good IPod.

(7) Since the animal told you that it was a dinosaur, it was a dragon for sure, for dragons will lie their socks off when they have to, whereas dinosaurs are the most truthful creatures ever to trample the earth. (Adapted from J. and A. Ahlberg, Jeremiah in the Dark Woods, Puffin Books, London, 1989, p.31.)

(8) What really establishes liberalism as the best approach for the new South Africa is its success in protecting individual freedom while also satisfying our material needs.

(9) Substance is that which has being (or reality) in the fullest possible sense.\(^7\) Thus individual substances must be simple entities, since composite things depend upon their parts for their existence. (Simplified version of an argument implicit in the metaphysical reasoning of Leibniz (1646–1716).)

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\(^5\) For example, that one is in pain. (Note that explanatory footnotes attached to exercise examples — such as this footnote — often provide incidental information that does not make much difference to the solutions to these exercises.)

\(^6\) For example, that one has an injury, or that a certain process is occurring in one's brain.

\(^7\) This concept of substance is not the everyday notion, but an important metaphysical concept with roots in ancient Greek thought.
1.2 Statements and Propositions

It is time to explain some of the unexplained terminology used in the first paragraph of section 1.1. To begin with, a statement is simply a claim or assertion, which is normally expressed by means of an indicative (or declarative) sentence, e.g., (1) and (2) of section 1.1 (“Mary has got an A on all her work for the course other than the upcoming final exam” and “Mary has always performed well on exams”). It will be convenient to use the notion of a statement loosely so that it applies both to the claim itself and to any sentence expressing it.

A single statement can (and sometimes must) be expressed in different words on different occasions, or when uttered by different speakers. For example, the sentence

(1) Obama was not born in Kenya

as uttered by me expresses the same statement as

(2) I was not born in Kenya

when it is uttered by Obama. (1) also expresses the same statement as

(3) He was not born in Kenya

when it is uttered by Joe Biden with the intention of referring to Obama. For in the above circumstances these three sentences all say the same thing.\(^8\)

\(^8\) Note, however, that the form in which a statement is expressed sometimes makes a difference to whether the speaker is justified in believing it or to the extent to which she is justified in believing it. If Beth sincerely asserts, “I have a headache,” then she is probably justified in believing what she says. If Cathy sincerely asserts, “Beth has a headache” entirely on the strength of the way in which Beth is holding her head and frowning, then she has less justification for believing it. Even if Beth herself sincerely asserts, “Beth has a headache,” she has less justification than she does in the case in which she asserts, “I have a headache,” because she leaves open the possibility that she is mistaken in thinking that she is Beth. This sort of difference between assertions and beliefs in the first person (i.e., those in which involve an “I”) and assertions and beliefs that are not in the first person can be important in philosophy. For instance, it is significant that Descartes says, in effect, “I can be certain that I exist” rather than, “I can be certain that Descartes exists.”
A single sentence can also express different statements depending on the speaker, the time and the context of the utterance. For example, if Uhuru Kenyatta utters (2), he does not make the same statement as Obama makes by uttering (2). For Kenyatta’s statement is about Kenyatta while Obama’s is not; and Kenyatta’s is false while Obama’s is true.

It is important to notice that a statement is always made or advanced by a speaker, who commits himself to the truth of that statement. For example, if someone utters sentence (2) while acting in a play, or in order to give an example of an six-word sentence, then she does not make a statement. It should be evident from this that any statement has two central aspects or “constituents,” viz., (i) a verbalized thought and (ii) the speaker’s assertion or endorsement of that thought, i.e., her commitment to its truth. We shall refer to (i), the thought, or to any verbal expression of it, as a proposition. Thus the formula

\[
\text{Statement} = \text{proposition} + \text{assertion}
\]

gives a clear representation of the relationship between statements and propositions.

Even though every statement involves the assertion of a proposition, not every proposition is asserted. It is in fact quite easy to express a proposition without asserting it. Consider, e.g., the proposition that Bafana Bafana will lose every game that they play next year. This is not something that I believe or want to assert, so we are not dealing here with a statement. There are numerous purposes for which someone might be required to express this proposition (especially as a part of a larger unit) without asserting it. Consider the following sentences.

(4) The idea that Bafana Bafana will lose every game that they play next year is absurd.

(5) Louis hopes that Bafana Bafana will lose every game that they play next year.

(6) If Bafana Bafana lose every game that they play next year, I am going to commit suicide.

Each of these involves an expression of the proposition that Bafana Bafana will lose every game that they play next year — or, to put the same point in different words, this proposition is embedded in each of (4)–(6). But in none of these three cases is the speaker committed to the truth of that embedded proposition. The proposition cannot, therefore, function as a statement in these contexts.

There are, however, cases in which a speaker is unable to avoid a
commitment to the truth of an embedded proposition. For example, if Miriam states that

(7) Descartes knows that one’s mind and body are distinct substances,

or that

(8) Descartes proves that one’s mind and body are distinct substances,

then she also commits herself to the truth of the proposition that one’s mind and body are distinct substances, which is clearly implied by each of (7) and (8). In contrast,

(9) Descartes says/claims/insists/argues that one’s mind and body are distinct substances

does not involve a commitment to the truth of the embedded proposition. Propositions (and statements) stand in contrast to questions and directives (including orders), which are normally expressed by means of interrogative and imperative sentences respectively. For example,

(10) How old is Nelson Mandela? and

(11) Did Bafana Bafana win every game they played in 2006?

are both interrogative sentences that express questions, while

(12) Play it again, Sam!

is an imperative sentence that expresses a directive (which could be either an order or a request, depending on the speaker’s tone of voice).

The crucial differences between propositions on the one hand and questions and directives on the other are:

---

9 The difference between “knows” and “proves” on the one hand and “says,” “claims,” “insists” and “argues” on the other is sometimes marked by describing the former as factives (because they imply that the proposition which they govern is a fact) and the latter as nonfactives. In writing about the views of others, students are advised to avoid factives unless they are sure that they wish to endorse those views.
(a) Propositions can be assumed, believed and asserted, while questions and directives cannot.

(b) It makes sense to talk of propositions, but not questions and directives, as being true or false.\(^\text{10}\)

Although directives are not themselves propositions, they always correspond to specific propositions. For example, (12) corresponds to the proposition that Sam will play it again. It does not, however, assert that this is true, but directs Sam to make it true. Likewise, the request

\[(13) \quad \text{Please help Ronald with his mathematics homework}\]

corresponds to the proposition that the addressee will help Ronald with his mathematics homework.

Taken as a whole, every yes-or-no question also corresponds to a proposition concerning which the speaker seeks information. (11), e.g., corresponds to the proposition that Bafana Bafana won every game they played in 2006, and it expresses the desire to know whether this proposition is true. Questions other than yes-or-no questions do not, however, correspond to whole propositions. Consider, e.g., the case of (10). This corresponds to the propositional frame

\[(14) \quad \text{Nelson Mandela is } \underline{\text{years old}},\]

but a propositional frame is not quite a proposition. Any answer to (10) nonetheless expresses a proposition; e.g., someone who answers (10) by saying “95” expresses (and asserts) the proposition that Nelson Mandela is 95 years old.

So far we have been depending on the following general correlation between certain grammatical forms of sentences and certain conversational functions that sentences can be used to perform.

\begin{tabular}{|l|l|}
\hline
Grammatical Form & Conversational Function \\
\hline
Indicative & Statement \\
Interrogative & Question \\
Imperative & Directive \\
\hline
\end{tabular}

It should, however, be noted that there are exceptions to this general correlation. For example, even though

\(^{10}\) Readers who have concerns about the concept of truth should consult the Appendix on Truth at the end of this text (pp.150–151).
(15) *How can I teach you anything when you are making so much noise?*

has the grammatical structure of an interrogative, it doesn’t express a question (i.e., a request for information), but a directive that could also be expressed more directly by the words “Please stop making so much noise.” Likewise, the indicative sentence

(16) *I would like to know who won the game*

is best taken as an expression of a question since it is more likely to function as a request for information than as an assertion about the speaker’s feelings. Finally, the interrogative sentence

(17) *Wasn’t Nelson Mandela an outstanding statesman?*

should obviously not be understood as a question, but as a statement asserting that Mandela was an outstanding statesman.

---

**Exercise Set 1.2**

I. Consider this statement and the proposition that it involves:

(*) Nancy Pelosi: *I am not Speaker of the House.*

(a) Which of (1)–(3) involve the same statement as Nancy Pelosi makes in (*), and which involve a different statement?

(1) Harry Reid: *I am not Speaker of the House.*

(2) Joe Biden: *Nancy Pelosi is not Speaker of the House.*

(3) John Boehner, addressing Nancy Pelosi: *You are not Speaker of the House.*

(b) For each of (4)–(7):

(i) Indicate whether the embedded clause in square brackets expresses (in context) the same proposition as that involved in (*) or a different proposition.
(ii) Indicate whether the whole statement (not just the embedded clause) implies that the proposition involved in (*) is true.

(4) David Price says that [Nancy Pelosi is not Speaker of the House].

(5) Barack Obama knows that [Nancy Pelosi is not Speaker of the House].

(6) Michelle Bachmann says that [Nancy Pelosi will never again be Speaker of the House].

(7) Newt Gingrich: John Boehner reminded me that [I am not Speaker of the House].

II. For each of (8)–(13):

(a) Identify the most likely conversational function of the sentence as a whole (statement, question or directive).

(b) In each case in which your answer to (a) is either “question” or “directive”: Indicate whether or not there is a proposition corresponding to the question or directive (taken as a whole) and, if so, express that proposition explicitly in the form of an indicative sentence.

In each case in which your answer to (a) is “statement”: Express all the propositions that are embedded within the statement explicitly in the form of indicative sentences.

(8) Who is President of the ANC?

(9) Take your old flag, Koos, and start waving it when Ramaphosa comes into the hall.

(10) The oldest person in the room denied that Mandela was born before Sobukwe.

(11) Does Helen Zille think that the Democratic Alliance will be the official opposition in 10 years time?

(12) Please pass the mustard, Roelf.

(13) Andrea asked whether Pete knew that she loved him.
III. For each of (14)–(18), identify

(a) the grammatical form (indicative, imperative or interrogative) and

(b) the most natural or likely conversational function (statement, directive or question).

(14) Who is the current President of Zimbabwe?

(15) Helen Zille is older than Cyril Ramaphosa.

(16) I would like to know who wrote this book.

(17) Isn’t he cute?

(18) Do not for one minute doubt that Nelson Mandela was one of the world’s greatest statesmen.

1.3 RECOGNIZING ARGUMENTS

It is important for students in all disciplines to be able to distinguish between arguments and other forms of discourse. In some cases this is easy. For example, nobody who understands what an argument is would mistake either (A) or (B) for an argument:

(A) Aggie was leaving the spaza shop with some Coke and chips when somebody made a grab for her bag. She jerked it back, cursed him, ran to the parking lot, and jumped into the car, where Sam was waiting for her. Later that night Sam joked that she would never have had the guts to pull it off if he hadn’t got her worked up during the fight they were having before they stopped at the spaza shop.

(B) [Radio commentator (speaking more rapidly as he goes along):] Ntini is really steamed up. He takes an extra long run. It’s a yorker … AND THE MIDDLE STUMP IS FLYING — HE’S BOWLED TENDULKAR!!

Both (A) and (B) are kinds of descriptions rather than arguments. More specifically, (A) is a straightforward narrative while (B) is a concurrent report of ongoing events.
Other kinds of discourse that are usually easy to distinguish from arguments include individual statements, interpretations of language, speech, behaviour, works of art, etc., expositions of texts, and dialogues (i.e., records of actual or imaginary conversations). For example, (C) is a dialogue:

(C) Now he’s blessing the bread and the wine. It’s supposed to be transubstantiated into the body and blood of Christ, and to have some kind of purifying function.

(D) Jeremiah: What did you do with the plate?
Goldilocks: I kept it; only then I had to throw it at those bears — they were going to eat me!
Jeremiah: No, they only eat porridge.
Goldilocks: Well, I was more or less full of porridge at the time..... Oh, look — there’s my mom and dad!

It must be emphasized that any of the above forms of discourse could easily contain or make reference to arguments. This is illustrated by dialogue (D), which contains two arguments neither of which is completely explicit. First, there is Jeremiah’s argument that the bears were not going to eat Goldilocks because “they only eat porridge.” Second, there is Goldilock’s counterargument that they might (nonetheless) have eaten her because she was “more or less full of porridge at the time.” I leave it to you to express these arguments in standard form.

As a further example of an argument occurring within another form of discourse, consider the following passage, which is predominantly a historical narrative.

(E) The late 1940s involved years of flux and struggle within the ANC, stemming in part from the activities of the ANC Youth League. Whether this grouping began to place rural issues and organization on the agenda of the ANC remains a question. However, it seems unlikely, as the organizational base of the league was in urban areas and educational institutions, and its membership was comprised largely of intellectuals. According to Walter Sisulu, “the issue of rural organization was not on the [Youth League] agenda at all despite the fact that many of us had a rural upbringing.” (Peter Delius, A Lion Amongst the Cattle, Ravan Press, Johannesburg, 1996, p.85 — lightly edited.)
The first sentence of (E) continues the preceding narrative. The second raises an unsettled question of historical fact. The remainder of the passage is a straightforward argument in support of the author's answer to this question. That answer — the conclusion of the argument — is expressed very briefly, cautiously, and indirectly by the words "it seems unlikely" at the beginning of the third sentence, which then continues with a premise signalled clearly by the premise-indicator "as." Although the last sentence in (E) is not explicitly marked as a premise, it should be treated as one because it is clearly intended to support the conclusion. The whole argument can be expressed in standard form as follows.

(Es)

1. The organizational base of the ANC Youth League in the late 1940s was in urban areas and educational institutions, and its membership was comprised largely of intellectuals.

2. Walter Sisulu reports that at that time the issue of rural organization was not on the ANC Youth League agenda at all despite the fact that many of its members had a rural upbringing.

\[ \therefore \text{The ANC Youth League had not begun to place rural issues and organization on the agenda of the ANC during the late 1940s.} \]

Notice how both the premises and the conclusion of the argument are made fully explicit in (Es).

The forms of discourse that people are most likely to confuse with arguments are conditional (or hypothetical) statements and certain kinds of explanations. Let us consider the case of conditionals first.

A conditional statement is either an if-statement or the equivalent of an if-statement, e.g.,

(1) \[ \text{If Mary takes the exam, then she will pass the course.} \]

(2) \[ \text{I will kill your dog if you don't keep it out of my vegetable patch.} \]

(3) \[ \text{Assuming that Descartes' argument}^{11} \text{ is sound, then water is} \not H_2O. \]

A conditional is a compound proposition involving a relationship between two simpler propositions, which are its major constituents. (1), e.g., is the result of combining the simpler propositions "Mary will take the exam" and

\[ \ldots \]

\[ ^{11} \text{The argument alluded to here is argument (4) of exercise Set 1.1 (see p.8).} \]
“Mary will pass the course” by means of the logical operator “if ... then ....” These two constituent propositions in the conditional are described as its antecedent and consequent respectively. The antecedent is the proposition governed by “if” (or its equivalent). The consequent is the proposition which is supposed to be “conditioned by” or to “flow from” the antecedent. The antecedent is not necessarily the part that comes first. In (2), e.g., the antecedent is “you don’t keep your dog out of my vegetable patch,” since this is the proposition governed by “if;” and “I will kill your dog” is the consequent. It should be clear that the antecedent of (3) is “Descartes’ argument is sound,” and that its consequent is “water is not H₂O.”

Although conditional statements have some structural similarities to arguments, no conditional is an argument in its own right. To see why this is so, let us contrast the conditional statement displayed as (3) above with the argument that corresponds most closely to it, viz.,

(F) Descartes’ argument is sound. Therefore water is not H₂O.

Notice that someone who seriously advances argument (F) states that Descartes’ argument is sound and that water is not H₂O, thereby committing herself to the truth of both claims; and she also presents the first as a reason for believing the second. Someone who advances the conditional statement (3), in contrast, does not state that Descartes’ argument is sound or that water is not H₂O, but only that there is a certain connection between the proposition that Descartes’ argument is sound and the proposition that water is not H₂O. It is, however, possible that she believes that both these propositions are false.

We turn next to explanations. The kinds of explanations that people are most likely to confuse with arguments are those that aim to give reasons (in the broadest possible sense) why something happened or is the case. These include scientific, historical, socio-economic, psychological and everyday explanations of events, situations, states of affairs, behaviour and attitudes.

Consider the following simple examples of such explanations.

(G) The electricity went off because rain water leaked into the fuse box.

(H) Alan fired Farhad because Farhad questioned his integrity and threatened to report the irregularities to the authorities.

As (G) and (H) illustrate, such explanations always involve an explanandum, i.e., a proposition describing the event or state of affairs to be explained, and an explanans, which consists of one or more
propositions describing the causal or other factors thought to explain it.\textsuperscript{12} In (G) the explanandum is “the electricity went off” and the explanans is “rain water leaked into the fuse box.” In (H) the explanandum is that Alan fired Farhad, and the explanans is that Farhad questioned Alan’s integrity and threatened to report the irregularities to the authorities.

Explanations are structurally very similar to arguments, and it may be tempting to treat an explanans as a premise or set of premises, and an explanandum as a conclusion. This would, however, be an error. For in an argument the premises are assumed or taken for granted, and the speaker moves forward from the premises to the conclusion, which is not taken for granted. In an explanation, on the other hand, it is the explanandum which is taken for granted, and the speaker moves backwards from the explanandum to the explanans.

To illustrate, let us contrast explanation (G) with this argument:

(I) \textit{Pete is likely to fail, because he has not attended classes or done any work.}

In the case of the argument, (I), the premise (that Pete has not attended classes or done any work) is assumed, and the conclusion (that Pete is likely to fail) is advanced on the strength of that premise. In the case of the explanation, (G), the explanandum (that the electricity went off) is assumed, and the explanans (that rain water leaked into the fuse box) is offered as a reason why this happened, or, more accurately, as an account of what caused it.

Some readers may be confused by the fact that both premises and explanantia can be described as “reasons.” It must, therefore, be emphasized that they are reasons in very different senses. \textbf{Premises}, on the one hand, are advanced as \textit{reasons for believing that a proposition (the conclusion) is true}. Equivalently, they are advanced as \textit{considerations that count in favor of believing the conclusion}. An \textbf{explanans}, on the other hand, is not supposed to give a reason for believing a proposition, but a \textit{reason why an event happened or a state of affairs obtains}. In other words, an explanans is supposed to identify a \textit{factor that caused the event or underlies the state of affairs}.

In (H), e.g., the explanans (that Farhad questioned Alan’s integrity and threatened to report the irregularities to the authorities) is not presented as a reason for \textit{those who are being addressed} to \textit{believe} that Alan fired Farhad, for this is taken as a given. What the explanans does, rather, is to present either Alan’s reasons for firing Farhad, or the factors that caused

\textsuperscript{12} The plural of “explanandum” is “explananda,” and the plural of “explanans” is “explanantia.”
him to fire Farhad (even if he would not offer them as reasons).

Observe, finally, that it can sometimes be ambiguous whether a passage in isolation is to be taken as an argument or an explanation. Consider:

(J) The car won’t start because the fuel tank is empty.

If the speaker believes or assumes that the fuel tank is empty and asserts that the car won’t start on that basis, then (J) is an argument. But if she believes or assumes that the car won’t start and guesses that the reason for this is that the fuel tank is empty, then (J) is an explanation. On their most natural interpretations the passages in the following exercises are not subject to this sort of ambiguity.

Exercise Set 1.3

For each of passages (1)–(10):

(a) Identify the predominant form of discourse of that passage taken as a whole (e.g., argument, statement, conditional statement, narrative, explanation).

(b) Whatever the predominant form of discourse of the passage, re-express any arguments that are advanced or mentioned in the passage in standard form.

(1) Either Sam saw the crime or he didn’t. If he didn’t, he will not be a good witness. But if he did, he is completely unable to describe what happened in a plausible way. He should therefore not be called as a witness.

(2) We are so confident in the quality and reliability of our cars that we provide free maintenance on every one of them for 100,000 miles.

(3) If feminists insist that women have a greater natural capacity for caring and nurturing, then they play into the hands of men who are ready to exploit women for their own advantage.

(4) Rebels in eastern Zaire are advancing rapidly into the heart of the central African rain forest. Already they hold a 560km long front parallel to the Rwandan border. (The Star, Johannesburg, 9 December 1996.)
Most styling products, conditioners and even ordinary shampoo can leave behind residue that coats the hair shaft, weighing it down and hiding the glow of even the healthiest, shiniest hair. So if your hair is flat and unmanageable even after it’s just been washed, you have a residue problem. (From a Neutrogena advertisement, November 1996.)

If the organization elected Thabo Mbeki, I would fully support that. He is highly capable, smart, influential and committed. (Nelson Mandela, quoted by The Mail and Guardian, Johannesburg, 15-21 November 1996.)

Since the euro’s value is backed by much stronger economies (than the Greek economy) the banks were willing to lend Greece large sums. (Gwynne Dyer, The News and Observer, Raleigh, 27 June 2011.)

A University of the Western Cape theological student charged with attending an illegal gathering on campus says he has laid a similar charge against South Africa’s first executive State President, Mr. P. W. Botha. Mr. Willies van der Westhuizen, 24, alleges that Mr. Botha’s inauguration on the Grand Parade on September 14 was illegal under Section 46 of the Internal Security Act. “I have checked with the State President’s protocol department and the Chief Magistrate of Cape Town and can find no trace of a permit for the meeting,” he said. (Weekend Argus, Cape Town, 17 November 1984.)

... as long as blacks are suffering from inferiority complex — a result of 300 years of deliberate oppression, denigration and derision — they will be useless as co-architects of a normal society where man is nothing else but man for his own sake. Hence what is necessary as a prelude to anything else that may come is a very strong grass-roots build-up of black consciousness such that blacks can learn to assert themselves and stake their rightful claim. (Steve Biko in 1970 — from I Write What I Like, Ravan Press, Johannesburg, 1996, p.21.)

American Planes are taking off, they are entering Libyan airspace, they are dropping bombs and the bombs are killing and injuring people and destroying things.... Nonetheless, the Obama administration insists that this is not a war. Why? Because, according to “United States activities in Libya,” a 32-page report that the administration released last week,
“U.S. operations do not involve sustained fighting or active exchange of fire with hostile forces, nor do they involve the presence of U.S. ground troops, U.S. casualties or a serious threat thereof, or any significant chance of escalation into a conflict characterized by those factors. (Jonathan Schell, The News and Observer, Raleigh, 8 July 2011.)

1.4 COMPOUND ARGUMENTS

To end this chapter, let us take a brief look at compound arguments, which are important in both academic disciplines and everyday reasoning. A compound argument is made up of two or more simple arguments linked by common statements.

This is well illustrated by the following.

(A) The absence of external force and coercion are not enough for autonomy. “Autonomous” means self-governed, which implies that autonomous people have positive control over their own lives.

The main conclusion here is expressed by the first sentence, which the second sentence is clearly meant to support. But the second sentence as a whole is also an argument, which we could put in standard form as follows.

\[ \therefore \text{Autonomous people have positive control over their own lives.} \]

However, it now becomes clear that it is the conclusion of (A1s) which is directly relevant to and serves as a premise for the main conclusion of (A). In standard form the argument in question is as follows.

(A2s) Autonomous people have positive control over their own lives. [= conclusion of (A1s)]
\[ \therefore \text{The absence of external force and coercion are not enough for autonomy.} \]

The linking statement in (A) is of course the claim that autonomous people have positive control over their own lives. This could be described as an intermediate conclusion, for it is not only the conclusion of the one simple argument, but is also the premise of the other, and one of its main functions is to provide support for the conclusion of this argument.
Let us turn next to argument (B), a slightly more complex example in which I have underlined the premise and conclusion indicators along with some other key expressions that help to bring out the overall structure of the argument.

(B) The term “impotent” should not be used to refer to male sexual nonarousal, for its use is degrading to the male insofar as it suggests inability, weakness, lack of strength, powerlessness or even lack of masculinity. Also, the term is strictly speaking incorrect, for it implies an inability to do something rather than the absence of desire. (Adapted from Stephen N. Thomas, *Practical Reasoning in Natural Language*, Prentice-Hall, Englewood Cliffs, 1977, p.61.)

It should be fairly obvious that the main conclusion (which is always the first thing you should aim to discover) is stated first. (B) can be analysed into three linked arguments, with the conclusions of two of them serving as premises for the third, which is in turn intended to support the main conclusion directly:

(B1s) The term “impotent” suggests inability, weakness, lack of strength, powerlessness or even lack of masculinity.

\[ \therefore \text{Using the term “impotent” to refer to male sexual nonarousal is degrading to the male.} \]

(B2s) The term “impotent” implies an inability to do something rather than the absence of desire.

\[ \therefore \text{It is strictly speaking incorrect to use the term “impotent” for male sexual nonarousal.} \]

(B3s) 1. Using the term “impotent” to refer to male sexual nonarousal is degrading to the male. [= conclusion of (B1s)]

2. It is strictly speaking incorrect to use the term “impotent” for male sexual nonarousal. [= conclusion of (B2s)]

\[ \therefore \text{The term “impotent” should not be used to refer to male sexual nonarousal.} \]

As this example illustrates, putting a compound argument into standard form can be a drawn-out affair. A useful alternative way of representing compound arguments and their structures is provided by argument diagrams. These are built up by repeated use of the following format for representing simple arguments.
PREMISES

\[ \therefore \ \text{CONCLUSION} \]

For example, where numbers represent certain statements, the diagram

\[
\begin{array}{c}
1 & 3 & 4 \\
\hline
\therefore 2
\end{array}
\]

represents the argument in which statements 1, 3 and 4 are the premises and statement 2 is the conclusion.

We now construct the diagram for compound argument (C):

(C) \[ \text{The fact that the rent and service charge boycott continues shows that present local government structures are illegitimate. This election is thus critical, especially because it is the first fully representative local government election in our country's history.} \]

(Slightly edited version of an argument advanced by Mohammed Valli Moosa and quoted on television before the South African local government election in 1995.)

Our first step is to underline all premise and conclusion indicators, etc., and to bracket and number every statement in (C) that functions either as a premise or a conclusion:

(C∗) \[ \begin{align*}
1 & \quad [\text{The fact that the rent and service charge boycott continues}] \\
2 & \quad \text{shows that} \ [\text{present local government structures are illegitimate}].
3 & \quad [\text{This election is thus critical}].
4 & \quad \text{especially because} \ [\text{it is the first fully representative local government election in our country's history}].
\end{align*} \]

We then identify the relevant premises and conclusions in (C), observing that:
(a) The main conclusion is expressed by statement 3 ("This election is critical").

(b) The premises for this conclusion are statements 2 and 4 (as signalled by the conclusion indicator “thus” and the premise indicator “especially because” respectively).

(c) Statement 2 is an intermediate conclusion (as signalled by the conclusion indicator "shows that") for which 1 is offered as a premise.

We then encode this information in the following diagram.

(Cd)  
1  
\[2\quad 4\]  
\[3\]

This clearly displays the overall structure of the argument.

Our next and final example is slightly more complex:

(D) An 18-month old toddler can have knowledge since she can know that the television set is on. However, since she does not yet understand the word “know,” she cannot claim that she knows anything. Thus in order for someone to know something it is not necessary for her to claim that she knows it.

After we have underlined all premise and conclusion indicators and bracketed and numbered all the statements involved, (D) looks like this:

(D*)  
1  
\[[An 18-month old toddler can have knowledge\] since [she can know that the television set is on]. However, since [she does not yet understand the word “know”], [she cannot claim that she knows anything]. Thus [in order for someone to know something it is not necessary for her to claim that she knows it].

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The diagram for (D) is as follows.

(Dd)  
\[
\begin{array}{c}
2 \\
\hspace{1cm} \downarrow 1 \\
3 \\
\hspace{1cm} \downarrow 4 \\
\hspace{2.5cm} \downarrow 5
\end{array}
\]

To end this section, let me note that standard forms and argument diagrams are best seen as useful tools for helping students to develop their capacity to recognize key features of the structures of arguments. I do not think that it is always worthwhile to attempt to apply these tools directly to intricate and extended arguments like those found in many serious articles or the writings of philosophers. However, if you want to evaluate such arguments fairly, you must be able to identify their most important premises and conclusions along with the relations in which they are intended to stand to one another. This will often require special knowledge of the relevant subject matter as well as the basic logical skills with which we have been concerned in Chapter 1. These skills will not take root and flourish unless you apply them frequently to arguments that you encounter in your academic and everyday reading, in public and private discussions, on television, on the internet, or anywhere else.

Exercise Set 1.4

I. Re-express the compound arguments contained in the following passages in standard form. Make all premises and conclusions completely explicit, and omit any material that does not form part of the arguments.

(1)  
Censorship is acceptable only if it is enforceable. But it cannot be enforced because it is impossible to monitor all the printed matter that is in anyone’s possession or is available anywhere in the country. Therefore censorship is unacceptable.

(2)  
People who smoke in enclosed public places are putting the health of others at risk, since “passive” smoking can cause cancer. They are also subjecting us to discomfort. That is why we should reject their view that such behavior is acceptable.
You state that fox hunting “is undeniably cruel.” For someone with only a casual acquaintance with the subject, it is easy to see how such a conclusion might be reached. [However,] what actually happens [in a fox hunt] is that the first foxhound to reach a fox kills it by breaking its neck. As foxhounds are five times heavier than foxes, the fox is killed instantly. Thus what is torn to shreds [by the foxhounds] is a dead fox, which has nothing more to do with cruelty than the eating of a shop-bought chop by a pet. (E.C. Pank, letter to The Economist, London, 22 November 1997)

II. Diagram the following arguments.

The People’s Republic of China is fast developing into an economic and political superpower. Also, its legitimacy is recognized by the United Nations, the United States, and most countries in the world. It is, therefore, in South Africa’s interest to recognize the People’s Republic rather than Taiwan. President Mandela should accordingly not be blamed for shifting South Africa’s allegiance. (Paragraph from an imaginary South African editorial in the 1990s)

Those who oppose restrictions on freedom of the press are wrong. Experience shows that kidnap victims are less likely to be killed if the kidnapping is not reported. Reporting a kidnapping can therefore endanger the victim’s life. If we do not pass legislation against publishing in these circumstances, some newspapers will continue to be irresponsible and publish details of the kidnapping before the victim is released or rescued.
Since killing people is abhorrent, capital punishment is justifiable only if it has a definite deterrent effect on potential murderers. However, there is evidence that murder rates in U.S. states with the death penalty are not significantly different from murder rates in other states that do not have the death penalty but are very similar in their social and cultural profiles. Thus it is not clear that capital punishment is an effective deterrent, and it is, therefore, unjustified.

Those who commit murder implicitly reject the sanctity of human life, and they therefore reject their own right to life. So it is not wrong to execute a murderer. Thus, given that the death penalty (when properly managed) is the most effective deterrent to murder, there is good reason to reintroduce it, especially as it satisfies the popular demand for real justice.
Chapter 2

EVALUATING ARGUMENTS

2.1 Logical Evaluation

Arguments can be evaluated with respect to a variety of features, but logic is concerned only with evaluations pertaining to their reasonableness. This clearly excludes, e.g., the literary elegance of an argument, or its power to shock or amuse, which might be crucial to a poet or a playwright. Note also that reasonableness is not the same as persuasiveness, or the power to convince. People are often persuaded by unreasonable arguments that play upon their prejudices, hopes, dreams, fears and other sentiments and emotions, and even on subconscious factors that are beyond the reach of reason. The study of persuasive power does not belong to logic, but to psychology and rhetoric — as well as to the theory of advertising. Logic is also not concerned with the extent to which arguments promote some special goal or interest (e.g., the good of The Party, The Firm or The Old Boys Club — or the career of Professor Blind Ambition), for this too may have nothing to do with their reasonableness.

From a logical point of view the most central evaluative question about an argument is whether and to what extent its premises support its conclusion — and here we are talking about rational support. Most of the remainder of this text is concerned with issues relevant to the notion of support and its applications. At this stage we can define support roughly as follows. (Note that “iff” as it occurs in this definition and elsewhere in this text is an abbreviation of “if and only if,” and it expresses equivalence between the two propositions that it combines.)

The premises of an argument support its conclusion iff the assumption that the premises are all true either guarantees or significantly increases the probability that the conclusion is true.

Alternatively, one could say that the premises support the conclusion iff, relative to the premises, the conclusion is either certain or (sufficiently) probable. Deductively valid arguments are those whose
conclusions are guaranteed, or certain, relative to their premises. Arguments falling short of deductive validity but whose premises still provide good support for their conclusions will be described as strong or nondeductively strong. ¹

Although the premises of any reasonable argument support its conclusion, this support is not the only virtue required for an argument to count as reasonable. Consider the following argument, which is deductively valid since its conclusion is certain relative to its premises.

(A) \[
\begin{align*}
\text{The moon is made of green cheese.} \\
\therefore \text{The moon is made of cheese.}
\end{align*}
\]

You will find it obvious that, despite its validity, (A) does not provide a good reason for believing that the moon is made of cheese. For, as we know, the premise that the moon is made of green cheese, is false. Thus the fact that the conclusion follows from the assumption that the premise is true is of little consequence.

In evaluating an argument from a logical point of view we must, therefore, raise at least two crucial questions:

(a) **Do the premises support the conclusion?** and

(b) **Are the premises all true, or is there good reason to believe or assume that they are true?**

An argument is not satisfactory unless the answer to both these questions is “Yes.”

With regard to (b), it should be noted that logic on its own cannot tell you whether a proposition is true or false, so you are forced to depend upon everyday experience, common sense, specialist disciplines, and the various branches of knowledge and understanding other than logic itself.² Is it true or false that it’s raining? Look out of the window. That Djokovic beat Nadal in the Wimbledon final? Ask a tennis fan. That cyanoacrylate dissolves in acetone? Do an experiment, ask a chemist, or consult an authoritative source on the internet. Logic itself cannot answer such questions even though answers to them might be required for the rational

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¹ Deductive validity and nondeductive strength are discussed in greater detail in Chapter 4.

² There are exceptions to this rule, viz., **logical truths** such as “All cats are cats” and “It is not the case that Bill Clinton is both dead and not dead.” The most obvious of these truths are trivial.
evaluation of an argument. In what follows I will, therefore, draw on general knowledge and other sources for such answers whenever necessary.

It is important to recognize that we should not add the question “Is the conclusion true?” to the above two crucial questions to ask when we are evaluating an argument from a logical point of view. For what is at issue when we are determining how good an argument is, is whether it is reasonable to believe its conclusion on the strength of its premises, rather than on some other basis. Thus if the conclusion happens, coincidentally, to be true, this does not make the argument any better. It may sometimes make the argument unnecessary, but not always: An argument with a conclusion that is independently known to be true may not be idle, for if the argument is a good one it may still add to the reasonability of our accepting its conclusion.

It should also be emphasized that the judgment that an argument is logically unsatisfactory does not imply that its conclusion is false, but only that its premises do not provide good reasons for believing it. If the conclusion really is true or worthy of acceptance, then it is quite likely that there are other reasonable arguments that support it. Students should, therefore, resist the temptation to reject a negative evaluation of an argument just because they accept its conclusion.

To return to the key issue of support, it must be emphasized that support is not a subjective matter, and it is not to be identified with someone’s merely thinking that the premises of the argument add to the plausibility of its conclusion. The difference between support and persuasive power can be illustrated nicely with reference to two common logical fallacies — a logical fallacy being a type of argument that is in some respect logically defective but is still apt to convince the unwary.

The first fallacy we will consider is widely referred to by its Latin name, “ad hominem,” the translation of which is “to the man” (in the sense of human being). This fallacy can be characterized as follows.

**Ad Hominem Fallacy**

An attempt to undermine a claim or position by appealing to negative or seemingly prejudicial features of the character, views, interests or circumstances of one or more persons who support that claim or position when those factors are of little or no relevance to its truth or falsity.

The following argument is an example of this fallacy.

(B) *The accused’s claim that she was at a nightclub in Hillbrow at the time when her husband was murdered at home must be rejected on the ground that it is clearly in her interest to establish an alibi.*
The assumption that the premise of (B) (that it is in the accused's interest to establish an alibi) is true does not on its own undermine the credibility of the accused's claim that she was at the nightclub at the time of the murder, and this claim could very well be true. Thus the premise of (B) does not significantly support its conclusion — although it does of course provide an excellent reason for seeking independent checks on the plausibility of the accused's alibi.

While (B) could be described as a circumstantial argument ad hominem, (C) is a good example of what is sometimes referred to as an abusive ad hominem:

(C)  
*Gottlob Frege was a racist and an anti-semite; thus his theory of the foundations of mathematics can have nothing to recommend it.*

Although we may be so repulsed by racism and anti-semitism that we don’t want to say anything positive about racists and anti-semites, it should be clear that the premise of (B) is completely irrelevant to its conclusion, and that it gives it no objective support whatever. For the acceptability of a theory of the foundations of mathematics depends only on mathematical and philosophical considerations, not on the character or political views of its author.

This is not to suggest that premises that attack someone’s character or circumstances never support their conclusions. Indeed, it is easy to come up with cases in which they do. Consider:

(D)  
*Alvin White is a racist who has no respect for anyone outside his own bigoted community. It would, therefore, be a travesty to appoint him to the Human Rights Commission.*

Since the Human Rights Commission has the function of promoting human rights, the premise of (D) is clearly relevant to its conclusion, and it gives it significant support. So (D) is not an example of the ad hominem fallacy.

Generally speaking, in order for an argument to be guilty of a given fallacy it must (i) be of the right kind and (ii) be a bad instance of that kind. The kinds of arguments that are subject to the ad hominem fallacy are those in which the conclusion opposes or seeks to undermine a claim or view advanced by X (a person, group of persons, book, etc.) and the premises criticize X or claim or suggest that X is biased. In order for an

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3 Frege (1848–1925) was in fact a racist and an anti-Semite; but he was also the most brilliant philosopher of mathematics and philosopher of language of his generation.
argument of this kind to be guilty of the fallacy, it must be the case that these criticisms or suggestions are irrelevant to the question of whether the conclusion is true, or do not significantly support the claim that it is true.

It should be clear that arguments (B) and (C) satisfy both of these conditions. The conclusion of (B) opposes a claim advanced by the accused and the premises suggest that she is biased. (B) is, therefore, of the right kind. And it is a bad instance of that kind, because the mere fact that the accused had an interest in establishing an alibi does not provide a good reason for counting the conclusion as true. (C) is of the right kind because its premise involves abusive criticism of Frege while its conclusion seeks to undermine Frege’s views on the foundations of mathematics. And it is a bad instance of that kind because, however justified the premise may be in its own right, it is totally irrelevant to the question of whether the conclusion is true.

Whether argument (D) is of the right kind to be a possible ad hominem depends on the context in which the argument has been advanced. In a context in which it is clear that Alvin White thinks that he ought to be appointed to the Human Rights Commission, and the argument is intended to oppose his view by criticizing him in certain respects, then the argument is of the right kind. But it is not a bad example of that kind, since the criticisms advanced provide good reasons for holding that he should not be appointed to the commission. Thus the argument is not an ad hominem fallacy. On the other hand, in a context in which (D) is advanced without regard to White’s views (or without regard to whether he has an opinion on the issue), then (D) is not of the right kind to be a candidate ad hominem.

The following argument is of the right kind to be a candidate ad hominem, but it is not in fact guilty of the fallacy.

(E) Professor Butthead’s arguments against appointing Dr. Mangope as Professor of Philosophy have been considered in great detail and have been found to be confused, prejudicial and malicious. The committee should, therefore, reject them.

This is clearly a candidate ad hominem since it seeks to undermine Butthead’s views through criticism of him. But in this case the criticisms do provide good reasons for accepting the conclusion of the argument. (E) is therefore not guilty of the ad hominem fallacy.

Our second fallacy is the irrelevant appeal to authority:

**Fallacy of Irrelevant Appeal to Authority**

(i) The argument appeals to a possible “authority,” X, i.e., it advances its conclusion on the strength of the claim that X accepts or endorses the proposition concerned (or something that supports that proposition).
(ii) X does not have real authority on the relevant subject matter because, e.g., X lacks relevant knowledge or expertise, or because X is unreliable on that subject matter.

This applies to the following argument, the substance of which was probably advanced by traditionalists in the early seventeenth century.

(F) Galileo is absolutely wrong to claim that the earth moves, for the fathers of the Church teach that it is stationary.

“The fathers of the Church” (the “authority” appealed to here) had no expertise in physics or astronomy. Thus the premise of (F) is irrelevant to its conclusion and fails to support it.

Many appeals to authority are, however, justified and therefore not fallacious. Consider, e.g., the following.

(G) I am legally entitled to demand that you stop playing music loudly in the middle of the night, for I have consulted my lawyer, who confirms that this is so.

(H) We must assume that the hit-and-run vehicle was a red Mercedes, because this is what Vusi, who is a reliable eyewitness, claims he saw.

(G) involves a justifiable appeal to an appropriate authority on the relevant topic, viz., the law, on which we are entitled to suppose that a lawyer has some expertise. And (H) invokes reasonable testimony, which is something that we must depend on whenever we need information from others who have had direct access to that information. The premise of each of these arguments supports its conclusion to a reasonable degree, and neither argument is a fallacy.

Which sources should be counted as genuine authorities on a given topic is not always obvious. This problem is especially pressing because of the ongoing information explosion on the internet, which provides rapid access to vast quantities of useful information, but also contains a great deal of misleading information as well as significant misinformation. A genuine authority is a reliable source of information on that topic to which any reasonable person would give significant weight. In these terms somebody who is highly qualified, or works as a professional, in a given field is (normally) a good authority on that field, but not necessarily on other fields. A chemist can be a real authority on the properties of semiconductors but a useless authority on the best way to coach soccer teams. Well-respected newspapers and websites are good authorities on current events and results of sporting events, but should not be relied upon.
for precise information about a philosophical topic such as the theory of duty of Immanuel Kant (1724–1804). A reputable, up-to-date general encyclopaedia (electronic or physical) is a good source of general factual information, but not of information about subtle questions in philosophy or recent advances in science. Other things being equal, most ordinary people are reasonable authorities about recent events that they have experienced in person, but habitual liars are seldom good authorities about anything.

Nobody should be counted as a genuine authority on topics such as the existence of God or contentious questions of morality, since in these fields there is nobody whose opinion will or should carry weight with all reasonable people. Thus, if someone argues that abortion is wrong (or that God exists) on the basis of the fact that the priest in her Catholic Church insists that this is so, then she is guilty of an irrelevant appeal to authority, because many reasonable people (including reasonable Buddhists, Unitarians, agnostics, and atheists) need not consider a Catholic priest reliable on this sort of issue. But this is not to deny that a Catholic priest is a reliable authority about the content of Catholic doctrines.

You should, incidentally, notice that, although arguments ad hominem and irrelevant appeals to authority both involve references to the views of others, these views play completely different roles in the arguments concerned. Arguments ad hominem oppose these views, while appeals to authority (whether relevant or irrelevant) advance these views on the ground that those concerned endorse them.

Exercise Set 2.1

I. Explain carefully what is wrong with saying “This must be a good argument because its conclusion is obviously true.”

II. Evaluate each of arguments (1)–(8) by answering the following questions and supporting your answers as necessary.

(a) Does the argument commit either of the fallacies discussed above, and, if so, which?

(b) Do the premises support the conclusion?

(c) If it is possible to tell, are the premises all true, or is it reasonable to believe that they are all true?

(d) Given your answers to (a)–(c), what is your overall evaluation of the argument (“good,” “reasonable,” “weak,” or whatever)?
(1) Adam Habib is Vice-Chancellor of the University of the Witwatersrand (Wits), and it is part of his job to promote its image. Thus any reasons he might give in support of the view that Wits is one of the country’s premier universities are completely worthless. (When evaluating this argument, assume that Adam Habib was Vice-Chancellor of Wits when the argument was advanced.)

(2) The new constitution of South Africa is in force if it has been approved by the Constitutional Court and signed by the State President. The Constitutional Court approved the new constitution in late 1996, and State President Mandela signed it in Sharpeville on International Human Rights Day, 10 December 1996. Thus the new constitution is now in force.

(3) My reason for claiming that silicone implants do not cause cancer is that my friend Suzy has them, and she is absolutely convinced that women with silicone implants are not at risk of getting cancer.

(4) Argument (2) in exercise set 1.1 (p.7).

(5) Many of those who complain about the crime rate are rich, “liberal” whites who have no commitment to South Africa. It should, therefore, be obvious that our crime rate is not extraordinary.

(6) In the Appendix on Truth (pp.150–151) the author of this text says that cyanoacrylate dissolves in acetone. This must, therefore, be the case.

(7) Argument (Es) on p.17. (In answering the above questions about this argument, you should take it into account that Walter Sisulu was one of the top leaders of the ANC Youth League in the 1940s.)

(8) Dr Kosinski makes a number of elementary logical errors in his alleged proof of his “New Theorem in Rational Choice Theory.” We must, therefore reject his claim that he has established the truth of this so-called “theorem.”

2.2 Some Fallacies of Inadequate Support

We considered two logical fallacies in section 2.1, viz.,

*Ad Hominem*, and Irrelevant Appeal to Authority.
Sections 2.2 and 2.3 introduce seven further fallacies that should prove useful for the practical evaluation of arguments in academic disciplines and everyday life. Section 2.2 deals with four of them which, along with the above two, could be described as fallacies of inadequate support.\(^4\)

Let us consider each of these fallacies in turn, beginning with the irrelevant appeal to popular opinion.

**Fallacy of Irrelevant Appeal to Popular Opinion**

(i) The argument advances its conclusion on the ground that popular opinion agrees with, or tends to favor, the proposition concerned. Thus the argument is a variation on "Most people think that \(P\); therefore \(P\)."

(ii) The fact that popular opinion favors the conclusion is irrelevant to its truth or falsity, or it does not provide a good reason for holding that the conclusion is true.

This fallacy is something like an irrelevant appeal to authority in which the illegitimate "authority" appealed to is that of public opinion. The following is a good example of this.

(A) *Reintroducing the death penalty in South Africa would result in a dramatic reduction in the rate of violent crime, for this is what the majority of people believe.*

It is clear both that (A) is of the right kind to be a candidate irrelevant appeal to popular opinion (clause (i)), and that it is a bad instance of that kind, since its premise does not support its conclusion (clause (ii)). This should be evident from the fact that the majority’s beliefs about the impact of the death penalty could easily turn out to be false if the death penalty were reintroduced.

Of course there are also legitimate appeals to popular opinion, which are not fallacious. Consider:

(B) *This is undoubtedly a popular government, for, as public opinion surveys reveal, the great majority of people think that it is doing a terrific job.*

This is a strong argument because the conclusion is exclusively concerned with the popularity of the government, not some other question on which popular opinion may not be so relevant. (B) is not, therefore, fallacious.

\(^4\) This also applies to four further fallacies to be introduced in sections 4.2–4.4.
Fallacy of Irrelevant Emotional Appeal
(i) The premises of the argument involve an appeal to emotional factors (e.g., fears, prejudices, sense of pity, patriotism, positively or negatively colored concepts, etc.).
(ii) The emotions concerned are not relevant to the question of whether the conclusion is true or false.

Here is a rather obvious example:

(C) America is the world’s greatest nation. This shows that Smith’s claim that we do not have the best national health-care system is nothing more than the babbling of an unpatriotic socialist.

This is entirely an appeal to emotion that milks patriotic sentiments but offers no substantial reasons for believing that the American health-care system is superior to those of other countries.

Of course not all emotional appeals are fallacious, and emotional factors can support conclusions to which they are relevant as reasons.

Consider the following argument.

(D) It would be a big mistake to appoint Henry as a public relations officer. The guy is obnoxious, he doesn’t give a damn for others, he hardly ever washes, and he stinks like a pig.

If Henry is indeed as offensive as this negative language suggests, then that is an excellent reason for not appointing him to a job in which it is crucial for him not to offend the people he deals with. (D) does not, therefore, commit a fallacy.

Argument from Ignorance Fallacy
(i) An argument for the conclusion based on the claim that its opposite (or a significant alternative view that is incompatible with it) has not been proved or established. Thus the argument is a variation on “It has not been shown that $P$ is not the case; therefore $P$ is the case.”
(ii) In the circumstances, the absence of a proof of the proposition opposed to the conclusion does not favor the truth of the conclusion.

For example:

(E) It has not been proved that the consumption of crocodile eggs is dangerous to one’s health, so we are entitled to assume that they are not.

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Note that the following argument does not commit this fallacy.

(F)  *The effects of crocodile eggs on human health have been so extensively investigated over the past 50 years that we can be sure that any significant dangers would have been discovered by now. Since none have, it is reasonable to assume that crocodile eggs are not dangerous to one’s health.*

The premises here may not be true, but it is clear that if they were true then this would significantly increase the probability that the conclusion is true. For (F) is not based merely on lack of good evidence for the proposition that crocodile eggs are a health hazard, but on lack of evidence in circumstances in which evidence could reasonably be expected if the proposition were true.

**Fallacy of Ambiguity**

(i) The argument involves an ambiguous word or expression that is used in different ways at different points.

(ii) This ambiguity makes a difference, i.e., any appearance of strength or validity disappears when the argument is re-expressed without the use of ambiguous words or expressions.

For example:

(G)  *Gambling should not be legally restricted since it is something that we cannot avoid. It is an integral part of human experience; people gamble every time they cross the road, catch a taxi, walk downtown, come to the campus, or get married.* (Adapted from T. Edward Donner, *Attacking Faulty Reasoning*, Wadsworth, Belmont, California, 1980, p.24.)

The word “gambling” means *betting* in the conclusion of (G) (“Gambling should not be legally restricted”), but it means everyday *risk-taking* — which is a completely different thing — in the premises. If we substitute “betting” for “gambling” in the conclusion and “take risks” for “gamble” in the premises, then it will be obvious that, despite initial appearances, the premises of (G) are completely irrelevant to its conclusion.

Let us note, finally, that an argument may be affected by more than one logical fallacy, as in the case of

(H)  *The proof that Trevor Manuel’s budget will not benefit ordinary South Africans is the unseemly praise being heaped on it by neo-liberal journalists, who are totally committed to the interests of the business establishment.*
Apart from an irrelevant appeal to emotion through negative expressions like “unseemly praise,” “heaped on” and “neo-liberal” (which is almost always meant as an insult in South Africa), (H) is also an argument ad hominem, for instead of substantiating its negative assessment of the budget, it offers us an irrelevant negative assessment of some people who support it.

Exercise Set 2.2

Answer the following questions about each of passages (1)–(10), supporting your answers as necessary.

(a) Does the passage contain an argument? If it does not, what form of discourse is it? If it does:

(b) Which, if any, of the above six fallacies of inadequate support apply to the argument? and

(c) To what extent do its premises support its conclusion?

(1) If the Springboks cannot beat the All Blacks, then they are not the best rugby team in the world.

(2) Since science has not proved that everything in the universe is physical, we are entitled to conclude that non-physical entities, such as souls, exist.

(3) Most South Africans do not approve of homosexual behavior. It should, therefore, be made illegal.

(4) Francois Pienaar said that he had no political ambitions because he had “taken too many knocks against the head to go into politics.” (Adapted from the Saturday Star, Johannesburg, 14 December 1996.)

(5) A friend of mine who runs a spaza shop in Diepkloof told me that the atomic number of platinum is 78; this must, therefore be so, since he is aware of the atomic numbers of all the elements.

(6) Science attempts to discover laws, but laws are impossible without a law-giver. Thus science presupposes God (the law-giver of nature).
The Research Centre has made a complete and exhaustive examination of the Conference Unit's airconditioning system, and can find absolutely no evidence that the delegates were infected via the airconditioning. We should, therefore, be open to the idea that the bacteria were transmitted in some other way.

Do you want to know why I think that Suzy must be upset? Well, first, she gets turned down for a job that she really wanted badly. Then her boyfriend, who has been extremely nasty to her for the past few weeks, doesn't comfort her, but harasses her for applying after he told her that she didn't have a hope in hell of getting the position.

Since most people think that their lives have been easier over the past few years, we can reasonably conclude that they have been easier.

The Foothills Community Electrification Project has the complete backing of Franklin Sibisi, who never stops sprouting his wild and unrealistic populist political twaddle. Furthermore, it has certainly not been proved that this pie-in-the-sky project will succeed in its aims. We therefore have good reason to believe that this is a wasteful and unjustified use of public funds.

2.3 Three Further Fallacies

We come now to three fallacies which involve weaknesses other than inadequate support, and which occur more often than one might expect in philosophical reasoning.

The first of these fallacies is false dilemma:

**Fallacy of False Dilemma**

(i) The argument depends on a "dilemma," i.e., a premise or background assumption that one of a certain set of alternatives is or must be the case. In the simplest examples this takes the form of an explicit "Either ... or ..." premise.

(ii) This dilemma is false. In other words, it fails to cover all the relevant alternatives.

Consider:
Either it is right to kill another human being or it is not right. If it is right, then murder is not a crime and should not be punished. If it is not right, then there is no justification for putting anyone to death — this would only multiply wrongs. Therefore in either case capital punishment cannot be defended. (From James D. Carney and Richard K. Scheer, Fundamentals of Logic, 3rd Edition, Macmillan, New York, 1980, p.106 — slightly edited.)

In order for this argument to make sense the dilemma stated in the first sentence must be interpreted as meaning “Either it is always right to kill another human being or it is never right.” On that interpretation the premises do support the conclusion, but the first premise is simply false. For it is sometimes not right to kill another human being (e.g., for the pleasure of seeing someone die) and sometimes right (e.g., to prevent him from killing numerous innocent people at whom he is shooting with a machine gun).

When an argument tacitly presupposes too few alternative possibilities it is guilty of an implicit false dilemma. This applies to the following variant of (A).

If it is right to kill another human being, then murder is not a crime and should not be punished. If it is not right, then there is no justification for putting anyone to death. Thus capital punishment cannot be defended.

Our next fallacy shows up in arguments which are in a certain respect misdirected even though they may not be problematic internally.

Straw Man Fallacy
An attack on someone’s position that depends on a misinterpretation or misrepresentation of that position which makes it easier to criticize, or an attack against a merely apparent opponent with an easily refutable position.

The misinterpretation or misrepresentation involved in a case of the straw man fallacy could, but need not, appear explicitly within the argument itself. In caricature, the form of a straw man argument is:

My opponent believes that \( P \) [where this is a misinterpretation or misrepresentation]; \( P \) is easy to refute; thus my opponent’s position is wrong.

Consider the following example of straw man.
In *Utilitarianism* John Stuart Mill commits himself to the view that anything that anyone desires is good. But this is not so, for there are psychopaths who want nothing more than to commit acts of assault, rape and theft. No one could possibly doubt that these things are evil.

There is a good argument contained in (D) that we can set out in standard form as follows.

(Ds)  
1. There are psychopaths who want nothing more than to commit acts of assault, rape and theft.
2. These things are evil.

\[ \therefore \text{It is not true that anything that anyone desires is good.} \]

The problem with (D) is not located in this argument, but in the suggestion that the argument undermines a position to which Mill (1806–1873) is committed. This is simply false. The argument in (D), in other words, does not count against Mill himself, but only against a “straw man.”

The last fallacy we will consider in this section is circular argument.

**Fallacy of Circular Argument**

An argument in which the conclusion is presupposed by one or more premises in such a way that anyone who understood those premises and the conclusion could not accept the premises without accepting the conclusion independently.  

Argument (A) on p.30 is an obvious example of this fallacy (as well as having a false premise). For nobody could accept its premise (that the moon is made of green cheese) unless they were already prepared to accept its conclusion (that the moon is made of cheese).

The circularity involved in a circular argument is usually less obvious. Consider:

(E) *Shakespeare’s King Lear* is clearly better literature than *Garfield*, for anyone who fails to grasp this simply doesn’t understand what good literature is.

The premise, to make it explicit, says that anyone who fails to grasp that

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5 This fallacy is sometimes called “begging the question,” because the phrase “beg the question” originally meant assume something that is in question. But the phrase is often now used for raise the question. So, to avoid confusion, I have decided to name the fallacy “circular argument.”
Shakespeare’s *King Lear* is better literature than Garfield doesn’t understand what good literature is. This is not something one could accept without already accepting that Shakespeare’s *King Lear* is better literature than Garfield. Thus (D) is circular.

Circular argument is not uncommon in philosophy, where it sometimes shows up in long compound arguments in which the premises that presuppose the conclusions are concealed. The following case is much more obvious.

(F) \textit{Knowledge without absolute certainty is impossible, for one cannot know anything unless it is beyond all possible doubt.}

The circularity involved here becomes clear once we recognize that a proposition is meant to be understood as “absolutely certain” if and only if it is “beyond all possible doubt.”

Notice that a circular argument is either deductively valid (if the premises contain the conclusion) or nondeductively strong (if the premises presuppose the conclusion in a way that depends upon obvious collateral information), and that all the premises of the argument could be true. What is wrong with a circular argument is not that the premises do not support its conclusion, or that the premises must be false, but that the argument provides absolutely no reason for believing the conclusion to anyone who does not already accept it. Circular argument is in fact a particular case of a more general defect that occurs whenever the key premises of an argument are at least as doubtful or contentious as the conclusion itself.

To end Chapter 2, let us consider an argument that involves several of the nine logical fallacies that have been covered so far:

(G) \textit{The University of the Witwatersrand should resist all moves in the direction of Africanization. Our students do not want a university that always falls over backwards to satisfy the changing demands of political correctness, but one that offers them a quality education that will help them to achieve their full potential, enrich their lives, and equip them to succeed in an increasingly competitive economy. And we should never forget that there are advocates of Africanization who are even willing to endorse the foolish and retrogressive idea that traditional tribal medicine, with all its witchcraft and superstition, should be incorporated in the standard medical curriculum.}\footnote{This is a caricature of arguments advanced by some academic conservatives at the University of the Witwatersrand when Apartheid was being dismantled and South Africa was becoming a democracy.}

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I encourage you to test your grasp of the fallacies that we have considered by spending some time trying to identify all the fallacies involved in (G) before you proceed to the next paragraph.

Argument (G) clearly involves a significant irrelevant appeal to emotion. In particular, it attaches negative associations to the idea of Africanization by means of the expressions “falling over backwards to satisfy the changing demands of political correctness” and “foolish and retrogressive idea.” It also attaches favorable associations to the idea of resisting Africanization by means of positive expressions like “quality education,” “enrich their lives,” “achieve their full potential” and “equip them to succeed.” Furthermore, (G) simply assumes that quality education, enrichment, etc. are incompatible with any degree of Africanization. This is an expression of an implicit false dilemma in (G), which presupposes that just two alternatives are possible: either the University does not Africanize at all and continues to offer a quality education that enriches its students, helps them to achieve their full potential, etc., or it falls over backwards to be politically correct by moving in the direction of Africanization, and as a result is forced to sacrifice the quality and value of the education it offers. There is a third possibility that (G) ignores, viz., a well-considered form of Africanization that is responsive to the University’s location but does nothing to sacrifice the quality and value of the education it provides. (G) is also an argument ad hominem insofar as it gratuitously attacks views held by some advocates of Africanization, and it involves an implicit straw man to the extent that it suggests that a refutation of their extreme position will undermine any degree or form of Africanization.

Exercise Set 2.3

Answer the following questions about each of passages (1)–(10), supporting your answers as necessary.

(a) Does the passage contain an argument? If it does:

(b) Which, if any, of the logical fallacies discussed in Chapter 2 as a whole apply to the argument? and

(c) To what extent do its premises support its conclusion?

(1) Numbers must be either physical or mental entities, but they are clearly not physical. Numbers, therefore, are mental entities.
(2) It is only when agents could have acted otherwise that they are responsible for what they have done, for someone is not responsible for an action that was not in his or her power to avoid.

(3) Rape, from a woman’s point of view, is not prohibited; it is regulated. (Catherine MacKinnon, “Feminism, Marxism, Method and the State: Toward Feminist Jurisprudence,” in Sandra Harding (Editor), Feminism and Methodology, Indiana University Press, Bloomington, 1987, p.144.)

(4) Professor Pendlebury’s advocacy of reason in this text must be rejected, because it is clear that things other than reason (e.g., feeling and emotion) are also of crucial importance to human beings.

(5) If one could contract the Umhlanga virus by sitting on Wits University lecture theatre seats, then the Virology Department would definitely have established this by now, and they haven’t. Thus there is no danger that you will succumb to Umhlanga flu by attending philosophy lectures.

(6) [Advocate of much heavier sentences for convicted criminals:] My opponent will tell you that there is absolutely nothing we can do to reduce the rate of violent crime. This is a position that we cannot and must not accept, for it is not only defeatism, but self-fulfilling defeatism.

(7) Impartiality is an absolute requirement of justice, for it is simply unfair to give preference to one party’s interest without a legitimate reason.

(8) My philosophy instructor says that atheists commit no more crimes than people who belong to established religions, but he is an atheist himself, and he is always trying to put down views held by respectable people who are much more successful than him. I am therefore positive that the crime rate among atheists is higher, especially because this is something my parents have always believed. Moreover, no one (to the best of my knowledge) has ever produced evidence that disproves it.

(9) [Hypothetical extract from a philosophy paper written in 2009:] Many beliefs about the future are subject to reasonable doubt because they could easily be undermined by everyday events that are highly improbable but cannot be ruled out. Consider, e.g., my
belief that Barack Obama will have a second term as President, which would turn out to be false if Obama died of a heart attack before the 2012 election. But unless someone can prove us wrong, we are entitled to assume that many other everyday beliefs are not subject to reasonable doubt (e.g., my belief that I am a woman). For I don’t see why the “burden of proof” should be placed on people with ordinary common sense rather than on the skeptic.

(10) Learning is impossible. Either we know already what we are after or we do not know. If we know already, there is nothing left to learn. And if we do not know we are completely in the dark about what to look for, and will not even be able to recognize it if we happen to bump into it. (Ancient Greek paradox of learning.)
Chapter 3

MEANING AND DEFINITION

3.1 Meaning Versus Denotation

This chapter deals with some aspects of meaning and definition that can make a significant difference to the interpretation and evaluation of arguments, and of scientific and intellectual thinking and writing in general. The theory of meaning, or semantics (which is studied in both philosophy and linguistics), is abstract and speculative, and the nature of meaning is not fully understood. In this section we consider some basic points that apply most directly to nouns and noun phrases, or are best illustrated by means of them.

Let us begin with the centrally important distinction between *meaning* and *denotation* in its application to *singular terms*. A singular term is a singular noun, which on any given occasion is meant to apply to one person, place, animal or thing, e.g.,

(1) *the Vice-Chancellor of Wits University in September 2013*,

(2) *the capital of Mpumalanga*,

(3) *me*,

(4) *my spouse*.

The denotation of a singular term is simply the object to which the term

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1 In this chapter, I often use “noun” as shorthand for “noun or noun phrase.”

2 There is no standard terminology for this distinction, which is often referred to as the distinction between “sense and reference,” “connotation and denotation” and “intension and extension.” The way in which the distinction is drawn also varies between different writers.
applies on the relevant occasion. Here “object” must be understood broadly, so that it covers almost anything, including persons, animals, places, etc. Term (1), e.g., denotes Adam Habib, while (2) denotes the town of Nelspruit. When they are uttered by the author of this text, (3) denotes Michael Pendlebury and (4) denotes Mary Tjiattas. But, as you know, the denotations of (3) and (4) are different when they are uttered by others. In general, “me” denotes the speaker (or writer), whoever that may be, and “my spouse” denotes the person to whom the speaker is married. If the speaker is not married, then the term has no denotation.

It is important to recognize that the meaning of a singular term is distinct from its denotation. This is obvious from two notable facts. First, a singular term can be meaningful even if it has no denotation. For example,

\[(5) \text{ the Professor of Kurdish at Wits University}\]

has meaning, and is easy enough to understand. But it has no denotation, because there is no Professor of Kurdish at Wits.

Second, singular terms with different meanings can have the same denotation. Term (1), e.g., has precisely the same denotation as

\[(6) \text{ the author of } \textit{South Africa’s Suspended Revolution},\]

for (6), like (1), applies to Adam Habib. But (1) and (6) do not have the same meaning. This is evident from a number of considerations, notably:

(a) (1) implies that the relevant person was a top-level university executive in September 2013 while (6) does not.

(b) (6) implies that the relevant person is an author while (1) does not.

(c) It is easily possible for somebody to understand both (1) and (6) (or, in other words, to grasp the meanings of both) without knowing who they denote, or that they denote the same person.

It is difficult to give a foolproof characterization of meaning as it applies to terms like (1) and (6), but it would not be unreasonable to say that their meanings are their descriptive contents. Alternatively, we could say that their meanings are the concepts that they express, these being the concepts which serve to identify their denotations, and which must therefore apply to those denotations. Consider the singular term:

\[(7) \text{ the person who wrote } \textit{South Africa’s Suspended Revolution},\]
which also denotes Adam Habib. Although (7) differs in meaning from (1), it has the same meaning as (6). For (6) and (7) can be said to have the same descriptive content, to express the same concepts in different words, and to apply to Adam Habib in virtue of the same facts about him.

Let me stress that when I characterize the meaning of an expression in terms of the concepts it expresses, I am not implying that any idea that is associated with or may be evoked by the expression is part of its meaning. The term (1), e.g., may cause Andy to think of a man, but it is no part of the meaning of (1) that it must apply to a man, for it could have been that the Vice-Chancellor of Wits in September 2013 was a woman. (The Vice-Chancellor of Wits in 2001 was a woman.) A concept is part of the meaning of an expression only if it is inseparable from it. Thus the concept university official, unlike the concept man, is clearly involved in the meaning of (1). This shows up in the fact that the claim

(8) The Vice-Chancellor of Wits University in September 2013 was not a university official

is self-contradictory, and could not possibly be true, while

(9) The Vice-Chancellor of Wits University in September 2013 was not a man

is not self-contradictory, and might well have been true.

Given only the denotation of a singular term, it is not possible to determine its meaning. For example, as I write this I am thinking of a singular term that happens to denote Adam Habib, but there is no way that you can determine from this information what that term is or what it means. On the other hand, a competent speaker of the language who understands the meaning of a singular term, is aware of who is speaking and the time and circumstances of the utterance, and who also knows the relevant facts, can usually figure out the denotation of that term. If, e.g., Sam utters term (4) ("my spouse") in an ordinary conversation and one knows that Sam is married to Maropeng, then it doesn’t take genius to infer that on that occasion the term denotes Maropeng.

This leads on to a further important point, viz., that singular terms that have the same meaning must always denote the same object relative to any given speaker and occasion of utterance. For example, although the synonymous terms

(10) my right thigh bone and

(11) my right femur

is
denote different objects when spoken by different people, they always denote the same thing when uttered by the same person.$^3$

The distinction between meaning and denotation can usefully be applied to expressions other than singular terms, including common nouns and noun phrases. $^4$ Common nouns are either count nouns (like “woman,” “egg” or “library book”) or mass nouns (like “milk,” “gold” and “sticky brown sugar”). Roughly speaking, count nouns apply to things, while mass nouns apply to stuffs. In language this difference shows up in the following important ways.

(a) Count nouns are subject to numerical qualification while mass nouns are not; e.g., “one woman” and “37 library books” make obvious sense, but “23 milk” does not.

(b) The distinction between singular and plural applies straightforwardly to count nouns (e.g., “egg” v. “eggs”) but not to mass nouns.

(c) In educated British English and the strictest American academic English, it is correct to use “fewer” and “many” with count nouns, but “less” and “much” with mass nouns; e.g., “fewer women” and “many library books,” but “less gold” and “much sticky brown sugar.”$^5$

There is room for flexibility in applying the notion of denotation to common nouns. Consider, e.g., the count noun

(12) cat/cats.

Depending on its context, we could understand (12) as denoting either the set of cats (past, present and future) or catkind (i.e., the kind of animal that

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$^3$ In the above discussion of singular terms I have purposely avoided the question of whether proper names (e.g., “Adam Habib” and “Nelspruit”) have meanings as well as denotations because this issue is seriously contested in philosophy of language. Proper names often have important psychological associations, but associations are not the same as meanings. One reason for doubting that proper names have meanings is that it does not seem necessary for a name to carry information about its bearer.

$^4$ This is the only other case that we will consider.

$^5$ These rules are often not applied in everyday speech and writing. This indicates that the distinction between count nouns and mass nouns is becoming less important in English.

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all cats are). Notice the contrast between, e.g.,

(13) No cat will ever be born at the North Pole and

(14) A cat is more closely related to a leopard than to an elephant.

(13) is in effect about the set of cats, and what it says is that no member of this set will ever be born at the North Pole. (14), on the other hand, is about catkind, and says that it is more closely related to leopardkind than to elephantkind.

Similarly, the mass noun

(15) water

could be understood as denoting either the totality of all water (i.e., the stuff itself) or the natural kind, water (i.e., the kind of stuff that all water is).

The reasons for believing that meaning and denotation are distinct for common nouns are similar to those that apply in the case of singular terms. First, it is clear that a common noun could be meaningful without having a denotation, e.g.,

(16) mammals with eight legs.

This must have a meaning if it is meaningful to say things like: “There are no such things as mammals with eight legs.” Second, common nouns with different meanings could apply to the same things. For example, the term

(17) animals that (normally) have hearts

clearly does not have the same meaning as

(18) animals that (normally) have kidneys,

but it turns out that these two terms denote the same animals.

One final point is worthy of special mention, viz., that the meanings and denotations of ordinary language expressions are often (and perhaps typically) vague and indeterminate. Consider the terms:

(19) bald person and

(20) adult.

It is quite clear that a man with 10, 20, or 40 hairs on his head is bald, and that someone with as much hair as Hillary Clinton is not. But there is no
definite borderline between those who are bald and those who are not, and we might even count someone as bald in a group of people with lots of hair but not bald in a group of people with very little hair. Likewise, there is no definite age at which someone becomes an adult. We may, e.g., want to count a 17-year-old as an adult for some purposes but not for others.

Even a seemingly precise term, such as

(21) man who weighs 95 kilograms,

is subject to a degree of vagueness. For there is no definite weight between 94.00 and 94.99 kilograms at which term (21) begins to apply, even though it would clearly apply at 94.98 and 94.99 kilograms. Moreover, one cannot avoid this sort of vagueness by the use of extremely precise expressions like "man who weighs exactly 95.023765 kilograms," because this degree of precision greatly exceeds momentary variations in body weight due to breathing and other interactions with the environment.

Vagueness and indeterminacy in ordinary language is a fact of life. And it is not one that we should complain about, for it contributes to the flexibility of language, usually suits our purposes, and does much to facilitate communication and agreement. For example, it is much easier for us to agree that somebody is "fairly tall" than that he is "exactly 1.85 metres tall." And just imagine how difficult it would be for a witness to describe a criminal if she were restricted to absolutely precise language (assuming there is such a thing).

Although vagueness is unavoidable, this does not mean that any degree of vagueness is acceptable in speech and writing. And one should always strive for the clarity, accuracy and specificity that is appropriate to the relevant topic and occasion. Notice also that vagueness can lead to trouble if it is misused. If, e.g., someone uses one standard for applying a vague expression at one point in an argument and a different standard for applying the same expression elsewhere in that argument, a fallacy of ambiguity may result. Furthermore, although a statement like

(22) Either she’s an adult or she isn’t

sounds trivially true, it could easily give rise to false dilemmas, especially if it is tacitly understood as "Either she is definitely an adult or definitely not an adult."

Vagueness, it should be noticed, is not the same as generality. The opposite of "vague" is "precise," while the opposite of "general" is "specific." In order to see that vagueness and generality are different, observe that although the term

(23) elephant
Exercise Set 3.1

I. For each of the following items, give two singular terms with different meanings which both denote that item.

(1) Yourself
(2) The city of Bloemfontein

II. Give another singular term with the same meaning as each of the following.

(3) “the most famous President of any African country in the 1990s”
(4) “the oldest living elephant”

III. Which of the following items are part of the meaning of the singular term “the largest city in South Africa”? Give a brief reason in support of each answer.

(5) The concept city
(6) Johannesburg, i.e., the place itself
(7) The concept capital of Gauteng
(8) The concept place where people live

IV. Indicate whether each of the following expressions taken as a whole is (i) a singular term, (ii) a count noun (or noun phrase), (iii) a mass noun (or noun phrase) or (iv) none of these.

(9) sugar
(10) my mother’s helicopter
(11) eats ice cream every night while watching the TV news
king of an island in the Pacific Ocean

V. Give your own examples of the following.

(13) Two count nouns (or count noun phrases) with different meanings but the same denotation

(14) Two mass nouns (or mass noun phrases) with different meanings but the same denotation

(15) Two different common nouns or noun phrases (either count or mass) with the same meaning

VI. Are any of the following terms subject to any degree of vagueness? Support your answer briefly in each case.

(16) big dog

(17) woman

(18) shoe

3.2 Types of Definition

In this section we distinguish between five types of definitions, each of which serves a different purpose. It should be noted that some definitions may not be covered by the classification to be presented, and that others may exhibit features of more than one type. In talking about a definition of any of our five types, it is often useful to distinguish between the definendum, or what is being defined, and the definiens, or what is used to define it.6

Our first type is the STIPULATIVE DEFINITION, which assigns a meaning to a new term or a new meaning to an old term. Consider, e.g., the following.

(1) Let us call the chemical element with atomic number 93 Neptunium.

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6 The plural of “definiendum” is “definienda,” and the plural of “definiens” is “definientia.”
In this paper I shall say that a belief is “self-validating” if and only if it guarantees its own truth.

Exercise: Identify the definiendum and definiens of each of these definitions. The usual point of a stipulative definition is to provide a brief and convenient label for a concept that is likely to be applied on several occasions. A stipulative definition is in effect a proposal, decision or directive to use a given term in a certain way in a certain context. It is not a proposition that is true or false, and it cannot be evaluated as correct or incorrect.

This is not to suggest that stipulative definitions are beyond evaluation, for they are subject to criticism on at least two possible grounds, viz., that the relevant concept will not be used often enough to warrant the introduction of a special term for it, or that the term selected is inappropriate insofar as its associations could obscure or confuse the issues at hand. (It might, e.g., be misleading for a medical researcher to define an illness as democratic if it attacks many parts of the body at once.) Someone who gives a stipulative definition of a term is also subject to criticism if he or she does not stick to that definition in the relevant discourse. Furthermore, an argument in which some uses of a given term accord with a stipulative definition while others do not is liable to involve a fallacy of ambiguity.

Stipulative definitions stand in obvious contrast to LEXICAL DEFINITIONS. These aim to specify a pre-existing meaning of a word that is already in circulation (or of a particular sense of an ambiguous word). Ordinary dictionary definitions belong to this type. Consider:

WATER: the liquid that descends as rain and forms rivers, lakes and seas.

... definiendum, or what is being defined,... (see the first paragraph of section 3.2 on p.55)

The point of a lexical definition is simply to convey an understanding of the relevant word or expression so that people can interpret or use it correctly. Since meanings are not very clear-cut things, there may be many different ways of achieving this. This is reflected in the different definitions of a single word that may appear in different dictionaries.

This openness does not, however, imply that lexical definitions cannot be mistaken. Lexical definitions must answer to linguistic usage, and can, therefore, be correct or incorrect. Reputable dictionaries compiled by expert lexicographers contain very few definite errors, but such errors do occur. And ordinary speakers are quite frequently in error when they attempt to give a lexical definition, i.e., to “explain the meaning of a word.”
What I shall describe as **PARTLY STIPULATIVE DEFINITIONS** are well illustrated by the following examples.

(5)  *For the purposes of these regulations an adult shall be any person who has attained the age of 21 years.*

(6)  *In this paper I will restrict the term “belief” to beliefs of which the agent is fully conscious.*

It should be evident that such definitions involve a significant stipulative element, but that they do not assign completely new meanings to their definienda. They may also presuppose an understanding of the ordinary meaning of the relevant term, as in the case of (6).

Partly stipulative definitions can serve several different purposes, including the following. (i) They can be used to make a vague word more precise when such precision is desirable — e.g., for scientific or legal purposes. Definition (5) is a good example of this. (ii) They can provide a convenient term for a narrower (or slightly different) range of phenomena than that covered by the usual sense of a pre-existing word, as illustrated by the case of (6). Finally, (iii) they can help to settle or avoid certain kinds of purely verbal disputes. Suppose, e.g., that Andy claims that a state university should be run democratically while Andrea insists that it should not; that (unbeknown to one another) they both think that staff, students, and other stakeholders should all have a significant input on the university’s goals and policies, and on the selection of its top executives; but that while Andy means no more than this when he applies the word “democratic” to universities, Andrea uses it for a much more radical arrangement that neither she nor Andy would favor. In these circumstances the dispute between Andy and Andrea is verbal rather than substantive. And the dispute could easily be resolved if one of them were to provide a partly stipulative definition of “democratic” — i.e., explain how he or she is using it in the context at hand.

A so-called **PERSUASIVE DEFINITION** is an expression of attitude, or an attempt to influence attitudes, presented in the form of a definition. Here are some examples:

(7)  *Poetry is simply the most beautiful, impressive, and widely effective mode of saying things.* (Matthew Arnold (1822–1888))

(8)  *Liberals are people who claim to be committed to human rights, but are only interested in protecting their own privileges.* (South African left-wing definition.)
(9) Liberals are people who want to overtax the able, hardworking and successful in order to support the idle and incompetent. (American right-wing definition.)

It is obvious that (7) is intended to express and evoke a favorable attitude towards poetry, and that (8) and (9) are intended to express and evoke negative attitudes towards liberals, but from different points of view. Such “definitions” may also have a stipulative effect. Arnold’s definition of poetry in effect classifies unbeautiful poetry as non-poetry, and an advocate of (8) or (9) may be forced to insist that a person who claims to be a liberal is not really one because she doesn’t fit the preferred stereotype.

Someone who is interested in the logical evaluation of arguments should be able to recognize clear cases of persuasive definitions, and should also be alive to the possibility that arguments that include them may involve fallacious appeals to emotion. At the same time, one should be cautious about labeling something as a persuasive definition just because it involves emotive language. Consider:

(10) Racism is racial prejudice by members of a privileged race that is instrumental in the domination, exploitation or oppression of members of another race.

This definition clearly suggests that racism is a bad thing, but that’s okay, because it is a bad thing. Furthermore, it seems to me that (10) accords quite well with an important everyday use of the word “racism” — and it is a reasonable lexical definition to this extent. But (10) may also contain a small stipulative element along with some theoretical elaboration. None of this tells us when it is helpful or enlightening to apply a definition like (10), but it would be very unwise to stigmatize it as a persuasive definition.

We come, finally, to THEORETICAL DEFINITIONS. These definitions aim to contribute to our understanding of the world by identifying the natures of their definienda. And it is important to note that their definienda are to be understood not as linguistic expressions but as the denotations of the relevant expressions. In the theoretical definition

(11) Water is $H_2O$

the definiendum is not the word “water,” but the stuff (or kind of stuff) that the word denotes. Furthermore, what the definiens aims to tell us is not the meaning of the word, but the nature of the stuff, and in this case it does so by identifying its chemical composition.

The contrast between this theoretical definition of water and the above lexical definition of the word “water” (see (3) on p.56) is notable. The lexical
definition could help someone to understand and use the word “water” as it occurs in ordinary speech, but says nothing about the ultimate nature or composition of the stuff. This reflects the fact that the meaning of the word does not involve information about the nature of its denotation (in the sense in which a scientist might be interested in its nature). And this is in turn confirmed by the fact that speakers of English can understand the word “water” without knowing the chemical make-up of the stuff.

The theoretical definition, (11), on the other hand, does not on its own tell us what the word “water” means. For someone who is aware only that water molecules are composed of two hydrogen atoms and one oxygen atom, but is unable to appreciate that the liquid that falls as rain, comes out of taps, etc. is water, does not have an understanding of the English word, and cannot communicate successfully by means of it. Relative to such a person, (11) in effect functions as a stipulative definition. When it functions as a genuine theoretical definition (as intended), (11) in fact presupposes an understanding of the word “water” in its ordinary sense, for it is this word that is being used to identify the stuff whose nature (11) aims to specify.

Despite all this, there are definitions that could be treated as either lexical or theoretical. Consider, e.g.,

(12) A woman is an adult, female human being.

This could easily help someone to understand the word “woman,” or it could be taken as a very rough biological account of what a woman is. Such dual-purpose definitions are possible only when there is a close link between the meaning of the relevant term and the nature of its denotation. This is probably common in the case of terms for particular kinds of artifacts (e.g., “chair,” “fork”), institutions (e.g., “bank,” “school”), and social relationships (e.g., “husband,” “aunt”). However, recent research in semantics suggests that it may not be the norm.

Theoretical definitions are important and useful in most fields of intellectual inquiry. Our third example of such a definition comes from philosophy, and is highly contestable:

(13) An action is right if and only if the maxim on which it is based is one that the agent can will to be a universal law.
(Reformulation of one version of Kant’s “Categorical Imperative”)

This definition presupposes an everyday understanding of the word “right,” and offers a theory of the nature of right and wrong. This is not the place to unpack the definition, but its consequences are interesting and significant. For example, (13) implies that if a person acts on a principle
that he would not be willing to have everybody act on always, then she does wrong. Anyone who accepts this has a powerful tool for the moral evaluation of actions. This sort of consequence illustrates the value of good theoretical definitions.

Good theoretical definitions are, however, difficult to produce, and they are impossible in the case of phenomena that do not exhibit enough unity to count as having a common nature. To borrow an example from Ludwig Wittgenstein (1889–1951) (one of the great philosophers of the twentieth century), there is nothing that all actual and possible games have in common, even though they bear a “family resemblance” to one another. Thus there is no such thing as the nature of a game for a theoretical definition to specify (although there are lexical definitions of “game” in all good English dictionaries).

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**Exercise Set 3.2**

What type of definition is each of the following? Comment briefly on two or three of these examples where

(a) the definition does not fit neatly into one of our 5 types, and/or

(b) you think that the definition has definite shortcomings in relation to its intended purpose.

1. Let us refer to Kant’s account of right actions (i.e., his Categorical Imperative) as “KCI.”
2. An “enthymeme” is an argument with one or more missing elements.
3. Platinum is the element with atomic number 78.
4. Gold: A shiny, light yellow precious metal often used in valuable jewellery.
5. For purposes of applying the mature age exemption a person shall be treated as being of mature age from the age of 25.

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7 This is an oversimplification, but it will do for our purposes. Students who find issues like this interesting should take a course in ethics.
(6) A free market economy is a productive and efficient economic system in which government interference is kept to a bare minimum.

(7) Depression is an ongoing psychological state of unhappiness, dejection, helplessness and despair.

(8) Depression is a disorder of the brain involving a deficiency in the uptake of serotonin.

(9) **Murder**: Intentional, malicious and wrongful killing.

(10) Action is intentional behavior.

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3.3 Evaluating Theoretical Definitions

Theoretical definitions can be more or less useful or informative, and they can also be outright incorrect. This section deals with six basic rules for the evaluation of theoretical definitions. I shall proceed simply by stating each rule and then explaining it with the help of examples (all of which I will treat as theoretical definitions even if they would be better suited to another purpose).\(^8\)

**RULE 1: A theoretical definition should not be circular.**

In other words, the application of the definiens should not depend on the definiendum either explicitly or implicitly. What is wrong with circular definitions is that they cannot usefully be applied, and that they yield little or no new information. This is well illustrated by the following example.

(1) **Freedom of choice is the human ability to choose freely between real alternatives.**

The circularity of (1) is blatant, for the two concepts involved in the specification of the definiendum, *freedom* and *choice*, appear explicitly in the definiens in the form of the words “freely” and “choose” in such a way that one could not apply the definiens without being able to apply the definiendum. It is quite obvious that (1) tells us nothing whatever about

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\(^8\) Some but not all of the following rules also apply to other kinds of definitions, but this is not the place to pursue the details.
what freedom of choice is, and that we could not apply it to determine whether someone was exercising free choice — for this would require that we already knew whether she was choosing freely.

A more subtle form of circularity is illustrated by

(2)  
Knowledge is an awareness of facts.

The problem here is that we cannot understand “an awareness of facts” in this context other than as a circumlocution for “knowledge.” Thus, although it sounds good, (2) does not tell us what knowledge is or what conditions must be satisfied in order for it to exist.

RULE 2: A theoretical definition should not be expressed in ambiguous, obscure, figurative or unnecessarily vague language.

The need for this rule is obvious given that theoretical definitions are meant to contribute to our understanding of reality. Definitions that infringe this rule are often more impressive than informative. Consider the following example.

(3)  
Inquiry is the controlled transformation of an indeterminate situation into a unified whole. (John Dewey — edited)

Because of its obscurity, (3) (taken in isolation) adds little to our understanding of what inquiry is. (There is, however, merit to the idea of linking inquiry to transformation or change, for a central goal of inquiry is to change what we know. Dewey, however, seems to imply that this goal is always achieved, which is doubtful.)

It should be noted that Rule 2 does not completely prohibit the use of vague language in a definition, and it would an error to do so. Consider:

(4)  
A woman is an adult, female human being (= (12) on p.59),

which is a pretty good definition for most purposes. It would be inappropriate to complain about the vague word “adult” in (4), for its vagueness is exactly parallel to that of “woman” — in the sense that our confidence in viewing any female human being as a woman would match our confidence in viewing her as an adult. The introduction of unnecessary vagueness in a definition should, however, be resisted.

RULE 3: A theoretical definition should not be negative if it can be positive.
The need for this rule is obvious given that the point of a theoretical definition is to tell us what something is, not what it is not. The following, e.g., provides no enlightenment on what a male is.

(5)  A male is any sexed animal that is not female.

Rule 3 does, however, permit necessary negations in a definition, as in the case of

(6)  A bachelor is a man who has never been married,

for the negative (which appears in the word “never” here) is simply unavoidable.

**RULE 4: A theoretical definition should not be too broad.**

A definition is too broad if the definiens applies to items beyond the scope of the definiendum. Consider:

(7)  A woman is an adult female.

This is too broad because the definiens, “adult female,” applies to things that are not women, such as the oldest female gorilla in the Pretoria Zoo. It is of course easy to correct (7) by adding a further essential property of a woman, viz., human being, to the definiens, thus narrowing its application to the appropriate class. But this sort of move is not always possible.

**RULE 5: A theoretical definition should not be too narrow.**

A definition is too narrow if the definiens fails to apply to items within the scope of the definiendum, as in the case of

(8)  A truth is a proposition that everybody accepts.

What makes this too narrow is that there are truths that not everybody accepts. For example, it is true that I own a Toyota Camry, but not everybody accepts this since the thought has clearly not occurred to the overwhelming majority of people.

Rules 4 and 5 are especially useful and important because definitions that infringe them are not only inadequate, but are also decisively incorrect. And it should be noticed that a single definition can infringe both rules simultaneously, by being too broad in one respect but too narrow in another. For example,
is too broad insofar as the definiens, “female over the age of 25,” applies to some non-human females, such as older elephant cows. And is too narrow insofar as the definiendum fails to apply to women who are younger than 26.

RULE 6: A theoretical definition should mention essential rather than merely accidental properties.

An essential property of things of a given kind is a property that all things of that kind must have in order to belong to that kind, while an accidental property is property that they (or some of them) merely happen to have, but might not have had. Being metal, e.g., is an essential property of gold, since stuff that is not metal could not be gold, while being stored in Fort Knox is an accidental property of gold, since there is a possibility that gold might not have been stored in Fort Knox.

What Rule 6 in effect means is that in a good theoretical definition the definiens must apply necessarily to all and only things of the relevant kind. Thus although

(10) Gold is the kind of metal that is stored in Fort Knox

is a true statement of fact, it is not an adequate definition. To see this, it is enough to imagine possible circumstances in which (10) would be false. Suppose that United States government stored only aluminium in Fort Knox. Then in terms of (10) taken as a definition, aluminium would be gold, which is obviously bunkum.

In contrast, the chemical definition of gold,

(11) Gold is the element with atomic number 79,

fares well in terms of Rule 6, since this element, and nothing but this element, would be gold in all genuinely possible circumstances. Likewise, definition (4) of a woman (“A woman is an adult, female human being”) passes this test, since nothing but an adult, female human being could be a woman, and vice-versa.

Generally speaking, it is not worth applying Rule 6 to a definition unless it satisfies the other five rules, but any one of those five may be applied independently of the others.
Exercise Set 3.3

(a) Very briefly evaluate each of (1)–(12) understood as theoretical definitions and support your evaluation.

(b) Wherever possible, indicate how to improve those definitions that are too broad and/or too narrow but otherwise reasonable.

(c) Where it seems clear that an example would be better treated as a definition of another type, identify the relevant type.

(1) A car is a motorized vehicle for transporting people.

(2) Love is a big fat river in flood. (Sting)

(3) By analysis, we mean analyzing the contradictions in things. (Mao Tsetung)

(4) Ostriches are large flightless birds that are farmed for meat and feathers in South Africa.

(5) A boy is a male who is not yet fully developed.

(6) Jewelry: Articles of gold, silver, other precious metals and/or precious stones for personal adornment.

(7) Yu, shall I teach you what knowledge is? When you know a thing, to recognize that you know it, and when you do not know a thing, to recognize that you do not know it. That is knowledge. (Confucius (551–479 BCE))

(8) A triangle is a three-sided polygon.

(9) A chair is a piece of furniture for sitting on.

(10) Apes: Gorillas, orangutans, chimpanzees, and gibbons.

(11) Knowledge is nothing other than true belief.

(12) A person is free if he is not subject to threat, coercion or physical restraints (e.g., being locked up or in chains).
Chapter 4

DEDUCTIVE VALIDITY AND NONDEDUCTIVE STRENGTH

4.1 Deductive Validity

As emphasized in section 2.1, the most central evaluative question about an argument from a logical point of view is whether and to what extent its premises support its conclusion. The remainder of this text is concerned with a range of important issues related to the notion of support. Chapter 4 deals with the concept of deductive validity (in section 4.1) and the concept of nondeductive strength as it applies to three important types of argument (in sections 4.2–4.4).

Recall that an argument is deductively valid iff the truth of its premises would guarantee that its conclusion is true. There are also other ways of explaining this concept, e.g.:

An argument is deductively valid iff EITHER

- if its premises were all true then its conclusion would have to be true; OR

- it is not logically possible for all its premises to be true and its conclusion false.

These alternative definitions, together with the examples that follow, are meant to help you develop a good practical grasp of the idea of deductive validity. We can describe an argument as a deductive argument if it is deductively valid or is intended to be deductively valid.

It will be convenient from now on to reserve the term “valid” for deductive validity. Here are two examples of valid arguments:

(A) The colours of the South African national flag are red, white, blue, green, gold and black.

\[ \therefore \] There is at least one flag with six colours.
(B) 1. *Cats are mammals.*
   2. *All mammals are egg-laying animals.*
   \[ \text{Cats are egg-laying animals.} \]

Notice that it is possible to tell that these arguments are valid without knowing whether the propositions involved are true or false. What makes them valid is simply that their conclusions follow with certainty from their premises. In other words, their conclusions would have to be true on the assumption that their premises were all true. Thus one can appreciate the validity of (A) and (B) simply by imagining hypothetical situations in which their premises are true and seeing that their conclusions must also be true in all such situations.

Valid arguments can have any of the following patterns.

**POSSIBLE PATTERNS OF VALID ARGUMENTS**

(i) All premises true, conclusion true.
(ii) One or more premises false, conclusion false.
(iii) One or more premises false, conclusion true.

Argument (A) is an example of pattern (i) and argument (B) is an example of pattern (ii). The task of providing an example of pattern (iii) is included in Exercise Set 4.1. The only pattern that is impossible for valid arguments is *all premises true, conclusion false*. You should confirm that this follows directly from the above definitions of validity.

We can now define invalidity as follows.

An argument is invalid (i.e., deductively invalid) iff it is not valid.

It is important to understand that an invalid argument could still be a good argument, for the premises may support the conclusion to some degree and provide good reasons for believing it even though they do not guarantee its truth.

It should be clear from the above definitions of validity and invalidity that any argument in which all the premises are true and the conclusion is false must be invalid. But invalid arguments can also have any of the above three possible patterns of valid arguments. Thus invalid arguments can have any of the following patterns.

**POSSIBLE PATTERNS OF INVALID ARGUMENTS**

(i) All premises true, conclusion true.
(ii) One or more premises false, conclusion false.
(iii) One or more premises false, conclusion true.
(iv) All premises true, conclusion false.
It is easy to come up with invalid arguments exemplifying each of these patterns. Consider:

(C) 1. Nelson Mandela was a President of South Africa.
2. Bill Clinton was a President of the USA.
\[\therefore\] Nelson Mandela was born before Bill Clinton.

Argument (C) exemplifies pattern (i) and is obviously invalid, for the conclusion does not follow from the premises (which are totally irrelevant to it). With a few changes we can turn (C) into a good example of an invalid argument of pattern (ii), with both premises obviously false and its conclusion also obviously false:

(D) 1. Nelson Mandela was a President of the USA.
2. Bill Clinton was a President of South Africa.
\[\therefore\] Bill Clinton was born before Nelson Mandela.

You should not have much difficulty constructing clear examples of invalid arguments with patterns (iii) and (iv).

There are of course arguments whose invalidity is not so obvious as the invalidity of (C) and (D). One way of establishing invalidity in less obvious cases is by conducting a “thought experiment” in which one tries to imagine a hypothetical situation — no matter how wild or improbable — in which the premises of the argument would all be true but the conclusion would be false. If the situation that one imagines does not involve a contradiction (either overt or tacit), then it is logically possible for all the premises to be true while the conclusion is false, so the argument is invalid.

Consider the following example.

(E) \text{Nelson Mandela believes that he has children.}
\[\therefore\] Nelson Mandela is a parent.

It is easy to imagine a situation in which Nelson Mandela has no children even though he believes that certain people who were born to his former wives are his children. This would apply in a world in which his former wives cheated on him on all the relevant occasions and led him to believe falsely (but perhaps reasonably) that the resulting children were his own. In this hypothetical situation the premise of (E) is true and its conclusion is false. The imagined situation is possible since it involves no contradictions, and it therefore shows that the argument is invalid.

The thought-experiment method of establishing invalidity is not foolproof, for two reasons. First, one might not be able to come up with a hypothetical situation in which the premises of the argument are true and the conclusion is false because of limitations of one’s imagination rather
than because the argument is valid. Second, one might sometimes be mistaken in thinking that the hypothetical situation that one is imagining is possible, for it could involve an implicit contradiction of which one is unaware. The method is useful despite these limitations. Some other techniques for identifying valid and invalid arguments are considered in Chapters 5–7, which deal with some basic topics in deductive logic.

Let me end this section by introducing the concepts of **logical implication** (or entailment) and deductive **soundness**. Implication can be defined as follows.

**One proposition logically implies (or entails) another iff the argument from the first to the second is valid.**

It is important to note that “infers” does not mean the same as “implies.” We say that a person infers a proposition from one or more other propositions when she accepts it as a conclusion on the strength of those other propositions taken as premises. This applies even if the argument concerned is a bad one and the premises do not support or imply the conclusion. It is never correct to say that one proposition infers another.

The definition of soundness is as follows.

**An argument is (deductively) sound iff it is valid and all its premises are true.**

Arguments that are not sound are **unsound**. Soundness is important because a valid argument that is unsound does not in the end give us good reasons to accept its conclusion. It ought to be clear that any argument that is invalid (e.g., (C), (D), (E)) is unsound, as is any valid argument with one or more false premises (e.g., (B)). A sound argument (e.g., (A)) must have a true conclusion because its premises, which are all true, certify its conclusion. An argument with a false conclusion must therefore be unsound.

**Exercise Set 4.1**

**I. Which of the following statements are correct and which are incorrect? Give brief justifications for your answers.**

(a) Any invalid argument is totally useless.

(b) If all the premises of an argument are true and the conclusion is also true, then it must be valid.
(c) If all the premises of an argument are true and the conclusion is false, then it must be invalid.

(d) If one proposition logically implies another and the first is false, then the second must also be false.

(e) Any argument with a false conclusion is invalid.

(f) Every valid argument with a false conclusion has at least one false premise.

(g) Every sound argument has a true conclusion.

(h) If an argument is valid and its conclusion is true, then it must be sound.

II. Give an indisputable example of

(a) an invalid argument with at least one false premise and a true conclusion,

(b) a valid argument with at least one false premise and a true conclusion.

III. For each of the following arguments, describe a hypothetical situation in which the premises are all true and the conclusion is false, and which therefore establishes that the argument is invalid.

(1) Argument (A) on p.2.

(2) Argument (5) from exercise set 2.2 (p.40).

(3) Suzy is a mother; therefore Suzy is a woman.

4.2 Nondeductive Strength (I): Inductive Arguments

Although deductively valid arguments involve the maximum possible degree of support, they can never yield conclusions that go beyond the information contained (either explicitly or implicitly) in their premises. This is a significant limitation, for the curiosity that gives rise to philosophy, science and human inquiry in general is not satisfied merely by unpacking information that we already have, and we are continually driven forward towards new, more distant, and less certain horizons.
Moreover, the overwhelming majority of substantive general claims about the world that are advanced in scientific and other academic disciplines as well as in everyday life do not follow deductively from the evidence on which they are based. Consider, e.g., the simple claim that the minimum temperatures in Johannesburg are almost always higher in January than in July. This is meant to apply to the future as well as the past, but all the evidence that we have for it must be drawn from the past. The claim is, therefore, a projection that is not deductively guaranteed by the evidence (even though it is a “practical certainty”). Even the simplest practicalities of life depend upon expectations and predictions that go beyond the information on which they are based. Human beings cannot, therefore, confine themselves to the certainties of deductive validity, but must embrace the risks of nondeductive support.

Validity is a yes-or-no matter, and it does not come in degrees. Nondeductive strength, in contrast, is a more-or-less matter. For example, the premises support the conclusion to a higher degree in the case of

(A) 1. 99% of people who are infected by the Ebola virus die within a week.
2. Sean has been infected by the Ebola virus.
\[ \therefore \text{Sean will probably die soon} \]

than in the case of

(B) 1. 80% of people who are infected by the Ebola virus die within a week.
2. Sean has been infected by the Ebola virus.
\[ \therefore \text{Sean will probably die soon} \]

— and (A) is correspondingly stronger than (B). (Both arguments are examples of one kind of inductive generalization, involving the projection of statistical regularities onto new cases.)

There is a question of how much the premises of an argument must support its conclusion in order for that argument to qualify as strong. This cannot be answered once and for all, for different degrees of support may be appropriate in different contexts, depending on the importance of the conclusion, how much evidence could reasonably be expected on the topic within the applicable time frame, and other such factors. For example, a doctor dealing with a life-or-death matter may not have the time to wait for more information, and may have to accept as reasonable a conclusion that is based on very limited evidence, while a theoretical physicist whose work has no immediate applications may treat a similar degree of support as inadequate. What is crucially important is for the premises of an argument to support its conclusion significantly more than they would support the
opposite conclusion, and those which do not meet this standard are useless. By any reasonable standards, arguments (A) and (B) can both be described as strong.

In addition to the fact that it is a matter of degree, nondeductive strength differs from deductive validity in at least two crucial respects. First, no matter how strong an argument is, if it is not valid it remains possible for its conclusion to be false while all its premises are true. Even if, e.g., “99%” in (A) were changed to “99.99999%,” it would still be possible, however surprising, for the premises to be true and the conclusion false. Second, adding an extra premise can make a strong argument weak. Consider:

(C) 1. Most cats have tails.
   2. Deuteronomy is a cat.
   \[ \therefore \text{Deuteronomy has a tail,} \]

which is fairly strong. But if we add the extra premise that Deuteronomy is a Manx cat, then the argument becomes rather weak, for many Manx cats are tailless.

Nondeductive arguments are important in almost all disciplines, including philosophy. There are many types of nondeductive argument, and it would be difficult to give a complete classification of all of them. One important class is that of **inductive arguments**, a term that I will reserve for fairly straightforward projections from the past to the future or the known to the unknown, as well as for arguments from known correlations to causal connections. So understood, inductive arguments include

(a) various kinds of **statistical and probabilistic generalizations and projections**, including arguments such as (A), (B) and (C);

(b) **nonstatistical generalizations**, e.g.,

(D) *It appears likely that all pigs are immune to the Umhlanga virus, for all those tested so far are;*

(c) **inductions to a further instance**, e.g.,

(E) *All Dobermans I have encountered are fierce; so it’s reasonable to believe that the next Doberman I come across will be fierce;*

and

(d) **simple causal arguments** from correlations between properties to causal connections between them, as in
(F) More milk is consumed, and more people die of cancer, in Wisconsin than in any other American state. Thus a high level of milk consumption is a cause of cancer.

Many nondeductive arguments that appear in Chapter 4 and the exercises applying to it are not inductive arguments in the above restricted sense.¹

Factors affecting the strength of inductive arguments are studied in inductive logic and the theory of logical probability, which are beyond the scope of this text. Two important fallacies are, however, worth noting. The first of these fallacies can apply only to arguments of types (a)–(c), which I will refer to collectively as “inductive projections.”

Fallacy of Hasty Generalization
Inductive projection based on a sample that is too unrepresentative to make the conclusion probable.

Argument (E), e.g., would be a hasty generalization if the speaker had encountered only two Dobermans, both of whom were police dogs (and thus trained to be fierce). For in that case the sample of Dobermans on which the inductive projection is based would be unrepresentative of Dobermans in general.

Likewise, (D) would be a hasty generalization if only three pigs had been tested for immunity to the Umhlanga virus, or if only pot-bellied sows beyond childbearing age from a single pig farm had been tested (and there were no background evidence that findings about them could be generalized to pigs of other ages, sexes and breeds). But (D) would be a reasonably strong argument and not a hasty generalization if (i) the sample of pigs found to be immune to the Umhlanga virus included thousands of individual pigs and (ii) this sample was representative in the sense that it included older and younger pigs of both sexes and pigs from a wide variety of locations and breeds. The requirements for adequate sample size and representativeness are studied in detail in statistics.

Not every inductive projection based on a small sample commits the fallacy of a hasty generalization. Even an inductive projection from a single case is not guilty of the fallacy if there is good reason to believe that the case in question is representative. The outcome of a single experiment on the properties of a certain kind of molecule may, e.g., provide reasonably strong inductive support for claims about the properties of all molecules of that kind — providing the experiment is carefully designed to ensure that the outcome depends mainly (or only) on features common to all or most

¹ Some writers, however, apply the word “inductive” much more broadly, so that it is virtually equivalent to “nondeductive.”
molecules of that kind, and is not influenced by extraneous factors.

Similarly, if I find my first pair of shoes of a particular brand and style comfortable, I can reasonably infer that I will find further pairs of shoes of the same brand and style comfortable without committing a hasty generalization. The reason is that there is usually very little variation between the most important characteristics of different pairs of shoes of the same brand and style. So, in the absence of evidence to the contrary, any particular pair can reasonably be regarded as representative.

Our second fallacy pertaining to inductive arguments is as follows.

**False Cause Fallacy**

Argument for a causal relationship on the basis of a correlation between the relevant factors that is too limited or might be accidental.

(F) is a good example of a fallacious causal inference based on an accidental correlation. People tend to live longer in Wisconsin than in other American states (possibly because they consume more milk), and older people are more likely to die of cancer. The most primitive form of false cause, which is not at all uncommon, is an argument from the premise that one event preceded another to the conclusion that it caused it.

Of course not all simple causal arguments are fallacious. When one property tends to vary systematically with changes in another in a wide range of different circumstances, this provides evidence of a causal connection between them. This is well illustrated by the following example of a simple causal argument that is entirely reasonable.

(G) *It has been found in a very wide, representative range of cases that the lung capacity of people who smoke diminishes, and that the more they have smoked the more likely they are to display a greater reduction in their lung capacity.*

\[ \therefore \text{Smoking is apt to cause a reduction in lung capacity.} \]

**Exercise Set 4.2**

I. Give your own example of a nondeductive argument that is reasonably strong and show how it can be (i) weakened and (ii) strengthened by the addition of an extra premise.

II. Answer the following questions about each of passages (1)–(9), briefly supporting your answers as necessary.
(a) Does the passage contain an argument? If it does:

(b) Which, if any, of the two logical fallacies discussed in section 4.2 apply to the argument? And

(c) How strong is the argument, i.e., how well do its premises support its conclusion?

1. It must be the stove that is causing the earth-leakage switch to trip. I have been experimenting for the last hour, and the switch trips every time I turn the stove on, but not in response to anything else.

2. The beggars you see around Jo’burg actually don’t need your help. I once met a guy with a good private income and a nice flat in Killarney who makes a fortune in a Rosebank parking lot wearing his scruffiest clothes and posing as a retrenched teacher with a family to support.

3. [Roger Babson:] After I became ill with tuberculosis I returned home to Massachusetts where I left my windows open during the freezing winter. The fact that I soon recovered shows that fresh air is an effective cure of this dreaded illness. (Adapted from Martin Gardner, Fads and Fallacies in the Name of Science, Dover, New York, 1957, p.92.)

4. I was quite taken aback when he [Francois Pienaar] was dropped as captain of the team because he is the man who led our team to that unprecedented victory at the world cup. (Nelson Mandela, quoted in the Saturday Star, Johannesburg, 14 December 1996.)

5. The denims I bought recently are Levis, style 505, size 34, and they fit me perfectly. So there’s good reason to think that, if I buy a new pair of size 34 style 505 Levis, they will fit me.

6. Whenever I have gone to classroom number 4 in the Richard Ward Building, my philosophy lecturer has shown up there too. Thus, if I go there right now (as I read this), he will (probably) also arrive.

7. Over 90 students have come to various Wits faculties from Madiba High School over the past five years, and all but one of them have passed all their courses first time, with an unusual number of superior results. It is therefore reasonable to suppose that, in general, Madiba High provides excellent preparation for university.
It was found in a recent survey of 15,000 men living in New York city that only seven had ever engaged in hunting as a sport. On the basis of this evidence we are surely entitled to conclude that the number of American men who hunt as a sport is tiny — perhaps even fewer than one in a thousand.

The press conducted careful surveys of a large variety of communities, where it found that an average of 23% of census forms had not been collected by the official end of the South African census of 1996. This suggests that the rate of non-return for the country as a whole has been above the 4% claimed by the Central Statistical Service.

4.3 Nondeductive Strength (II): Abductive Arguments

Among the most important nondeductive arguments from the point of view of philosophy and other theoretical disciplines are abductive arguments. These are also sometimes referred to as “arguments to the best explanation.” It will become evident that this name can be misleading, but it is correct in suggesting that an abductive argument is an argument from supposed facts to a proposed explanation of those facts.

Here’s an everyday example of an abductive argument:

(A) I must be pregnant. My period is two weeks overdue; I’ve been waking up with terrible nausea; and I’ve just realized that we didn’t use a condom when we made love after that wild, drunken party at Pete’s place four weeks ago.

Dubbing our protagonist “Angie,” we can express this argument in standard form as follows (leaving out some embellishments).

(As) 1. Angie’s period is two weeks overdue.
2. Angie has been waking up with terrible nausea.
3. Angie and her partner made love without a contraceptive after a wild, drunken party at Pete’s place four weeks ago.

∴ Angie is pregnant.

Obviously (As) is not deductively valid, but it is still fairly strong. This rests largely on the fact that the situation described by the conclusion would provide a good explanation, and possibly the best explanation, of the circumstances described by premises 1 and 2. Premise 3 provides additional support to the conclusion by introducing a background factor that increases the probability that it is true.
A central feature of abductive arguments is that the explanations which they advance always involve concepts that are not involved in the description of the facts that they are meant to explain. The concept of pregnancy, e.g., is central to the explanation provided by the conclusion of (A), but is not involved in premises 1 and 2, which present the facts that pregnancy hypothesis is supposed to explain. Scientific abductive arguments for the existence of theoretical entities (e.g., genes, electrons or quarks) also have this feature, for the relevant explananda are not described in terms of the theoretical entities that are meant to explain them.

Some causal arguments are also abductive arguments, and their conclusions introduce concepts (in addition to the concept of causation) which are not used to specify the evidence given in their premises. Consider:

(B) That light turns on whenever a person, large animal or running vehicle is close to it. The light’s going on must, therefore, be caused by heat in its vicinity.

Because causes explain their effects, this is an argument from certain supposed facts about when the light goes on to a proposed explanation of those facts. So (B) is, indeed, an abductive argument. What makes (B) different from simple causal arguments such as arguments (F) and (G) of section 4.2 (see pp.73 and 74) is that the proposed causal explanation of the light's going on, viz., heat, is not explicitly mentioned in the premises.

Perhaps the most important thing to understand about abductive arguments is that it is an error to suppose that an explanation is supported just because it is the only available explanation of the relevant facts. Consider the following argument, which might be advanced in a primitive or very superstitious community.

(C) Somebody is using witchcraft to try to destroy me. How else can you explain why both my sons were killed in the Battle of the Olives, why my goats are always getting sick and dying, and why my house was struck by lightning last week?

The premises here do not support the conclusion, for although witchcraft may provide the only available explanation of the facts cited, it is not an explanation that is reasonable to believe. In general, it is better to admit that there are things that we do not understand or are not subject to explanation than to grasp at an “explanation” that is completely uninformative or inadequate.

Let us refer to the above fallacy as the “only explanation fallacy.”

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Only Explanation Fallacy
Argument to the effect that a proposition is true because it gives the only available explanation of one or more states of affairs specified by its premises.

Philosophers (many of whom would love to be able to explain everything) are prone to this error — which is often in play when a philosophical position is defended on the ground that it is “the only game in town.”

An abductive argument that does not commit the only explanation fallacy will be weak if the explanation it advances is a bad one. But its premises will support its conclusion to some degree if the explanation is a good one — even if it is not the best possible. Obviously the strongest abductive arguments will be those which advance the best available good explanations of the relevant facts.

Factors that affect the quality of explanations — including their empirical adequacy, simplicity, scope, power and theoretical backing — are studied in detail in the theory of explanation, which is an important and open-ended field in the philosophy of science. We will have to make do with a few basic points that barely scratch the surface. It should also be noted that it is often difficult or even impossible to judge the quality of an explanation without special expertise in the relevant subject-matter.

One very important property of an adequate explanation is that it yields substantive predictions that could turn out to be false. An explanation that is consistent with anything is worth nothing. Consider someone’s attempting to explain why his watch has stopped by claiming that there must be a gremlin in it. This rules out nothing, and is consistent with anything that might happen to his watch. The idea that its battery is flat provides a much better explanation (even if it turns out to be false) because it yields at least one determinate prediction, viz., that the watch will start running again if the battery is replaced. This general requirement applies to explanations regardless of whether they are involved in abductive arguments.

In order for an abductive argument to qualify as strong, the explanation it advances should not only satisfy the above requirement, but should also do real work in relation to the supposed explananda mentioned in the premises. What this comes down to is:

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2 In the case of highly theoretical explanations it might be difficult to determine whether this condition is satisfied, because this could depend on background assumptions that are not part of the explanation itself.

3 It should be clear from section 1.3 that many explanations do not appear within arguments; so you should not assume that a passage involves an abductive argument merely because it contains an explanation.
(a) The relevant facts should actually require explanation.

(b) The explanation advanced should in fact explain them, i.e., make them less surprising or more predictable.

In the case of (A), e.g., Angie’s overdue period and her early morning nausea call for explanation, and they are explained by the pregnancy hypothesis. This hypothesis also has the virtue that it yields further testable predictions, viz., that a pregnancy test will yield a positive result, that Angie’s abdomen will begin to expand after a couple of months, and so on. In the case of argument (C), in contrast, it is not clear that the death of the speaker’s sons in battle or the lightning’s striking his house call for special explanation. Furthermore, the witchcraft hypothesis is idle, for it rules out nothing whatever, and it also does nothing to make the relevant events less surprising or more predictable.

Exercise Set 4.3

Answer the following questions about each of passages (1)–(8), supporting your answers as necessary.

(a) Does the passage contain an argument and, if so, is it a deductive argument, an inductive argument, an abductive argument or some other type of argument?

If the passage contains an argument:

(b) Which, if any, of the twelve logical fallacies discussed so far in Chapters 2 and 4 apply to the argument? And

(c) How strong is the argument, i.e., how well do its premises support its conclusion? (If in a particular case you do not feel competent to answer this, explain why.)

(1) Our concept of God must be innate, because there is no other explanation of how we came to have it.

4 These fallacies are: ad hominem, irrelevant appeal to authority, irrelevant appeal to popular opinion, irrelevant emotional appeal, argument from ignorance, fallacy of ambiguity, false dilemma, straw man, circular argument, hasty generalization, false cause, and only explanation fallacy.
The high rate of crime in South Africa is due to the introduction of democracy. For, as everyone knows, the crime rate has been increasing ever since the country’s first democratic election.

The reason why there are ocean tides is that the water in the oceans is attracted by the gravity of the moon and, to a lesser extent, the sun.

You guys may be skeptical, but I believe in ghosts. After a few drinks on Saturday night, three of us took a short cut home through the Brixton Cemetery, and you should have heard the weird noises there — like that Irish singer with the funny name. It made the hair on my back stand up. Then, right in the middle of the cemetery, I feel this silky thing stroking against my cheek, and go completely rigid. Then I make a grab at it — but nothing’s there. One thing’s for sure — I’ll never go to that place again.

Some people amongst the black communities felt that the best approach would be a black take-over of the “open” student organizations engineered from within. However this idea never got any real support since … black students at the University Colleges were not even allowed to participate freely in these organizations. (Steve Biko (1946–1977) in 1970 — from I Write What I Like, Ravan Press, Johannesburg, 1996, p.10.)

... in 1475, because of war in Europe, British fishermen lost access to the traditional fishing grounds off Iceland. Yet British cod stocks did not fall, and in 1490 (two years before Columbus sailed) when Iceland offered the British fishermen the chance to come back, they declined. The presumption is that they had discovered the cod-rich waters off Newfoundland and didn’t want anyone else to know about them. (Bill Bryson, Made in America, Minerva Paperbacks, London, 1995, p.13.)

... we must accept the traditions of the men of old times who affirm themselves to be the offspring of the gods — that is what they say — and they must surely have known their own ancestors. How can we doubt the word of children of the gods? (Plato (427–347 BCE), Timaeus.)

Human beings who grow up in normal communities master their first language from scratch before they are five. Notwithstanding the immense complexity of any human language, they achieve this
at a time when their capacity for non-linguistic judgment and inference is extremely limited. Children who grow up in isolation cannot ever learn a human language if they are first introduced to human society after the age of five or six. (Some evidence comes from documented cases of children cared for by wolves from early infancy.) Furthermore, despite their differences, all human languages share certain high-level features known as linguistic universals. The hypothesis that we have an innate, specialized language-learning faculty that must be activated by human society in early childhood explains all this and is, therefore, justified. (Adapted from the thought of Noam Chomsky (1928– ).)

4.4 Nondeductive Strength (III): Analogical Arguments

To give an analogy is to claim or suggest that an object of interest is similar to something else in some respect or respects relevant to matters under consideration. In what follows, I will refer to the object of interest as “the object” and the thing it is supposed to resemble as “the analogue.” Although typical analogies involve one object and one analogue, analogies with more than one object or more than one analogue are also possible.

Here are three examples of analogies:

(1) Like an iceberg, most of the human mind is concealed below the surface.

(2) Electrostatic force is like gravity inasmuch as it operates at a distance and reduces as the distance increases.

(3) Criticizing the character of the Minister of Health rather than the contents of his bill is like playing the man instead of the ball.

As (1)–(3) illustrate, the objects of analogies and their analogues can belong to various categories, including particular concrete things, particular abstract things, types of things (whether concrete or abstract), states of affairs, events, or actions. In the case of (1), the object of the analogy is the human mind, the analogue is an iceberg, and the respect in which they are presented as similar is that both are “mostly concealed below the surface.” In the case of (2), the object is electrostatic force, the analogue is gravity, and the respect in which they are presented as similar is that both are forces that operate at a distance and reduce as distance increases. In the case of (3), the object and the analogue are different types of action, and the respect in which they are supposed to be similar is not specified.
Analogies can be used for various purposes. Among other things: they can be used for literary effect; to clarify and help communicate thoughts; to help highlight or draw attention to some features (or supposed features) of the object; and to suggest ideas that may be worthy of investigation. This last use of analogies is very important in science. For instance, analogy (2) suggested to eighteenth-century scientists that the formula specifying the effect of distance on force might be the same for electrostatic force as for gravity. This actually turned out to be the case: Newton’s “inverse square law” for gravity also applies to electrostatic force. This was not, however, established by the analogy, but by careful measurement and inductive generalization.

Our main interest here is not in these uses of analogy, but in analogical arguments. An analogical argument is an argument that draws on an analogy in order to support a conclusion. More specifically, an analogical argument is one that has the following distinctive features.

(a) The premises advance an analogy and claim that the analogue has a certain key property, \( P \) (or that each of the analogues has property \( P \)).

(b) The conclusion claims (on the strength of the premises) that the object (or each of the objects) of the analogy has either property \( P \) or another specified property that is relevantly similar to \( P \) in light of the analogy.

Here, in standard form, is an example of an analogical argument that is suggested by the analogy presented by (3):

(A) 1. Criticizing the character of the Minister of Health rather than the contents of his bill is like playing the man instead of the ball.
2. Playing the man instead of the ball is against the rules.
\[ \therefore \] It is wrong to criticize the character of the Minister of Health rather than the contents of his bill.

This is painfully explicit, but (A) still provides a clear illustration of what an analogical argument involves. The first premise advances an analogy whose object and analogue were specified on p.81. The second premise claims that the key property of “playing the man instead of the ball” (the analogue) is that it is against the rules. On the strength of this, the conclusion claims that criticizing the character of the Minister of Health rather than the contents of his bill (the object of the analogy) is wrong — a property which is relevantly similar to being against the rules. I will tackle the question of how to evaluate (A) later.

Our second example of an analogical argument is an abridged version
of an argument advanced by Thomas Reid (1710–1796)\(^5\) in support of the claim that there is life on other planets in the solar system:

(B)  
There are many similarities between the earth and the other planets in the solar system: they all revolve around the sun, get their light from the sun, and are subject to the same laws of gravitation; many of them rotate on their axes and have a succession of day and night; and many of them have moons that give them light in the absence of the sun. The earth is inhabited by living creatures. So it is not unreasonable to think that the other planets are inhabited by living creatures.

The first premise of (B) advances an analogy in which the objects are the planets in the solar system other than the earth, the analogue is the earth, and the respect in which they are (correctly) presented as similar are explicitly mentioned after the colon in the first premise. The second premise identifies the key property of the analogue, viz., that it is inhabited by living creatures. And the (very tentative) conclusion attributes the same property to the objects of the analogy, viz., the other planets.

A third example of an analogical argument is suggested by the defence of the claim that there are mountains and valleys on the surface of the moon that was advanced by Galileo Galilei (1564–1642):\(^6\)

(C)  
Certain changing patterns of light and darkness that can be seen through a telescope on the surface of the moon resemble changing areas of light and shade around mountains and valleys on the earth that result from the movement of the sun relative to the mountains and valleys. This supports the claim that there are mountains and valleys on the surface of moon.

It should not be difficult for you to figure out how this fits the above description of an analogical argument.

Many analogical arguments about matters of fact can be reconstructed as inductive or abductive arguments. As we will see, this is well illustrated by (B) and (C) respectively. Reconstructing such arguments in one of these ways is often a good idea, because it can make for easier evaluation.

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\(^6\) In *The Starry Messenger*. When I say that the following analogical argument is suggested by Galileo’s defence of his claim, I am not implying or suggesting that his defence was in fact an analogical argument.
Consider (B), our abridged version of Reid’s argument. Although this argument fits the above description of an analogical argument, it can also be reconstructed as an inductive projection of the property *being inhabited by living creatures* from a single case (the earth) to further instances of the same type (the other planets in the solar system). If, to keep things simple, we collapse some of the details in (B), we can represent the core of this inductive projection as follows.

\[(B_i)\] The earth, a planet in the solar system which shares several significant properties with other planets in the solar system, is inhabited by living creatures. So we have reason to believe that the other planets in the solar system are inhabited by living creatures.

It should be obvious that (Bi) is guilty of the fallacy of hasty generalization. And it would still be guilty of this fallacy if the features of the earth and the other planets which Reid had in mind were spelled out in detail. For the earth is not a representative planet with respect to other features that make life possible, such as surface water, an atmosphere containing a significant quantity of oxygen, and temperatures within a certain range.

As previously indicated, argument (C) is a good example of an analogical argument which can be reconstructed as an abductive argument. Here’s a fairly straightforward reconstruction:

\[(C_a)\] Certain changing patterns of light and darkness that can be seen through a telescope on the surface of the moon can be explained by assuming that they are areas of light and shade caused by the movement of the sun in relation to mountains and valleys on the surface of the moon. This supports the claim that there are mountains and valleys on the moon.

It is obviously not possible to give a final evaluation of this abductive argument in the absence of information about the effectiveness of Galileo’s explanation. But I can inform you that Galileo’s explanation accounted systematically for the relevant changes of light and darkness on the surface of the moon, including intricate and surprising details; that it yielded several predictions that Galileo was able to confirm; and that no better explanation was or is available. In light of this information, it is clear that (Ca) is a strong abductive argument.

It is possible that most analogical arguments about matters of fact (including analogical arguments advanced in the empirical sciences) can, like (B) and (C), be reconstructed as other types of argument and evaluated as such. If this is correct, then the importance of analogy in
factual inquiry depends far more on the ideas it suggests for further investigation (or, in other words, its heuristic value) than on its use in analogical arguments. This is well illustrated by the comments about analogy (2) on p.82.

Analogical arguments are much more important, and are probably indispensable, in both legal and moral reasoning — as well as in other types of normative reasoning, such as reasoning about what is required by prudence, etiquette, social expectations, or rationality. All normative reasoning is subject to the logical (or perhaps conceptual) requirement that like cases must be treated alike — or, in other words, that relevantly similar cases must be treated in the same way. Although the principles of normative reasoning of a given type will often determine whether two cases under consideration are relevantly similar, it is unlikely that they will always be able to do so. And when they do not, it will be necessary to rely on analogical arguments, which are concerned with relevant similarities, to take up the slack.

Consider the case of legal reasoning. Laws cannot be so precisely formulated and so thoroughly codified that a court (or even a super computer) could simply read off whether any possible behaviour is legal or illegal. But courts are required to decide cases one way or another. And to do so when the law is unclear, or when different laws pull in different directions, they often have no alternative but to ask whether there is enough relevant similarity between behaviour under consideration and other behaviour that is known to be legal (or illegal) to justify them in classifying the behaviour under consideration in the same way.

If they decide that there is, they thereby commit themselves to an analogical argument of the following pattern.

\[(D) \quad \text{This behaviour is relevantly similar to that behaviour, which is legal (or illegal); so this behaviour is also legal (or illegal).}\]

Arguments of this pattern could also be advanced by anybody with an interest in the law. The pattern is well illustrated by the following argument.

\[(E) \quad \text{In South Africa, freedom of expression is a constitutional right. Burning the national flag is a way of expressing an opinion about the state or the government. So flag-burning is legal.}\]

I leave it to you to confirm that this satisfies the description of analogical arguments given on p.82.

We turn now to the evaluation of analogical arguments as such. The obvious question to ask when evaluating an analogical argument is whether there is enough relevant similarity between the object of the analogy and the analogue to provide reasonable support for the conclusion that the
object has the key property of the analogue, or a specified property that resembles it. This in turn raises the question of whether there are any relevant differences between the object and the analogue, viz., differences that cast doubt on the proposition that analogy supports the conclusion. If we cannot come up with any relevant differences, then we have reason to think that the premises support the conclusion. If we come up with some obvious relevant differences, then we have reason to think that the premises do not provide much support for the conclusion. Things get more difficult if it is unclear whether the differences between the object and the analogue that we consider are relevant or not. If these differences are relevant, then they must also make a difference in other cases. So it is necessary to consider whether they do make a difference other cases. And this can in turn lead to further complications. The upshot is that evaluations of the most challenging analogical arguments must be provisional. But the evaluation of many analogical arguments is fairly straightforward.

Consider (B), our abridged version of Reid’s argument for the claim that planets other than the earth are inhabited by living creatures. Some of the similarities between the earth and the other planets that are mentioned in the argument are relevant to the conclusion inasmuch as they are necessary for life on earth. But it should be clear from the above discussion of (Bi) (our inductive reconstruction of (B)) that there are further features that the earth does not share with the other planets which are crucial to life (including surface water, an atmosphere containing a significant quantity of oxygen, and temperatures within a certain range). These differences between the earth and the other planets are obviously relevant to the question of whether there are living creatures on the other planets, and they decisively undermine the conclusion that there are. So, in very general terms, argument (B) fails for lack of sufficient relevant similarities.

Let us label this shortcoming the “fallacy of insufficient similarity.”

**Fallacy of Insufficient Similarity**
Analogical argument in which there is clearly not enough relevant similarity between the object of the analogy and the analogue to provide reasonable support for the conclusion.7

I would like to emphasize that this fallacy applies only to analogical arguments in which there is clearly not enough relevant similarity to provide reasonable support for the conclusion. Usually the best way to establish this

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7 I prefer working with this nonstandard fallacy than with a standard alternative such as “weak analogy” because it has clearer criteria of application and provides a better account of what is wrong with arguments to which it applies.
is by identifying obvious relevant differences. In any event, the fallacy of insufficient similarity can be invoked to dismiss only the very weakest analogical arguments. So analogical arguments that do not commit the fallacy could still be weak.

It should not be too difficult to see that argument (C) is not guilty of the fallacy of insufficient similarity. For the similarities that Galileo found between the changing patterns of light and darkness on the surface of the moon and the changing areas of light and shade around mountains and valleys on the earth that result from the movement of the sun were not only extensive, but could be explained effectively and in detail on the basis of the same laws of nature. (This should be evident from the above discussion of (Ca), our abductive reconstruction of (C).) And there are no differences between the changing light patterns on the moon and the changing patterns of light and shade around mountains on the earth that are obviously relevant to the conclusion. So, given the details of Galileo’s explanation, (C) not only avoids the fallacy of insufficient similarity, but also qualifies as a strong analogical argument.

In evaluating analogical arguments (B) and (C), we have found it useful to draw on our evaluations of non-analogical reconstructions of these arguments. This strategy cannot be applied to argument (E) and other similar legal and normative arguments, so we have to tackle them directly.

Before we get to (E), I’d like to consider a normative analogical argument that is easier to evaluate:

(F) Removing the life-support system of a terminal patient who does not want to live is wrong, because it is like cutting the rope supporting a depressed mountaineer halfway up a cliff.

Now there is of course some similarity between removing the life-support system of a terminal patient who does not want to live (the object of the analogy) and cutting the rope supporting a depressed mountaineer (the analogue) inasmuch as both actions would result in the death of the persons supported. But there are also significant relevant differences between the two. Given that the terminal patient does not want to live, he implicitly wants the life-support system removed, because it is keeping him alive. If it is removed, he will die, which is what he wants, and we have no good reason to suppose that his dying will involve a lot of pain and suffering. On the other hand, it cannot be assumed that any depressed mountaineer is (like the terminal patient) close to death, or that she wants to die. And it is obvious that if she does die as a result of someone’s cutting the rope supporting her, then her death will probably involve considerable

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8 A defence of this claim is beyond the scope of this text.
injury, pain, and suffering. In light of these differences, argument (F) is guilty of the fallacy of insufficient similarity.

Let us now consider argument (E). The big question here is whether there is sufficiently similarity between flag-burning and the expression of opinion that is protected by the constitution to provide reasonable support for the claim that flag-burning is also legal. To be fair to the argument, we must assume that the flag-burning under consideration involves the expression of opinion, e.g., that it expresses a negative opinion about something that the government is doing. So behaviour such as setting fire to a national flag that is hanging in a building as part of an act of arson (i.e., maliciously burning the building) is not at issue. But the mere fact that the flag-burning under consideration involves the expression of opinion is not enough. To establish that it is legal, it is necessary to show that it is relevantly and sufficiently similar to other ways of expressing opinions that are known to be legal in terms of the constitution. For not all forms of expressing opinions are legal. Expressing one’s outrage at the Minister of Health’s bill by holding a knife to his throat, e.g., is not, because it is excluded by other laws.

But flag-burning has significant similarities with several ways of expressing opinions that are recognized as legal in many circumstances, such as participating in protest marches, carrying placards in public places, shouting out slogans, chanting, and doing other things to dramatize and draw attention to one’s views and even shock others into thinking about them. Burning a national flag to protest against the government in a way that does not endanger or threaten persons or property can reasonably be seen as similar to such activities. So argument (E) is not guilty of the fallacy of insufficient similarity. Indeed, it seems to me to be a fairly strong analogical argument, because I cannot come up with relevant differences between such activities and cases of flag-burning that are not intrinsically dangerous or threatening. If flag-burning were illegal for other reasons (e.g., being directly prohibited by either the constitution or a law that is constitutional), then that would be a relevant difference that undermines the argument. But, as it happens, flag-burning is legal in South Africa.9

We turn now to the evaluation of argument (A) (according to which it is wrong to criticize the character of the Minister of Health rather than the contents of his bill because this is like “playing the man without the ball,”

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9 So, from a legal point of view, argument (E) is not very interesting. But it is possible to imagine circumstances in which a more extended version of such an argument is used by a court to support a decision that flag-burning is legal. Be that as it may, I have given attention to (E) only because it provides a useful illustration of some important moves required for the evaluation of analogical arguments.
which is against the rules). I begin with two preliminary observations. First,
in order for the argument to get off the ground, it should be the case that
the analogue — “playing the man instead of the ball” — is always against
the rules. This isn’t true in all ball sports (it doesn’t apply in rugby or
American football), but it may be true in some ball sports that actions that
could be described as “playing the person instead of the ball” are always
prohibited. Soccer is a possible example, but I don’t know enough about it
to be sure. In any case, to be fair to (A), we should assume that its
premises are meant to be restricted to sports in which all such actions are
prohibited. (Actually, this restriction is something that we could simply have
taken for granted.) Second, and far more importantly, criticizing the
Minister of Health’s character rather than the contents of his bill can be
wrong or right, depending on the circumstances. For example, it is wrong
in a committee which has the task of reviewing and improving the contents
of a draft of the bill; but it may be right if the Minister, with complete
indifference to identified injustices that will result if the bill becomes law,
tries to ram it through parliament.

Now, regardless of the circumstances in which argument (A) is
advanced, it is easy to see that the only way in which we can determine
whether criticizing the character of the Minister of Health rather than the
contents of his bill is relevantly similar to “playing the man instead of the
ball” is by first determining whether it is right or wrong to criticize his
character. Thus the premises of (A) tacitly presuppose its conclusion. So
(A) should be dismissed on the ground that it is a circular argument. But
“playing the man instead of the ball” may still provide a useful
conversational analogy for criticizing the character of the Minister rather
than the contents of his bill when it is wrong to do this. As this suggests, (A)
is not guilty of the fallacy of insufficient similarity. But the fallacy of
circularity is a much more serious offence.

To end this section, I will look very briefly at an important use of
analogical arguments, viz., to challenge (and possibly refute) claims and
arguments. The analogies involved in such analogical arguments are often
introduced by an expression such as “You might as well say/argue that ....,”
“That’s like claiming/arguing that ....,” or “The same reasoning would
establish that ....” And in such cases, the conclusion of the analogical
argument (viz., that the claim or argument in question is flawed) is often
not stated explicitly.

Here’s an example of an analogical argument that challenges an
argument:

10 This is a good time to review the material on the fallacy of circular
argument in section 2.3 (on pp.43–44).
You say that we should not change the requirements for getting a student loan because we've had the current requirements for as long as we can remember. You might as well argue that slavery should not have been ended because it had been practised for so long.

The obvious conclusion, that the student-loan argument is flawed, is left implicit. We can express the argument in standard form as follows.

(G) 1. The argument that we should not change the requirements for getting a student loan because we've had the current requirements for as long as we can remember is like the argument that slavery should not have been ended because it had been practised for so long.
2. The second of these arguments is flawed.

This makes it obvious that the object of the analogy is the student-loan argument, that the analogue is the slavery argument, and that argument (G) advances the claim that the student-loan argument is flawed on the strength of the claim that the slavery argument is flawed.

We turn now to the evaluation of (Gs). The first thing to note is that the student-loan argument and the slavery argument are significantly similar insofar as both arguments advance the claim that a social practice should be retained on the sole ground that it has existed for a long time. So we should ask whether there are any relevant differences between them.

It might be suggested that one relevant difference is the fact that the conclusion of the slavery argument, viz.,

(4) Slavery should not have been ended,

is a morally outrageous proposition, while the conclusion of the student-loan argument, viz.,

(5) We should not change the requirements for getting a student loan,

is not a morally outrageous proposition. But one reason why the slavery argument is worth introducing is that, because its conclusion (= (4)) is a morally outrageous proposition, it illustrates dramatically how an argument for retaining a practice on the sole ground that it has existed for a long time can lead to an unacceptable conclusion. So the mere fact that (5) does not appear to be a morally outrageous proposition does not disqualify the analogy.
Here it is worth adding that, although (5) looks innocent enough, it is a morally objectionable proposition if the current requirements for getting a student loan discriminate unfairly against some people, such as Africans or women. And even if retaining the current requirements for getting student loans were not morally objectionable, doing so could be problematic for other reasons, e.g., because the current requirements are too complex for most students to understand, or because these requirements give rise to administrative inefficiency. Regardless of whether any of these problems apply to the current requirements, the fact that they have existed for a long time does not on its own provide much of a reason for not replacing them. So, taken in its own right, the student-loan argument is flawed. And this is something that is very well supported by the similarity between the student-loan argument and the slavery argument, which is much more obviously flawed. I therefore conclude that (Gs) is not guilty of the fallacy of insufficient similarity, and indeed that it is a reasonably strong analogical argument.

Our second and last example of an attempted refutation by an argument from analogy comes from a 1979 article in a respectable intellectual magazine:

\[(H)\]

The economic leadership denies that budget deficits lead to inflation on the ground that price increases are the cause of inflation. This is like saying that meals cause hunger. (Adapted from Tom Bethell, “Fooling the Budget,” Harper’s, October 1979, p.44.)

It is important to notice that the analogy in (H) does not apply to the whole of the argument mentioned in its first sentence, but only to the premise of that arguments, viz., the claim that price increases are the cause of inflation. The proposed analogue of this claim, which is implicitly supposed to refute it, is the claim that meals cause hunger. So the analogical argument implicit in (H) could be expressed in standard form as follows.

\[(H_s)\]

1. The claim that price increases are the cause of inflation is like the claim that meals cause hunger.
2. The claim that meals cause hunger is flawed.
\[\therefore\] The claim that price increases are the cause of inflation is flawed.

No doubt “flawed” understates what the author had in mind: he would surely have used a much stronger word, such as “absurd” or “ridiculous.” But this does not make any difference to the evaluation of the argument.

In order to explain what is wrong with (Hs), it will be convenient to present the two claims that it mentions as numbered sentences:
Price increases are the cause of inflation.

Meals cause hunger.

Now it is easy to see that the conclusion of (Hs) is true. “Inflation” means general price increases, so (4) is equivalent to:

Price increases are the cause of general price increases.

And (6e) can’t be true, because what constitutes something can’t cause it. (A cause must bring about its effect.) So (6) is flawed, as asserted by the conclusion of (Hs). But the truth of the conclusion of (Hs) has got nothing to do with the premises of (Hs). Indeed, I see no relevant similarity between (6) and (7) that could support an inference from the fact that (7) is flawed to the conclusion that (6) is flawed. Claim (7) is absurd because it asserts that certain things (viz., meals) which would relieve a certain condition (viz., hunger) actually cause that condition. But the problem with claim (6) is nothing at all like this. So (Hs) is guilty of the fallacy of insufficient similarity.

Exercise Set 4.4

Answer the following questions about each of passages (1)–(12).

(a) Does the passage contain an analogical argument (either explicitly or implicitly)? Answer “Yes” or “No.” (If the passage merely suggests an analogical argument, answer “No.”)

If your answer to (a) is “No,” answer (b):

(b) What is the main function of the passage (e.g., to express or advance an analogy, a deductive argument, an inductive argument, an abductive argument, a non-analogical statement of some type, a question, or whatever)?

If your answer to (a) is “Yes,” answer (c)–(e):

(c) Identify the object, the analogue, the key property of the analogue, and the related property attributed to the object in the conclusion of the analogical argument.
(d) Indicate whether the argument commits the fallacy of insufficient similarity and explain why or why not.

(e) Provide an overall evaluation of how strongly the premises support the conclusion and support that evaluation. (If you think that the argument can be reconstructed as either an inductive argument or an abductive argument, you are encouraged to provide and evaluate such a reconstruction and to take your evaluation of the reconstruction into account when evaluating the original analogical argument as such.)

(1) Like an onion, Verdi’s music has many layers. (Guest expert on WCPE (“The Classical Station”) on October 10, 2013, the 200th anniversary of Verdi’s birth — slightly edited.)

(2) Australian arachnologists have halved the size of the McLean’s spiders in a colony in their laboratory by adjusting these spiders’ diets over several generations. Human beings are like McLean’s spiders inasmuch as both are living creatures. So it is reasonable to believe that the size of human beings could be reduced by changing their diets over several generations.

(3) Sudeshni likes dark chocolate more than she likes milk chocolate.

(4) I really like the taste of this Colgate Max Fresh toothpaste. So, if I buy another tube, I can reasonably expect to like it too.

(5) Water pressure decreases nearer the surface because water pressure at any level depends upon the weight of the water above it. The weight of the air above any level decreases higher up in the atmosphere. So we can predict that atmospheric pressure will reduce higher up in the atmosphere. (Adapted from the thinking of Blaise Pascal, 1623–1662.)

(6) Just as water pressure decreases nearer the surface, air pressure decreases higher up in the atmosphere. In the case of water, the explanation of the decrease in pressure is that the weight of the water above any level reduces nearer the surface. So it is reasonable to conclude that air has weight and that the weight of the air above any level reduces higher up in the atmosphere. (Imaginary variation on (5) from a different perspective.)
I can tell that other people feel pleasure and pain because they behave in similar ways to the ways in which I behave when I feel pleasure and pain.

Handguns should not be banned, because doing this is like shackling everybody except criminals. (Adapted from Michael Scriven, *Reasoning*, McGraw-Hill, New York, 1976, p.211.)

Using genetic engineering to bring it about that future children have desirable characteristics is wrong, because doing so is like playing God.

Having an abortion to avoid giving birth to a gay or dyslexic child is morally suspect. But using genetic engineering to bring it about that one’s future child has characteristics which one desires is like having an abortion to avoid giving birth to a gay or dyslexic child. So using genetic engineering to bring it about that one’s future child has characteristics which one desires is morally suspect. (Adapted from p.59 of Michael Sandel, “The Case Against Perfection,” *The Atlantic Monthly*, Vol. 293, Issue 3 (April 2004), 51–62.)

Arguing that the theory of evolution should be rejected because it cannot explain everything about life is like arguing that medicine should be abandoned because it cannot cure all illnesses. This is obviously a bad argument. So the argument that the theory of evolution should be rejected because it cannot explain everything about life is also a bad argument. (Adapted from John A. Moore, “Countering the Creationists,” *Academe*, Vol.68, No.2 (March–April 1982), p.16.)

“... you should say what you mean.”

“I do,” Alice hastily replied; “at least — at least I mean what I say — that’s the same thing, you know.”

“Not the same thing a bit!” said the Hatter. “Why, you might just as well say that ‘I see what I eat’ is the same thing as ‘I eat what I see’!”

(Lewis Carroll (1832–1898), *Alice’s Adventures in Wonderland*, originally published in 1865 and now available in many editions, Chapter VII.)
Chapter 5

FORMAL VALIDITY

Consider the following two arguments, both of which are deductively valid.

(A)  
Deuteronomy is not a human being. 
\[ \therefore \text{Deuteronomy is not a woman.} \]

(B)  
1. If Zambia beat Nigeria, then Vusi lost his bet. 
2. Vusi did not lose his bet. 
\[ \therefore \text{Zambia did not beat Nigeria.} \]

A significant difference between (A) and (B) is that the validity of (A) depends crucially on the meanings of non-logical words, whereas the validity of (B) depends only on the logical form or logical structure of the argument, which arises from the application of the logical expressions “if ... then ...” and “not.” We can accordingly describe (B) as formally valid and (A) as materially valid. It is important to understand this difference.

In order to appreciate the validity of (A), one needs to be aware that the word “woman” means adult female human being, for this is what rules out the possibility of the premise being true while the conclusion is false. Think of it this way. If the conclusion of (A) were false, then Deuteronomy would be a woman, and hence a human being. So the premise would also be false. This excludes the possibility of the argument’s having a false conclusion and a true premise. So (A) is valid.

It is not, however, necessary to understand the non-logical (or “content”) words in (B) (viz., “Zambia,” “beat,” “Nigeria,” “lost,” and “bet”) in order to appreciate the validity of (B), which depends entirely on its logical form. To confirm this, consider the following nonsense-argument, which has the same logical form as (B).

(C)  
1. If snozzles chuggle, then grouchies zuggle. 
2. Grouchies do not zuggle. 
\[ \therefore \text{Snozzles do not chuggle.} \]

“Snozzles chuggle” and “grouchies zuggle” are meaningless. You cannot, therefore, take their meanings into account in evaluating (C) for validity.
Even so, assuming that you understand the logical expressions “if ... then ...” and “not,” I am confident that you see that if both the premises of (C) were true, then the conclusion of (C) would also have to be true. It is thus clear that (C) is valid, and that its validity depends only on its logical form. It should also be clear that someone who does not understand the basic propositions involved in (B) (“Zambia beat Nigeria” and “Vusi lost his bet”) can still tell that it is valid if she understands its logical structure.

The structure common to (B) and (C) can be represented by the following argument form.

(D) 1. If $p$ then $q$
2. Not $q$
3. Not $p$

To save space, we could also record this on a single line without numbering the premises, as follows.

(D) If $p$ then $q$, Not $q$ :: Not $p$

The “$p$”s and “$q$”s as they occur in (D) and other argument forms are known as propositional variables, and they represent any arbitrary proposition (but never anything less than a whole proposition).

We shall say that an argument has form (D) (or, equivalently, that it is an instance of form (D)) if it can be obtained from (D) by uniform substitution of propositions for the propositional variables in (D). For example, (B) is an instance of argument form (D) because we can get from (D) to (B) by substituting “Zambia beat Nigeria” for every occurrence of “$p$” and “Vusi lost his bet” for every occurrence of “$q$” — and then making necessary grammatical corrections (in this case, changing “Not: Vusi lost his bet” to “Vusi did not lose his bet”).

It is clear that any argument with form (D) is valid. We therefore describe (D) itself as a valid argument form. The crucial logical expressions in this case are, of course, “if ... then ...” and “not” (as it applies to a whole proposition). These are good examples of what are known as propositional operators, for when they are applied to propositions they yield new and more complex propositions in which the original propositions are embedded.

Formal validity can also arise from other logical expressions that do not apply to whole propositions. Consider the following argument.

(E) 1. Some furry animals are cats.
2. All cats are mammals.
3. Some furry animals are mammals.
It is easy to see that this argument is valid and that its validity is entirely a result of its having the structure:

(F)  Some a are b, All b are c  \( \therefore \)  Some a are c.

The validity of (E) does not depend on the specific non-logical terms that it involves (i.e., "furry animals," "cats," and "mammals") but on its logical form, which is determined by the ways in which these terms are combined by means of the relevant logical expressions. These logical expressions, "Some ... are ..." and "All ... are ...," could be labeled as term operators rather than propositional operators, because they are used to form propositions from terms rather than from other propositions. In line with this, "a," "b," and "c" as they occur in (F) are term variables rather than propositional variables.

We can confirm that (E) is formally valid by means of a nonsense-argument that also has form (F):

(G)  1. Some gazoops are beezles.
     2. All beezles are falloons. \( \therefore \)  Some gazoops are falloons.

Because the terms "gazoops," "beezles," and "falloons" are meaningless, you cannot take their meanings into account in evaluating (G) for validity. Even so, assuming that you understand the term operators "Some ... are ..." and "All ... are ...," you can no doubt recognize that if both premises of (G) were true, then the conclusion of (G) would also have to be true. It is thus clear that (G) is valid, and that its validity depends only on its logical form. It should also be clear that someone who does not understand the terms involved in (E) could still tell that it is valid if she understood its logical structure.

Validity as it applies to argument forms may now be defined as follows.

An argument form is valid iff there is no possible argument with that form in which all the premises are true and the conclusion is false.

Given that invalid = not valid, this implies that

\[ \text{valid} = \neg \text{invalid} \]

1 Although it is useful for the purposes of this text to label such logical expressions as "term operators," this is not standard nomenclature. My use of "propositional operators" is, however, standard.
An argument form is invalid iff there is at least one possible argument with that form in which all the premises are true and the conclusion is false.

Deductive formal logic is centred on the systematic study of valid and invalid argument forms. It is the most highly developed branch of logic, but we deal with only a few elementary aspects of it in Chapters 5, 6, and 7.\(^2\)

It should be evident from the above definitions that one can establish that an argument form is invalid by giving a single example of an argument of that form with all its premises true and its conclusion false. Such an argument is known as a **counterexample**. Consider the invalid argument form:

\[(H) \quad \text{If } p \text{ then } q \quad \therefore q\]

The following is a good counterexample to (H).

\[(H^*) \quad \text{If Nelson Mandela was born in Kenya, then he was born in East Africa.} \\
\therefore \text{Nelson Mandela was born in East Africa.}\]

What makes (H*) a counterexample to (H) is (i) that (H*) is an instance of (H), i.e., that it can be obtained from (H) by uniform substitution of propositions for propositional variables in (H); (ii) that the premise of (H*) is true; and (iii) that the conclusion of (H*) is false. What makes (H*) a **good** counterexample to (H) is that any reasonably informed reader should be able to tell without a special enquiry that the premise is true and the conclusion is false, and therefore that (H*) is a genuine counterexample.

Here’s a second example of an invalid argument form, in this case one involving “all” and “some”:

\[(I) \quad \text{All } a \text{ are } b, \text{ Some } b \text{ are } c \quad \therefore \text{Some } a \text{ are } c.\]

Here’s a good counterexample to (I):

\[(I^*) \quad 1. \text{ All cats are mammals.} \\
2. \text{ Some mammals are dogs.} \\
\therefore \text{Some cats are dogs.}\]

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\(^2\) If you want a solid introduction to deductive formal logic, you should take a course on symbolic logic, or work carefully through a reputable book on symbolic logic.
What makes (I*) a counterexample to (I) is (i) that (I*) is an instance of (I), i.e., that it can be obtained from (I) by uniform substitution of the terms “cats,” “mammals,” and “dogs” for the term variables “a,” “b,” and “c” in (I); (ii) that all the premises of (I*) are true; and (iii) that the conclusion of (I*) is false. What makes (I*) a good counterexample to (I) is that any reader should be able to tell without a special enquiry that the premises are all true and that the conclusion is false, and therefore that (I*) is a genuine counterexample.

Establishing that an argument form is valid is not as easy. For to say that an argument form is valid is to say that among the infinitely many possible arguments which have that form there is not one with all its premises true and its conclusion false. An argument form, in other words, is valid if it has no counterexample. But this is not something that one can prove by trying to come up with a counterexample and failing. For this failure could be due to limits to one’s imagination rather than the non-existence of a counterexample. Deductive formal logic uses various technical methods of establishing the validity of argument forms that we will touch on in Chapters 6 and 7 but not pursue in detail. The validity of some simple argument forms is nonetheless obvious to those who understand the logical terms involved, and it is possible to develop the cognitive skills involved in their recognition.

The obvious validity of some very simple argument forms is well illustrated by the case of

\[(J) \quad p \text{ and } q \quad \therefore p.\]

Instances of this form are all rather silly arguments, like

\[(J^*) \quad Bill \: Clinton \: was \: President \: of \: the \: USA \: in \: 1998 \: and \: George \: W. \: Bush \: was \: President \: of \: the \: USA \: in \: 2002. \quad \therefore Bill \: Clinton \: was \: President \: of \: the \: USA \: in \: 1998.\]

One reason why such arguments are silly is that they are so obviously valid that they are seldom worth advancing. The validity of (J) is a direct consequence of the meaning of “and”: One cannot know what “and” means without knowing (even if only tacitly) that if \(p \text{ and } q\) is true, then \(p\) must also be true.

The previous five paragraphs have been concerned with the validity and invalidity of argument forms. We now return to the formal validity and formal invalidity of actual arguments composed of fully-fledged propositions and terms rather than mere propositional variables and term variables. These two concepts can now be defined as follows.
An argument is formally valid iff it has a valid form.

An argument is formally invalid iff it does not have a valid form.

You should confirm that in terms of the first of these definitions arguments (B), (E), and (J*) are formally valid (as we already knew). It can be also be seen that in terms of the second definition that arguments (A), (H*), and (I*) are formally invalid. In the case of (A) this is because the argument’s validity is not a matter of form. Thus although (A) is materially valid it is formally invalid. (H*) and (I*) are not only formally invalid, but also invalid without qualification.

The above definitions imply that an argument must have at least one valid form to qualify as formally valid but no valid forms to qualify as formally invalid. This is necessary to accommodate the fact that a single argument can be an instance of more than one argument form.

Argument (E), e.g., not only has form (F), but also has this form:

\[(K) \quad p, q \quad \vdash r.\]

To confirm that (K) is indeed a form of (E), note that (E) can be obtained from (K) by substituting the first premise of (E) for \(p\), the second premise of (E) for \(q\), and the conclusion of (E) for \(r\). It is obvious that (K) is not a valid argument form. Here’s a good counterexample:

\[(K^*)\]

1. Johannesburg is in South Africa.
2. New York is in America.
\[\vdash\] Cape Town is in China.

So even though (E) is a formally valid argument, it is not formally valid because it is an instance of form (K). It is formally valid because it is an instance of another valid form, viz., (F).

As the case of argument (E) illustrates, one cannot show that an argument is formally invalid by establishing that one of its forms is invalid. However, one can show that an argument is formally invalid by establishing

---

3 This substitution qualifies as uniform because it does not involve the substitution of different propositions for the same propositional variable at different points in (K). It could not be non-uniform, because no propositional variable occurs more than once in (K). So this is a “limit case” of uniform substitution.
that it has a fully detailed logical form that is invalid — where a fully
detailed logical form of an argument is one that reflects the workings of all
its logical vocabulary.\footnote{This principle is not always easy to apply, because it is sometimes unclear which of the vocabulary that occurs in an argument should be treated as logical.}

The remaining two chapters of this text are concerned with matters
related to the idea of formal validity and its applications. Chapter 6 deals
with term operators and Chapter 7 with propositional operators. The
question of how to deal with the formal validity and invalidity of arguments
that essentially involve both these types of logical expressions together is
beyond the scope of this text, but is dealt with systematically in basic books
and courses on symbolic logic.

Exercise Set 5

I. Indicate whether each of arguments (1)–(7) is \textbf{formally valid},
\textbf{materially valid}, or \textbf{invalid}.

(1) \textit{South Africa beat Angola. If South Africa beat Angola, then Vusi
won his bet. Thus South Africa beat Angola and Vusi won his bet.}

(2) \textit{Sibisi is a bachelor; therefore Sibisi is a man.}

(3) \textit{Sibisi is not a bachelor; therefore Sibisi is not a man.}

(4) \textit{Either South Africa beat Morocco or Vusi lost his bet. Therefore
South Africa beat Morocco.}

(5) \textit{If Obama was born in America, then he was not born in Kenya. He
was born in Kenya. Therefore he was not born in America.}

(6) \textit{Some friends of mine are members of the Philosophy Club. All
members of the Philosophy Club are philosophy students. Therefore some friends of mine are philosophy students.}

(7) \textit{All friends of Sonia are members of the Philosophy Club. All friends
of Ahmed are members of the Philosophy Club. Therefore all
friends of Sonia are friends of Ahmed.}

4 This principle is not always easy to apply, because it is sometimes unclear which of the vocabulary that occurs in an argument should be treated as logical.
II. Which of argument forms (8)–(12) are valid and which are invalid? Give a good counterexample to each one that is invalid.

(8) \[ p \implies p \text{ and } q \]

(9) \[ \text{If } p \text{ then } q, \ p \implies q \]

(10) \[ \text{If } p \text{ then } q, \ q \implies p \]

(11) \[ \text{All } a \text{ are } b, \text{ All } b \text{ are } c \implies \text{All } a \text{ are } c \]

(12) \[ \text{Some } a \text{ are } b, \text{ Some } b \text{ are } c \implies \text{Some } a \text{ are } c \]
Chapter 6

“ALL,” “SOME,” “SOME NOT,” AND “NO”

6.1 Categorical Propositions

As we saw in Chapter 5, some arguments are formally valid because of term operators such as “All ... are ...” and “Some ... are ....” The main purpose of Chapter 6 is to discuss some basic valid and invalid argument forms involving such operators. Section 6.1 is not primarily concerned with whole arguments, but with propositions that can be formed by means of four basic term operators and the relationships between those propositions. It also deals briefly with other propositions that are equivalent to those that can be formed by means of these operators. The basic tools to be developed in section 6.1 will be put to work in the evaluation of arguments in sections 6.2 and 6.3.

Throughout this chapter, I will use the word “term” to stand for general terms in the form of plural count nouns and count noun phrases (see section 3.1). Here are some examples:

<table>
<thead>
<tr>
<th>SIMPLE TERMS</th>
<th>COMPOUND TERMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>elephants</td>
<td>women who own obese dogs</td>
</tr>
<tr>
<td>people</td>
<td>very large men</td>
</tr>
<tr>
<td>politicians</td>
<td>supporters of Bafana Bafana</td>
</tr>
<tr>
<td>husbands</td>
<td>yellow things with big ears</td>
</tr>
</tbody>
</table>

Simple terms are terms that do not contain other terms as parts, while compound terms are terms that do contain other terms as parts. The compound term “women who own obese dogs,” e.g., contains the terms “women,” “obese dogs” and “dogs” (which is also part of “obese dogs”).

The most basic propositions with which we will be concerned are known as standard form categorical propositions. There are four basic forms of proposition within this general class:

<table>
<thead>
<tr>
<th>NAME OF FORM</th>
<th>STRUCTURE OF PROPOSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal Affirmative</td>
<td>All (term) are (term)</td>
</tr>
<tr>
<td>Universal Negative</td>
<td>No (term) are (term)</td>
</tr>
<tr>
<td>Particular Affirmative</td>
<td>Some (term) are (term)</td>
</tr>
<tr>
<td>Particular Negative</td>
<td>Some (term) are not (term)</td>
</tr>
</tbody>
</table>
It is clear that every standard form categorical proposition contains two terms, each of which may be either simple or compound. The first of these terms is known as the **subject** of the proposition, and the second is known as the **predicate**. We will ignore the internal structures of compound subjects and predicates, even though they may sometimes affect validity. Note that a term that is part of a subject or predicate does not itself count as a subject or predicate.

A good way of testing whether an expression is a term in the sense of this chapter is by asking whether it can occur grammatically in both subject and predicate positions in the above structures. Unless both occurrences are possible, the expression does not qualify as a term. “Yellow,” e.g., is not a term because, even though it can occur grammatically in predicate position (as in “No crows are yellow”), it cannot occur grammatically in subject position. “Some yellow are cars” is not good English. But “yellow” can, be made into a term, viz., “yellow things” (which can occur in both positions).\(^1\)

In order to display the logically important structure of categorical propositions clearly, it is useful to symbolize their subject and predicate terms by means of capital letters. For example, the structure of the universal negative proposition

\[ (1) \quad \text{No members of the Meat Association are friends of the Animal Society} \]

is clearly displayed by

\[ (1s) \quad \text{No } M \text{ are } F, \]

where “M” represents “members of the Meat Association” and “F” represents “friends of the Animal Society.”

When symbolizing categorical propositions, it is necessary to provide a key to indicate which letters represent which terms. The convention I will most often use for doing this is to capitalize one appropriate word within each term, thereby indicating that the first letter of that word should be used to represent the whole term. And when it is necessary to identify the subject and predicate of a categorical proposition explicitly, we may do so by enclosing the whole of each term in square brackets. To illustrate, in the particular negative proposition

\[ (2) \quad \text{Some [MARRIED men] are not [GOOD lovers]}, \]

\(^1\) It is recommended that you attempt exercise I in exercise set 6.1 before proceeding further.
the square brackets indicate that the subject and predicate are “married men” and “good lovers” respectively, and the capitalized words indicate that “M” should be used for “married men” and “G” for “good lovers.” Given this key, the correct symbolization of (2) is

(2s) Some M are not G.

As hinted earlier, some propositions that are not standard form categorical propositions can be re-expressed as such. The following are examples of propositions not in standard form, followed by their standard form equivalents (with suitable words capitalized), and their symbolizations (in that order). You should refer to the table of standard form categorical propositions on p.103 to see why it is necessary to modify these propositions in order to get them into standard form.

(3) Whales are not fish. (Original proposition)
(3a) No WHALES are FISH. (Standard form equivalent)
(3s) No W are F. (Symbolization)

(4) Only mammals are cats.
(4a) All CATS are MAMMALS.
(4s) All C are M.

It is important to recognize that (4) is not equivalent to “All mammals are cats.” The equivalence between (4) and (4a) is an instance of the following general principle.

“Only s are p” is equivalent to “All p are s” and not to “All s are p.”

(In this statement, the small letters “s” and “p” function as term variables, which represent any terms whatever.)

Here are some further examples of propositions which are not in standard form, their standard form equivalents, and their symbolizations:

(5) Some married men love their wives.
(5a) Some [MARRIED men] are [men who LOVE their wives].
(5s) Some M are L.
(6) Every patriot supports Bafana Bafana.

(6a) All PATRIOTS are [SUPPORTERS of Bafana Bafana].

(6s) All P are S.

(7) Not all students are brilliant.

(7a) Some STUDENTS are not [BRILLIANT people].

(7s) Some S are not B.

The move from (7) to (7a) illustrates another important logical principle:

The negation of a universal affirmative proposition is equivalent to the corresponding particular negative proposition.

Using “::” as a sort of two-directional therefore-sign, we can re-express this logical equivalence as:

(A) Not all s are p :: Some s are not p VALID EQUIVALENCE

This means that each of these two propositions implies the other. Another closely related equivalence is:

(B) Not (some s are not p) :: All s are p VALID EQUIVALENCE

Here “Not (..)” is meant to stand for any appropriate expression for the negation of a whole proposition, e.g., “It is not true that ..” or “It is not the case that ..”

A further two equivalences that are closely related to (A) and (B) are:

(C) Not (no s are p) :: Some s are p VALID EQUIVALENCE

(D) Not (some s are p) :: No s are p VALID EQUIVALENCE

All these equivalences are useful in rewriting categorical propositions in standard form.²

It is possible to represent categorical propositions by means of what are known as Venn Diagrams. As we will see in section 6.2, these are very

² Exercise II of exercise set 6.1 is recommended at this point.
useful for testing certain argument forms for validity. The inside of an empty circle labelled with a capital letter will be used to represent the term that the letter symbolizes, or the set of things that the term denotes. Thus if “C” symbolizes “cats,” then the inside of the circle

simply represents the term “cats,” or the set of cats. If we draw a cross in this circle, the resulting diagram represents the claim that this set is not empty. In other words, it says that there are cats, or that at least one cat exists. If we draw a cross outside the circle, the resulting diagram says that at least one non-cat exists. Thus the diagram

represents the content of the following two claims taken together.

(8)  \textit{At least one cat exists.}

(9)  \textit{At least one thing which is not a cat exists.}

If we blank out an area, we thereby represent emptiness or non-existence. Thus the diagram

represents the claim that no cats exist. (When you draw Venn Diagrams,
you can blank out an area in any obvious way, such as shading it in or filling it up entirely with parallel lines.) We should obviously not tolerate a diagram in which an area that contains a cross is also blanked out, because such a diagram would represent a logically impossible situation.

We come now to the Venn Diagrams for the four standard form categorical propositions, beginning with the particular affirmative,

(10)  Some s are p.

What this in effect says is that there exist things that are both s and p. Ordinary English makes no precise commitment about how many such things there are. For the sake of determinacy, we will follow standard logical practice and assume that (10) is true if there is at least one thing to which “s” and “p” both apply. This allows us to depict (10) as follows, for the cross here falls in both the s and the p circles.

(10d)

\[
\begin{array}{c}
\text{s} \\
\text{X} \\
\text{p}
\end{array}
\]

Notice that the converse\(^3\) of (10), “Some p are s,” has the same Venn Diagram as (10), and is logically equivalent to it. The diagram for a specific particular affirmative proposition would be the same as (10d), but with the circles labelled differently, e.g., the diagram for (5a)/(5s) would be exactly the same as (10d), but with “M” replacing “s” and “L” replacing “p”.

The particular negative

(11)  Some s are not p

should obviously be diagrammed as follows.

\[\text{---}\]

\(^3\) The converse of a standard form categorical proposition is the proposition that results when its subject and predicate are switched around.
This represents the claim that there are things (at least one of them) that are s but not p. The diagram for the converse of (11), "Some p are not s," is different from (11d) since it has a cross in the p-but-not-s area rather than the s-but-not-p area. Thus a particular negative and its converse are not logically equivalent.

The universal negative

(12) No s are p

is equivalent to the claim that no things are both s and p. Thus the area common to the s and p circles (the "lens" between s and p) must be empty:

It is worth observing that, as it stands, this diagram does not say that any s exist, that any p exist, or that anything whatever exists (but all this might be presupposed in an everyday conversation).

Two further points should be noted. First, the converse of (12), "No p are s," has the same diagram as (12) and is therefore logically equivalent to it. Second, diagrams (12d) and (10d) represent exactly opposite states of affairs, for the very same area that is empty in (12d) is occupied in (10d). Since that area must be either occupied or empty but not both, the propositions diagrammed must be logical opposites, so that one of the two is true and the other false. In a word, such propositions are known as contradictories of one another. This is, however, simply another face of equivalences (C) and (D), for it is clear that two propositions are contradictories iff either one is equivalent to the negation of the other.
For the sake of determinacy, we will depart from ordinary language and take the universal affirmative

(13)  \( \text{All s are p} \)

to assert that if any things are s, then they are also p. This does not itself say that some things are s, but merely rules out the possibility of there being s which are not p. The s-but-not-p area, it asserts, is empty:

(13d)

In the diagram for the converse of (13), “All p are s,” it is the p-but-not-s area rather than the s-but-not-p area that is blanked out. Thus a universal affirmative and its converse are not in general equivalent. Notice also that, as diagrams (13d) and (11d) illustrate, a universal affirmative and the corresponding particular negative are contradictories, or exact opposites, of one another. This is, of course, another aspect of equivalences (A) and (B).

To close this section let me summarize the logical relations between categorical propositions and their converses that have been mentioned:

(E) Conversion (two forms)

\[
\begin{align*}
\text{Some s are p} & \equiv \text{Some p are s} & \text{VALID EQUIVALENCE} \\
\text{No s are p} & \equiv \text{No p are s} & \text{VALID EQUIVALENCE}
\end{align*}
\]

(F)  \[
\begin{align*}
\text{Some s are not p} & \not\equiv \text{Some p are not s} & \text{INVALID} \\
\text{All s are p} & \not\equiv \text{All p are s} & \text{INVALID}
\end{align*}
\]

Note that the phrase “valid by conversion” applies only to arguments legitimated by (E).

Exercise Set 6.1

I. Indicate whether each of (1)–(5) is a standard form categorical proposition. If it is, identify its subject and predicate, and name its form (“universal negative,” or whatever).
1. Some cats have tails.

2. All good tennis players are fantastic lovers.

3. Some beautiful women are not friends of the animal society.

4. No pink elephants are gumbies with striped tails who love to gaze at the moon.

5. All who like logic are my friends.

II. For each of propositions (6)–(10):

(a) Re-express the proposition as a standard form categorical proposition, enclosing its subject and predicate terms in square brackets and capitalizing a suitable word in each term to serve as a symbolization key.

(b) Symbolize the proposition.

6. Some lions are white.

7. Some men don’t have girlfriends.

8. Every cat has a tail.

9. Only fools think they can pass this course without working hard.

10. It is not true that no students will be able to solve exercise (9).

III. For each of propositions (11)–(15):

(a) Re-express the proposition as a standard form categorical proposition, enclosing its subject and predicate terms in square brackets and capitalizing a suitable word in each term to serve as a symbolization key.

(b) Symbolize the proposition.

(c) Draw a Venn Diagram that represents the proposition.

11. At least one politician is honest.
6.2 Standard Form Syllogisms

A standard form syllogism is an argument that has the following features:

(a) It has two premises, both of them standard form categorical propositions.

(b) Its conclusion is a standard form categorical proposition.

(c) The subject of the conclusion is either the subject or the predicate of one of its premises.

(d) The predicate of the conclusion is either the subject or the predicate of the other premise.

(e) Three terms occur in subject or predicate position in the argument. (Thus the two premises have one term in common. This is often called the middle term.)

The following argument, e.g., satisfies all these conditions and so qualifies as a standard form syllogism. This is most readily evident from the symbolization of the argument, which is given below it.

\[\text{(A)}\]

1. Some [CONSERVATIONISTS] are not [FRIENDS of the Animal Society].
2. All [friends of the animal society] are [GENEROUS people].
\[\therefore \] Some [conservationists] are not [generous people].

\[\text{(As)}\]

Some C are not F, All F are G \[\therefore \] Some C are not G.

You should confirm that the above definition of a syllogism also covers arguments (E) and (I\(^*\)) of Chapter 5 (p.96 and p.98).

There is a simple mechanical procedure to determine whether a
syllogism is valid by means of Venn Diagrams. This procedure is worth mastering, especially because it provides a useful means of showing why certain arguments are valid or invalid. It is not, however, a substitute for non-mechanical thinking about an argument, and you should always try to figure out whether an argument is valid or invalid before applying such a test. This will not only serve as a check on your application of the test, but will also help to develop your natural powers of reasoning.

You should, e.g., be able to see that argument (A) is invalid before applying the Venn Diagram test to it (which we will do a few pages hence — see Example 4 on pp.118). After all, it is easily possible for both premises of (A) to be true while the conclusion is false. Suppose, e.g., that the premises are true, but that the conservationists who are not Friends of the Animal Society are generous anyway. (Maybe they didn’t sign up as “Friends” because they give all their free time and a lot of their resources helping to upgrade and empower a squatter community.)

The Venn Diagram test for syllogistic validity is as follows. We diagram both premises on three overlapping circles representing the three terms that occur in subject or predicate position in the argument. We then examine this diagram to see whether it contains the diagram for the conclusion. If it does, then the argument is valid. If it does not, then the argument is syllogistically invalid. (“Syllogistically invalid” rather than “invalid” without qualification because it might be valid because of features to which the Venn Diagram test is not responsive.) I now explain and illustrate this procedure with the help of four examples.

**EXAMPLE 1:** Is the following syllogistically valid?

(B)  
All m are p, All s are m : All s are p.

**Step 1:** Draw three overlapping circles representing the three terms, with the subject of the conclusion on the top left, the predicate of the conclusion on the top right and the middle term at the bottom centre. (This layout facilitates evaluation at the last step of the procedure.)
Step 2: Plot one premise (in this case the first, “All m are p”):

Notice that the whole of the m-but-not-p area must be blanked out here, including the part falling within the s circle, for what the premise says is that all m are p, not that all m, except those that are s, are p.

Step 3: Plot the other premise (“All s are m”) in the same diagram:

Step 4: Look and see whether the resulting diagram contains the diagram for the conclusion (“All s are p”), the diagram of which is as follows.
This is contained in (Bd), because all the areas which are blanked out here are also completely blanked out in (Bd). This shows that the conclusion of (B) must be true if its premises are. The argument is, therefore, **valid**.

**EXAMPLE 2:**

(C) \[\text{All } m \text{ are } p, \text{ All } m \text{ are } s \implies \text{All } s \text{ are } p.\]

Combining steps 1–3 above, we diagram both of the premises as follows.

(Cd)

This shows that the argument is **not syllogistically valid**. For if it were, the entire \(s\)-but-not-\(p\) area would have been blanked out, as in the diagram for the conclusion:

Note that it is not necessary to diagram the conclusion itself unless you find it useful to do so.

Diagramming particular propositions (both affirmative and negative) in a three-circled Venn Diagram can present a small problem. Suppose, e.g., that we want to diagram

(1) \[\text{Some } s \text{ are } m\]
in a three-circled Venn Diagram in which the terms are "s," "p" and "m." We know that we should place a cross in the both-s-and-m area, i.e., in the lens between s and m. However, we are not justified in placing it within the p circle as well, as in the following diagram.

This is no good because it represents the claim that some things are s, m and p, which goes beyond what is said by (1). For exactly parallel reasons, we are not justified in putting the cross outside the p circle. To solve this problem, we place it on the borderline of the p circle, thus:

This leaves it open whether the items represented by the cross are p or not. In other words, although they must be either p or not p, we are not entitled to assume that they are p and are also not entitled to assume that they are not p.

The above problem would not have come up if, e.g., the s-but-not-p area had already been blanked out, as in:
If we already had this and we wished to plot (1) on the same diagram, we could be sure that the cross should go inside the \( p \) circle since the s-and-m area outside it is already blanked out. In these circumstances we get the following.

Because crosses on borderlines are a nuisance, we should **always diagram a universal premise before a particular premise**. Sometimes this strategy will not help, but it often will.

**EXAMPLE 3:**

\[(D) \quad \text{Some s are m, All m are p} \quad \therefore \quad \text{Some s are p.}\]

The diagram for the premises is as follows.
To arrive at \((Dd)\) we plot the second premise — the universal premise — first. In order for the truth of the conclusion to be guaranteed, there should be a cross **anywhere** within the both-s-and-p area, and there is. Hence the argument is valid.

**EXAMPLE 4:**

Let us now use a Venn Diagram to test argument \((A)\) of this section (p.112). I repeat its symbolization for ease of reference:

\[
(As) \quad \text{Some } C \text{ are not } F, \text{ All } F \text{ are } G \therefore \text{Some } C \text{ are not } G.
\]

Here we cannot avoid fence-sitting, and the diagram for the premises is as follows.

\[
(Ad) \quad C \quad G \quad F
\]

For the truth of the conclusion of \((A)\) to be guaranteed, there would have to be a cross which is **definitely in** the C-but-not-G area. A cross sitting on the fence is not enough, since it leaves open the possibility that the items concerned actually belong on the wrong side of the fence. Hence \((A)\) is syllogistically invalid (as we figured out earlier).
Venn Diagram are not the only way of testing for syllogistic validity. It is also possible to specify requirements that any valid syllogism must satisfy. Here is an incomplete set of such requirements:

**Some Requirements for Valid Syllogisms**
A standard form syllogism cannot be valid unless
(i) it has at least one universal premise;
(ii) it has at least one affirmative (= non-negative) premise;
(iii) if it has a universal conclusion, then both its premises are universal; and
(iv) if it has a negative conclusion, then it has a negative premise.

Any syllogism that fails to satisfy all four of these requirements is invalid. You can confirm this yourself using Venn Diagrams.

As indicated above, this set of requirements is not complete. So even if a syllogism satisfies all four of these requirements, this does not guarantee that it is valid. To illustrate, syllogistic form (C) (p.115) satisfies all four of the above requirements, but is still syllogistically invalid (as we have shown by means of a Venn Diagram). It is possible to make the above list of requirements complete by adding requirements about the whether terms occurring in the argument are “distributed” in the premises and conclusion. But it would take us too far afield to present and explain the concept of distribution and these distribution requirements.

One final point is worth noting. Occasionally the result of the Venn Diagram test may not coincide with a well-considered judgment about whether a syllogism is valid or invalid. This could be due either (i) to the partial redefinitions of ordinary English expressions that we have adopted in order to make them determinate enough for Venn Diagram representation, or (ii) to background assumptions that have not been represented in the Venn Diagram for the argument. Mechanical tests are useful, but in the case of everyday arguments they can never be final.

**Exercise Set 6.2**

I. For each of argument forms (1)–(4):

(a) Determine whether the argument form is syllogistically valid or invalid by means of a Venn Diagram. If it is invalid:

(b) Give a good counterexample to the argument form. And:

(c) Indicate which, if any, of the above four requirements for validity it fails to satisfy.
(1)  No s are m, Some m are p  ∴ Some s are not p.
(2)  All s are m, No m are p  ∴ No s are p.
(3)  Some s are not m, All m are p  ∴ Some s are not p.
(4)  Some s are m, Some m are p  ∴ Some s are p.

II. Symbolize the following syllogisms and test them for syllogistic validity using Venn Diagrams.

(5)  Some MARRIED women are terrific LOVERS. All terrific lovers are BEAUTIFUL people. Thus some beautiful people are married women.

(6)  No GAZOOPS are BEEZLES. No beezles are JELLICLES. Thus some gazoops are not jellicles.

6.3 Other Arguments

Some arguments that are not standard form syllogisms can be re-expressed as standard form syllogisms and then tested for validity by means of Venn Diagrams. Here's an example:

(A)  I will buy a drink for any student who gets full marks on the upcoming test. But, since no student in the class will achieve that, I won't be buying drinks for any of them.

You should attempt to rephrase this as a standard form syllogism themselves before reading further.

The first step in re-expressing an appropriate argument as a standard form syllogism is to identify its premises and conclusion. Let us do this in the case of (A) by means of an argument diagram:

(A*)  

1.  I will buy a drink for any student who gets full marks on the upcoming test.
2.  But, since no student in the class will achieve that, I won't be buying drinks for any of them.
The next step is to re-express 1, 2 and 3 as standard form categorical propositions in such a way that any two of them have exactly one term in common. Since 1 says something positive about any student who satisfies a certain condition, it should be reformulated as a universal affirmative:

(1) \text{All [students who will get full marks on the upcoming test] are [students for whom I will buy drinks].}

Premise 2 is clearly best understood as a universal negative, and must be formulated in a way that ensures that it has one term in common with (1):

(2) \text{No [students in the class] are [students who will get full marks on the upcoming test].}

Proposition 3, the conclusion of (A), is equivalent to saying that I will be buying drinks for no students in the class, so it should be re-expressed as a universal negative that shares one of its terms with (1) and the other with (2):

(3) \text{No [students in the class] are [students for whom I will buy drinks].}

We can now put (1), (2) and (3) together as a standard form syllogism, capitalizing appropriate words in the first occurrence of each term for symbolization purposes:

\text{(Aa) 1. All [students who will get FULL marks on the upcoming test] are [students for whom I will buy DRINKS].}

\text{2. No [students in the CLASS] are [students who will get full marks on the upcoming test].}

\text{3. \Rightarrow No [students in the class] are [students for whom I will buy drinks].}

The symbolization of (Aa) is:

\text{(As) \quad All F are D, No C are F \quad \Rightarrow No C are D.}

And here's the Venn Diagram:
Since the whole of the C-and-D area is not blanked out, the truth of the conclusion is not guaranteed. Thus (A) is syllogistically invalid.

Here’s a second example of an argument that can be re-expressed as a syllogism:

(B) Jellicles love to gaze at the moon. Nothing that loves gazing at the moon likes the company of crocodiles. Thus it is not true that some jellicles like the company of crocodiles.

You should attempt to put this in standard form yourself before inspecting the following way of doing it.

(Ba) 1. All [JELLICLES] are [animals that love to gaze at the MOON].
2. No [animals that love to gaze at the moon] are [animals that like the company of CROCODILES].
   \[\therefore\] No [jellicles] are [animals that like the company of crocodiles].

Getting the conclusion into appropriate shape involves a tacit appeal to equivalence (D) of section 6.1, which also contains other material that is worth reviewing at this point.

The symbolization of (Ba) is:

(Bs) All J are M, No M are C \[\therefore\] No J are C.

And here’s the Venn diagram:
This is clearly valid since the whole J-and-C area is blanked out, which guarantees the truth of the conclusion.

Note, finally, that Venn Diagrams can be used to test arguments other than syllogisms. I illustrate the point with two examples.

(C) 1. CATS exist.
2. All cats are MAMMALS.
   \[
   \therefore \text{Mammals exist.}
   \]

The following depicts the contents of all the premises of (C) taken together.

(Cd)

(Note that the first premise was diagrammed after the second.) The truth of the conclusion is guaranteed if there is a cross in the M circle, and there is. Thus the argument is valid.

Our second example and last involves three separate conclusions based on a single set of premises:

(D) 1. No GUMBIES are JELLICLES.
2. All BLACK cats are jellicles.
3. At least one black cat exists.
   \[
   \therefore \text{(i) Some black cats are not gumbies.}
   \text{(ii) All jellicles are black cats.}
   \text{(iii) Gumbies exist.}
   \]
The Venn Diagram for the premises of (D) is as follows.

(Dd)

Since there is a cross in the B-but-not-G area, the argument to conclusion (i) is valid. For the premises to guarantee conclusion (ii) the whole of the J-but-not-B area would have to be blanked out, and for them to guarantee conclusion (iii) a cross would have to appear somewhere or other within the G circle. Since neither of these is the case the arguments to conclusions (ii) and (iii) are both invalid.

It is possible to adapt Venn Diagrams to test certain arguments involving more than three terms, but the details are beyond the scope of this text.

Exercise Set 6.3

I. For each of arguments (1)–(5):

(a) Rewrite the argument as a standard form syllogism, enclosing the three main terms in square brackets and capitalizing suitable words as a key to symbolization.

(b) Symbolize the argument.

(c) Use a Venn Diagram to test it for validity.

(1) Only Zoo-Groupies are entitled to pet the gorilla, but at least one student in this class may do so. Thus someone in this course is a Zoo-Groupie.

(2) None but good students will get this problem right. From this we can see that some students are not good students, since it is not true that all students will in fact get the problem right.
The after-image is not in physical space, but the brain process is. So the after-image is not a brain process. (J.J.C. Smart)

Not all old men who live in Houghton are contented. Thus some old men who live in Houghton are not rich, for every rich man is contented.

It’s not true that only men like watching soccer on TV. Some Voltarians do. Therefore there are Voltarians who are not men.

II. Determine whether the following are valid or invalid according to the Venn Diagram test.

1. There are no such things as UNICORNS.
2. COWS exist.
3. All cows are HORNED creatures. Some horned creatures are not unicorns.

1. All GAZOOPS are BEEZLES.
2. All beezles are LOVERS of the moon.
3. Lovers of the moon exist. Gazoops exist.

III. Draw a Venn diagram representing the contents of propositions (a)–(d) together and use that Venn Diagram to determine whether each of propositions (8)–(11) is definitely true, definitely false or indeterminate if we assume only that (a)–(d) are all true. (Indeterminate = given only that (a)–(d) are true, it is impossible to tell whether the proposition concerned is true or false.)

Assume:

(a) Only SNOCKERS are EVANATIONS.
(b) Some FALLOONS are not Snockers.
(c) No Evanation is a Falloon.
(d) Some Snockers are not Falloons.

True, False or Indeterminate? :-)
(8) Snockers exist.

(9) Some Falloon is not an Evanation.

(10) There is at least one thing that is an Evanation, a Snocker and a Falloon.

(11) No Snocker is a Falloon.
Chapter 7

“NOT,” “IF,” “AND,” AND “OR”

7.1 Symbolization (I)

As indicated in Chapter 5, some arguments are formally valid because of propositional operators such as “if ... then ...” and “not.” The main purpose of this final chapter is to explore some basic valid and invalid argument forms involving propositional operators. As we saw in Chapter 6, when assessing arguments for formal validity and invalidity it is often convenient to re-express them in terms of special symbols that allow for the transparent display of relevant aspects of their logical forms. Sections 7.1 and 7.2 provide a brief introduction to the elements of such a symbol-system for propositional operators. We will put these symbols to work in the evaluation of argument forms and arguments in sections 7.3 and 7.4.

Our most important symbols, which represent four basic logical expressions (and their equivalents), are as follows.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>BASIC ENGLISH</th>
<th>EQUIVALENT</th>
<th>NAME OF OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>~</td>
<td>It is not the case that ...</td>
<td>Negation</td>
<td></td>
</tr>
<tr>
<td>→</td>
<td>If ... then ...</td>
<td>Conditional</td>
<td></td>
</tr>
<tr>
<td>&amp;</td>
<td>Both ... and ...</td>
<td>Conjunction</td>
<td></td>
</tr>
<tr>
<td>v</td>
<td>Either ... or ...</td>
<td>Disjunction</td>
<td></td>
</tr>
</tbody>
</table>

These logical expressions are all propositional operators, which yield more complex propositions when they are applied to simpler propositions.

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1 For the sake of readers who are acquainted with basic symbolic logic, I should mention that I am not using these symbols as they are understood in standard first-order logic, but as proxies for their basic English equivalents in their everyday uses. (I qualify this a bit as we proceed.) The most notable result of this approach is that the oddities of the material conditional do not apply to “→.” I use the approach in order to encourage readers to think carefully about formal validity and invalidity with respect to logical operators of everyday English.
Negation is a one-place operator. This means that it takes one proposition and makes a more complex proposition out of it. For example, if we apply negation to the proposition

(1) Ahmed loves Sudeshni,

we get the more complex proposition

(2) It is not the case that Ahmed loves Sudeshni,

or, in more idiomatic English,

(2a) Ahmed does not love Sudeshni.

(2) and (2a) are naturally described as “negations of (1).” As such they deny precisely what (1) asserts. As this case illustrates, the word “negation” can be used for a whole proposition as well as for a sign or expression for the negation operator. Careful readers should not have a problem recognizing which applies on any particular occasion.

Apart from our symbols for the above propositional operators, we also need symbols for the propositions to which they are applied. Appropriate capital letters will be used for this purpose. We could, e.g., use the letter “L” to represent the proposition that Ahmed loves Sudeshni. If so, the correct symbolization of (1) would be just

(1s) L.

In order to symbolize (2) or (2a), we would simply apply our symbol for negation (“~”) before “L,” thus:

(2s) ~L,

pronouncing this as “it is not the case that L,” or “not L” for short.

Notice that negation can be re-applied over and over again, although it is seldom necessary to do this in ordinary speech. For example, it is possible to negate (2) even though (2) already involves the sign for negation. The result of doing so could be expressed as

(3) It is not the case that Ahmed does not love Sudeshni.

In this chapter, we use small letters for propositional variables and capital letters as abbreviations of particular propositions (not terms).
This would be symbolized as:

(3s) $\sim \sim L$

with a symbolic negation corresponding to each English negation in (3).

The propositional operators in the above list other than negation are all two-place operators. This means that they combine two propositions to yield a new proposition. For example, combining (1) and

(4) *Sudeshni is miserable*

with “and,” the most common expression for conjunction, we get the conjunctive proposition

(5) *Ahmed loves Sudeshni and Sudeshni is miserable,*

or, more idiomatically,

(5a) *Ahmed loves Sudeshni, but she is miserable.*

Using “M” for “Sudeshni is miserable,” we would symbolize (5) and (5a) as

(5s) $L \& M$

(5), (5a) and (5s) may all be referred to as conjunctions, and the two propositions that are conjoined in them are known as their conjuncts. Thus the conjuncts of (5s) are “L” and “M.”

Let us now bring all four of our propositional operators into play and illustrate them in action by symbolizing some ordinary English sentences. In order to indicate which letters are to be used to represent the basic propositions involved, we will use the convention of capitalizing one suitable word in each of these propositions, thereby indicating that the first letter of that word is to be used for that proposition as a whole. For example, the capitalization in

(6) *Maropeng is not going to ACCEPT Sam’s proposal*

indicates that “A” is to represent the smallest possible proposition involving the word “accept,” i.e., the proposition “Maropeng is going to accept Sam’s proposal.” The correct symbolization of (6) is therefore

(6s) $\sim A$. 
I am not going to discuss all the examples that follow because most of them are fairly straightforward. You are, however, strongly advised to work through them with care, trying to symbolize each English sentence yourself while concealing the correct symbolization (which is given immediately after the English) with a sheet of paper. This will enable you to check and improve your understanding at each point.

(7) If Maropeng ACCEPTS Sam’s proposal, then he will be DELIGHTED.

(7s) $A \rightarrow D$

(8) If Ahmed does not LOVE Sudeshni, then Komeshni is RELIEVED.

(8s) $\neg L \rightarrow R$

(9) Either Ahmed loves KOMESHNI or he loves SUDESHNI.

(9s) $K \lor S$

(10) If Eric PLUGS the lawnmower in and DEPRESSES this lever, then the engine will START.

(10s) $(P \land D) \rightarrow S$

Notice that brackets are needed in (10s) in order to indicate that as a whole (10) is a conditional rather than a conjunction, but that one of its two constituents is a conjunction. Contrast (10) with the following.

(11) Eric will PLUG the lawnmower in, and if he DEPRESSES this lever then the engine will START.

(11s) $P \land (D \rightarrow S)$

As a whole this is a conjunction rather than a conditional, but its second conjunct is a conditional.

The grouping function performed by brackets in (10s) and (11s) is performed by other mechanisms in the corresponding English sentences. In (10) “if” and “then” function as a left and a right “grouper” as well as expressing conditionality; and the comma before “then,” marking the main pause in the sentence, serves to emphasize that it is mainly a conditional. The main break before “and” in (11) suggests that it is primarily a conjunction, and this is confirmed by the fact that the proposition that Eric
will plug the lawnmower in does not appear between the “if” and the “then.” These grammatical differences signify an all-important semantic difference, viz., that someone who asserts (10) does not commit himself to the truth of the proposition that Eric will plug the lawnmower in, whereas someone who asserts (11) does commit himself to the truth of that proposition.

Before we proceed with more symbolization, let us add some further terminology. A disjunction or disjunctive proposition is a proposition (like (9) or (9s)) in which the main operator is a sign for disjunction. The constituents of a disjunction are known as disjuncts. As you should recall from section 1.3, the two constituents of a conditional are given different names in recognition of the fact that conditionality is asymmetrical. In the simplest English cases, such as (7) and (8), the antecedent is the proposition governed by “if” and the consequent is the proposition governed by “then.” In symbols the antecedent always comes before the “→” and the consequent after it. This holds even if the antecedent is expressed after the consequent in English, as in

(12) Ahmed will be DELIGHTED if Komeshni KISSES him,

which is a simple variant of “If Komeshni kisses Ahmed then he will be delighted,” and so should be symbolized as

(12s) K → D

This terminology allows us to explain the difference between (10) and (11) by saying that (10) is a conditional with a conjunctive antecedent, while (11) is a conjunction the second conjunct of which is a conditional.

More symbolization:

(13) Sudeshni will be SAD and Komeshni will be MAD if Ahmed KISSES Sudeshni and IGNORES Komeshni.

(13s) (K & I) → (S & M)

(14) If Ahmed either KISSES Komeshni or IGNORES Sudeshni, then Sudeshni will not be HAPPY.

(14s) (K v I) → ~H

(15) Ahmed does not love SUDESHNI, and he does not love KOMESHNI.

(15s) ~S & ~K
Ahmed does not love both SUDESHNI and KOMESHEI.

(16) Ahmed does not love both SUDESHNI and KOMESHEI.

(16s) ~(S & K)

In brief, the difference between (15) and (16) is that (15) is a conjunction of negations (a “both not”) while (16) is a negation of a conjunction (a “not both”). This difference is starkly displayed in symbolizations (15s) and (16s). The all-important semantic difference is of course that (15) implies that Ahmed loves neither Sudeshni nor Komeshni, while (16) leaves open the possibility that he loves one of them.

Exercise Set 7.1

Symbolize the following.

(1) Wits University is not a SPAZA shop.

(2) I will PAY Eric R80 if he MOWS the lawn today.

(3) It’s not true that there was not a CONSPIRACY to undermine the candidate.

(4) I’m not a GIRL anymore, but I’m still THINKING about hearts. (Slightly edited extract from a television advertisement for Floro margarine, November 1996.)

(5) Either Pete will APOLOGIZE to Maropeng, or she will not go to the MEETING.

(6) If Smithson RETIRES at the end of the year, then either MOLEFE or ESSOP will succeed him.

(7) Either Suzy is PREGNANT or she has put on a lot of WEIGHT, and I bet she is feeling SORRY for herself.

(8) If the argument is COGENT and WELL presented I MAY even find myself changing my mind. (David Bullard, Sunday Times, Johannesburg, 1 December 1996.)

(9) If the Junction proves SUCCESSFUL, Masekela hopes to replicate the concept COUNTRYWIDE; but at any such venue unruly clients will be told to LEAVE. (Sunday Times, Johannesburg, 8 December 1996 — slightly edited.)
If MAROPENG and TUMI both don’t come to the party, then Sam is going to be very DISAPPOINTED.

7.2 SYMBOLIZATION (II)

We turn now to more difficult symbolization, and to the symbolization of arguments. The key rule applying to the symbolization of arguments is that the same propositional letter should be used for the same proposition throughout an argument (even though it will be given only once by means of our capitalization convention). The following examples illustrate both points.

\[(A)\] If Bafana Bafana beat ZAIRE, then Vusi is HAPPY. Thus if Vusi is happy, then Bafana Bafana beat Zaire.

\[(As)\] \[Z \rightarrow H \therefore H \rightarrow Z\]

\[(B)\] If MAROPENG goes to the party then SAM will go but VUSI won’t. Sam, however, won’t go to the party if Vusi doesn’t. Thus Maropeng won’t be going to the party.

\[(Bs)\] \[M \rightarrow (S \& \neg V), \neg V \rightarrow \neg S \therefore \neg M\]

(Some reflective readers have no doubt figured out that (A) is formally invalid while (B) is formally valid.)

For more difficult symbolizations it is useful to keep the following basic equivalences in mind. (Some of these have already been mentioned.)

<table>
<thead>
<tr>
<th>ENGLISH</th>
<th>SYMBOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) p but q</td>
<td>p &amp; q</td>
</tr>
<tr>
<td>(b) although p, q</td>
<td>p &amp; q</td>
</tr>
<tr>
<td>(c) p even though q</td>
<td>p &amp; q</td>
</tr>
</tbody>
</table>

(“But,” “although” and “even though” are like “and” in that they require that both the propositions which they combine be true.)

---

3 The main difference between these expressions and “and” is that they suggest that it is surprising that the propositions that they conjoin are true together.
(d) both not p and not q \( \sim p \land \sim q \)
(e) not both p and q \( \sim (p \land q) \)
(f) either not p or not q \( \sim p \lor \sim q \)
(g) neither p nor q \( \sim (p \lor q) \)

("Neither p nor q" = "Not (either p or q)."")

(h) p if q \( q \rightarrow p \)
(i) assuming p, then q \( p \rightarrow q \)
(j) p is sufficient for q \( p \rightarrow q \)

(Sufficient conditions are antecedents.)

(k) p is necessary for q \( q \rightarrow p \)

(Necessary conditions are consequents.)

(l) p only if q \( p \rightarrow q \)

("Only if" precedes the consequent.)

(m) p unless q \( \sim q \rightarrow p \)

("Unless" = "if not.")

Some of the above equivalences may seem surprising, and none more so than (l). Without instruction almost all students would want to render "p only if q" as "q \rightarrow p" rather than "p \rightarrow q." To see why this is wrong, consider the following example and its correct symbolization in terms of (l):

(1) My best friend is PREGNANT only if my best friend is FEMALE.

(1s) \( P \rightarrow F \)

In terms of this symbolization (1) is being treated as equivalent to

(1a) If my best friend is pregnant then my best friend is (or: must be) female.

This must be correct, for given that (1) is true and that my best friend (x) is pregnant, it follows that x is female, but given that (1) is true and that x
is female it does not follow that x is pregnant. The above symbolization squares with this, but the alternative does not.\footnote{Note that even if in a “p only if q” proposition “q” refers to an earlier time than proposition “p,” it is still wrong to symbolize this as “q \rightarrow p,” for the order represented by “\rightarrow” is not time-order but an order of conditional dependence.}

A proper understanding of “only if” leads in turn to an appreciation the above rule — (k) — for necessary conditions. Consider:

\begin{equation}
(2) \quad \text{In order for this animal to be a SHEEP it is necessary that it be a MAMMAL.}
\end{equation}

This is clearly equivalent to

\begin{equation}
(2a) \quad \text{This animal is a sheep only if it is a mammal,}
\end{equation}

and not to “If this animal is a mammal then it is a sheep,” and (2a), as we have seen, must be symbolized as

\begin{equation}
(2s) \quad S \rightarrow M
\end{equation}

Thus, in line with (k), the necessary condition turns out to be the consequent.

I now illustrate some of the above equivalences with a few more examples:

\begin{equation}
(3) \quad \text{Neither KOMESHNI nor SUDESHNI will accept Ahmed’s invitation, but ANDREA will.}
\end{equation}

\begin{equation}
(3s) \quad \neg(K \lor S) \land A
\end{equation}

\begin{equation}
(4) \quad \text{Sean will not PASS unless he STUDIES hard. Thus his studying hard is a necessary condition of his passing.}
\end{equation}

\begin{equation}
(4s) \quad \neg S \rightarrow \neg P \therefore P \rightarrow S
\end{equation}

\begin{equation}
(5) \quad \text{In order for Sean to PASS it was sufficient for him to get a COURSEWORK mark of 55% and an exam mark of at LEAST 45%. Thus since Sean did not pass, his exam mark must have been BELOW 45%.
}\end{equation}
Remembering that “since” is a premise indicator and not an operator, this becomes:

\[(5s) \quad (C \land L) \rightarrow P, \neg P \vdash B\]

The following sentence is much more challenging.

\[(6) \quad \text{Ahmed will be unHAPPY if neither KOMESHNI nor SUDESHNI accepts his invitation, but he will be DELIGHTED if either one of them does.}\]

In examples involving this level of complexity it is wise to begin by underlining logical operators and entering brackets in the English in order to display the relevant logical structure clearly. The same strategy can also be recommended for somewhat simpler examples. The result of applying the strategy to (6) is

\[(6b) \quad \left[(\text{Ahmed will be unHAPPY}) \text{ if (neither KOMESHNI nor SUDESHNI accepts his invitation)}\right] \text{ but } \left[(\text{he will be DELIGHTED}) \text{ if (either one of them does)}\right].\]

We can then symbolize the whole sentence in easy steps, taking one operator at a time and adjusting brackets slightly where necessary. Starting with the main operator, “but,” we get the overall structure

\[(6c) \quad [\ ] \land [\ ]\]

Since each conjunct is clearly a conditional, this becomes

\[(6d) \quad [\rightarrow] \land [\rightarrow]\]

It is clear from (6b) that the antecedent of the first of these conditionals is “neither KOMESHNI nor SUDESHNI accepts Ahmed’s invitation” (= “\(\neg(K \lor S)\)”) and that its consequent is “Ahmed will be unHAPPY” (= “\(\neg H\)”). We can therefore fill in the gaps in the first pair of square brackets in (6d) as follows.

\[(6e) \quad [\neg(K \lor S) \rightarrow \neg H] \land [\rightarrow]\]

The consequent of the remaining conditional is “Ahmed will be DELIGHTED” (= “D”), and its antecedent is “either one of them does,” i.e., “either KOMESHNI or SUDESHNI accepts his invitation” (= “\((K \lor S)\)”, with brackets needed to indicate that the antecedent consist of the whole of this
proposition). Filling in the gaps in (6e) accordingly, we arrive at the complete symbolization of (6):

\[
(6s) \quad [\neg(K \vee S) \rightarrow \neg H] \land [(K \vee S) \rightarrow D]
\]

Our final example is a little less challenging:

\[
(7) \quad \text{How is it possible that RECONCILIATION will take place if the country continues to hear the same DENIALS, the same SELECTIVE choosing of facts, the same PROPAGANDA we heard under apartheid? (Bongana Finca of the Truth and Reconciliation Commission — Mail and Guardian, Johannesburg, 22–8 November 1996.)}
\]

Although this is an interrogative sentence, it is clearly intended to deny that reconciliation will occur under the specified conditions. We therefore symbolize (7) as

\[
(7s) \quad [(D \land S) \land P] \rightarrow \neg R
\]

The reason for bracketing the first two conjuncts of the antecedent is simply that we are treating “&” as a two-place operator, which means that every occurrence of “&” must join exactly two propositions.

Exercise Set 7.2

Symbolize the following.

(1) \hspace{1cm} \text{Bryan was not a POPULIST but a SILVER Democrat, and he did not UNDERSTAND the sub-treasury plan.}

(2) \hspace{1cm} \text{All of this has WEAKENED civil society and, if unCHECKED, will VITIATE the democracy. (Editorial, Sunday Times, Johannesburg, 1 December 1996.)}

(3) \hspace{1cm} \text{In order for Ramaphosa to SUCCEED Zuma, it is necessary for him to step back into the POLITICAL ring.}

(4) \hspace{1cm} \text{Alan will be ACCEPTABLE to the good old boys club only if he is WHITE. Alan, however, is not white but COLOURED. He won’t, therefore, be acceptable to the good old boys club.}
I will neither oppose you nor undermine you. From this it follows that I will not do both.

It’s not time to plant the mealies unless the Piet-my-vrous are calling. Thus it must be time to plant the mealies, for the Piet-my-vrous are calling.

The premises would be true and the conclusion false if the battery were not flat but an electrical connection between the ignition switch and the starter motor were broken. It is therefore clear that the argument is deductively invalid. (Paraphrase of an argument advanced on p. 141 in section 7.3.)

[Sign at the entrance to a fast-food restaurant:] No shoes, no shirt, no service.

In symbolizing this, use the following key:

\[ A = \text{You are wearing shoes.} \]
\[ B = \text{You are wearing a shirt.} \]
\[ C = \text{You get service.} \]

(A good way to tackle this exercise is to re-express the intended message using “if ... then ...” and other operators and then symbolize the result.)

... I

Except you enthral me, never shall be free,

Nor ever chaste, except you ravish me.

(From a holy sonnet by John Donne, 1572–1631.)

(A good way to begin tackling this exercise is to re-express what Donne is saying in more modern English, concentrating mainly on logical expressions.)

7.3 VALID AND INVALID ARGUMENT FORMS (I)

We now examine a number of valid and invalid argument forms involving the above four propositional operators. Several of these argument forms have traditional identifying names, which will be recorded (along with standard abbreviations of those names) for ease of reference.

Our first argument form is fundamental to deductive reasoning:

(A) **Modus Ponens (MP)**

\[ p \to q, p \vdash q \]

The validity of MP flows directly from the nature of the conditional operator:
Given an understanding of the meaning of “if ... then ...” or “→,” the validity of the argument form is obvious. One sign of this is that we would not be willing to treat a two-place operator as a conditional operator equivalent to “if ... then ...” if MP were not valid for that operator.

The identifying features of logical operators include not only the basic argument forms that are valid for those operators, but also those which are invalid. For example, it is not in general possible to infer an everyday conditional from the truth or falsity of either its antecedent or its consequent:

\[(B) \quad p \vdash p \rightarrow q \quad \text{INVALID}\]
\[(C) \quad \neg p \vdash p \rightarrow q \quad \text{INVALID}\]
\[(D) \quad q \vdash p \rightarrow q \quad \text{INVALID}^6\]
\[(E) \quad \neg q \vdash p \rightarrow q \quad \text{INVALID}\]

The following counterexamples establish the invalidity of (B) and (C).

\[(B^*) \quad \text{Barack Obama was President of the USA in 2013.} \quad \vdash \quad \text{If Barack Obama was President of the USA in 2013, then he died in 2012.}\]
\[(C^*) \quad \text{Nelson Mandela was not President of the USA.} \quad \vdash \quad \text{If Nelson Mandela was President of the USA, then he was born in Kenya.}\]

Although these are rather silly arguments, they are good counterexamples because, in addition to having the required forms, their premises are obviously and indisputably true and their conclusions are obviously and indisputably false. You should try to construct counterexamples to invalid argument forms, such as (D) and (E), to which counterexamples are not given in this text.

\[5\] In short, they include the basic logical powers of the operator, both negative and positive. One important aspect of research in logic and semantics involves the determination of the logical powers of the operators or expressions under investigation.

\[6\] Surprisingly, there is a conditional for which (C) and (D) are valid, viz., the so-called “material conditional” of standard first-order logic. But we are not concerned with the material conditional in this text.
Another characteristic feature of everyday conditionals is that one cannot in general infer either the truth or falsity of their antecedents or consequents in the absence of further premises:

\[(F) \quad p \rightarrow q \therefore p\] INVALID
\[(G) \quad p \rightarrow q \therefore \neg p\] INVALID
\[(H) \quad p \rightarrow q \therefore q\] INVALID
\[(I) \quad p \rightarrow q \therefore \neg q\] INVALID

Here’s a good counterexample to (G):

\[(G^*) \quad \text{If Nelson Mandela was President of South Africa, then he was a politician.} \]
\[\therefore \text{Nelson Mandela was not President of South Africa.}\]

Finding good counterexamples to (F), (H) and (I) should not be too difficult.

The invalidity of (B)–(I) is mainly of theoretical interest. An invalid argument form that is far more significant from a practical point of view is the formal fallacy of “affirming the consequent”:

\[(J) \quad \text{Fallacy of Affirming the Consequent} \quad p \rightarrow q, q \therefore p\] INVALID

People are often tempted to reason as if this argument form were valid, and some even confuse it with MP. It is, however, easy to establish that it is a fallacy by means of a counter-example:

\[(J^*) \quad 1. \quad \text{If Nelson Mandela was born in Egypt then he was born in Africa.} \]
\[2. \quad \text{Nelson Mandela was born in Africa.} \quad \therefore \text{Nelson Mandela was born in Egypt.}\]

Given a conditional one can always infer its consequent from its antecedent, but one cannot validly infer its antecedent from its consequent: “If” is a one-way street.

To recognize this is not, however, to deny that there are very reasonable abductive arguments\(^7\) that have form (J), e.g.,

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(Ji) 1. *If the battery were flat, then turning the ignition key would have no effect.*
2. *Turning the ignition key has no effect.*
   ∴ *The battery is flat.*

It is important to notice that (Ji) is deductively invalid, for the premises could both be true while the conclusion is false. (This would be the case if, e.g., the battery were not flat, but an electrical connection between the ignition switch and the starter motor were broken.) Thus the premises of (Ji) do not imply the conclusion. They support it significantly only relative to the unstated assumption that the battery’s being flat provides a good explanation, and perhaps the best explanation, of the fact that the ignition key has no effect. Although (Ji) is an instance of the fallacy of affirming the consequent, it would be unfair to criticize it for that reason unless it were advanced as a deductively valid argument.

Let us now turn to “&” and take note of the following basic argument forms, the validity of which is obvious.

(K) **Simplification (Simp)** (two forms)

<table>
<thead>
<tr>
<th>p &amp; q</th>
<th>∴ p</th>
<th>VALID[^8]</th>
</tr>
</thead>
<tbody>
<tr>
<td>p &amp; q</td>
<td>∴ q</td>
<td>VALID</td>
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(L) **Conjunction (Conj)**

| p, q | ∴ p & q | VALID |

Given that the order of the premises is not significant, (L) also covers “q, p ∴ p & q.” There are also a number of quite obviously invalid argument forms involving conjunction. It is clear, e.g., that a conjunction cannot be inferred from one of its conjuncts alone[^9], or from negations of its conjuncts, etc. Nobody with an understanding of conjunction would be misled by such argument forms, and it is not worth listing them explicitly.

Given that certain argument forms are valid, it is possible to prove the validity of others by deriving their conclusions from their premises using the argument forms whose validity is assumed. Consider, e.g.,

(M)  p, p → q, q → r ∴ r | VALID

Perhaps this is so obvious that it needs no proof, but we can still prove it by utilising MP (= (A), p.138) twice over, as follows.

[^8]: This is argument form (J) of Chapter 5 (p.99).

[^9]: See exercise II, (8) of exercise set 5 (p.102).
We begin this derivation by assuming the truth of all three premises of (M) at lines 1, 2 and 3. Line 4 in effect states that q is a deductive consequence of 1 and 2 by MP. Line 5 then applies MP to 3 and 4 to yield the conclusion of (M). Derivations, which are central to symbolic logic, can be very much more complex and interesting than this. Although we make use of other simple derivations in the rest of this chapter, we will not discuss the theory behind them.

We can establish by means of a second derivation that “p & q” is valid:

1. p & q  
   \text{Premise}
2. q 1 Simp (= (K))
3. p 1 Simp
4. q & p 2,3 Conj (= (L))

An exactly parallel derivation establishes the validity of the converse argument, “q & p” is valid: “p & q” and “q & p” are logically equivalent, which we represent as follows (using “::” as a two-directional therefore-sign, as in Chapter 6).

(N) Commutation (for &) (Com)  
\[ p \land q :: q \land p \]  
VALID EQUIVALENCE

Disjunctions are also symmetrical in this way (but we will treat this as a brute fact because we haven’t developed the resources to prove it):

(O) Commutation (for v) (Com)  
\[ p \lor q :: q \lor p \]  
VALID EQUIVALENCE

Conditionals, however, are obviously asymmetrical and thus not subject to commutation:

(P)  
\[ p \rightarrow q :: q \rightarrow p \]  
INVALID

“If,” to repeat, is a one-way street.

Some people may wish to challenge Com for & (equivalence (N)) on the ground that, e.g.,
are not equivalent. This is reasonable, since (1) suggests that Shelley’s
marriage preceded her falling pregnant, while (2) suggests that these
events happened in the opposite order. However, if we make these time-
orders explicit, as in

(1a) Shelley got married and then fell pregnant, and
(2a) Shelley fell pregnant and then got married,

it becomes clear that it is not possible to use Com to get from the one to
the other. The inequivalence between (1) and (2) — and (1a) and (2a) —
therefore fails to undermine Com. If we treat (1) as equivalent to (1a), then
a correct application of Com would yield something like the following
(expressed in idiomatic English).

(3) Shelley fell pregnant, but after she got married,

which is equivalent to (1a). Thus Com is, after all, acceptable.

Exercise Set 7.3

I. Give good counterexamples to the following invalid argument
forms.

(1) \(~q \therefore p \rightarrow q\) (= (E), p.139)
(2) \(p \rightarrow q \therefore q\) (= (H), p.140)
(3) \(p \lor q \therefore q\)

II. Which of argument forms (4)–(6) are valid and which are invalid?
Give a good counterexample to each one that is invalid, and a
derivation of each one that is valid. (In doing this you may use
any of the following: MP, Simp, Conj and Com.).

(4) \(p \& q, p \rightarrow r \therefore r\)
(5) \(p \rightarrow q, q \rightarrow r, r \therefore p\)
III. Symbolize arguments (7) and (8), and indicate whether the argument forms expressed by their symbolizations are valid or invalid. Support your answer.

(7) Mr Justice Goldstone used to be PROSECUTOR at the Bosnian War Crimes Tribunal in the Hague, but now he is a JUDGE in the Constitutional Court of South Africa and the CHANCELLOR of Wits University. If Goldstone is the Chancellor of Wits, then the University has a very DISTINGUISHED figurehead, and it should be able to develop a BETTER public image. Wits should, therefore, be able to develop a better public image. (Argument that could have been advanced in 2002.)

(8) If Ahmed gave her FLOWERS, then Komeshni SMILED at him sweetly and ACCEPTED his invitation. Komeshni did accept Ahmed’s invitation, and she also smiled at him sweetly. Thus he must have given her flowers.

7.4 VALID AND INVALID ARGUMENT FORMS (II)

Interactions between negation and other operators are extremely important. The two most crucial argument forms involving conditionals and negation are as follows.

(A) Modus Tollens (MT)
\[ p \rightarrow q, \neg q \therefore \neg p \]  VALID

(B) Fallacy of Denying the Antecedent
\[ p \rightarrow q, \neg p \therefore \neg q \]  INVALID

The Modus Tollens pattern of reasoning is very significant, and it represents one of the most effective ways of challenging a theory (or viewpoint) in any intellectual field. For if one can show that the theory (which we can think of as represented by \( p \) in (A)) has a consequence (represented by \( q \)) that is false (\( \neg q \)), then it follows deductively by MT that (taken as a whole) the theory itself is also false (\( \neg p \)).

10 This is the same as argument form (D) of Chapter 5 (p.96).
To appreciate the invalidity of (B), consider the following counterexample.

(B*) If Nelson Mandela was born in Kenya, then he was born in Africa. Nelson Mandela was not born in Kenya. So he was not born in Africa.

The validity of (A) (= MT) is fairly obvious, but it can also be supported by the following reasoning.

Suppose both premises are true, i.e., that \( p \rightarrow q \) and \( \neg q \). Now assume that it is also true that \( p \). Together with the first premise this yields \( q \) by MP. This result, however, directly contradicts the second premise. The source of this problem is our assumption that \( p \) is true. Thus \( p \) must be false. So \( \neg p \) is true, just as the conclusion claims.

This sort of reasoning — which can be very powerful in logic as well as other disciplines, especially philosophy and mathematics — is known as proof by Reductio ad Absurdum (“reduction to the absurd”). In general, what it involves is a demonstration that, given certain premises, the assumption that a select proposition is true leads to an absurd result, such as an overt contradiction; and from this it is validly concluded that the proposition is false.¹¹

Before looking at interactions between negation and disjunction, we must first get clear on how “\( \lor \)” is to be understood. There are two possibilities:

(a) \( p \lor q \) is true iff exactly one of \( p \), \( q \) is true.

(b) \( p \lor q \) is true iff at least one of \( p \), \( q \) is true.

In terms of (a) “\( \lor \)” represents exclusive disjunction, because it excludes the possibility of both disjuncts being true; in terms of (b) it represents inclusive disjunction because it includes, or allows for, that possibility. We will follow standard logical tradition and adopt (b), using “\( \lor \)” inclusively.

¹¹ Many systems of formal logic incorporate ways of representing Reductio ad Absurdum that would allow us to re-express the reasoning advanced in the indented passage above as a formal derivation, but it is not worth pursuing the necessary technicalities here.
For convenience we will assume that the English “either ... or ...” is also inclusive, even though this is sometimes debatable. When necessary we can express an exclusive disjunction by using “either ... or ..., but not both,” as in:

(1)  Ahmed loves either SUDESHNI or KOMESHNI, but not both.

(1s)  \((S \vee K) \& \neg(S \& K)\)

Given that “\(\vee\)” represents inclusive disjunction, we have:

(C)  **Disjunctive Syllogism (DS)**  (two forms)
\[
\begin{align*}
  p \vee q, \neg p & \vdash q \\
  p \vee q, \neg q & \vdash p
\end{align*}
\]
VALID

(D)  \[
\begin{align*}
  p \vee q, p & \vdash \neg q \\
  p \vee q, q & \vdash \neg p
\end{align*}
\]
INVALID

It is easy to appreciate the validity of (C) and the invalidity of (D). (C): Given that a disjunction is true, then at least one of its disjuncts is true; thus it follows from the fact that one of them is false that the other must be true. (D): Because “\(\vee\)” is inclusive, the first premise leaves open the possibility that both \(p\) and \(q\) are true; thus given that one of them is true it does not follow that the other is false.

The following principles concerning the interaction of negation and conjunction are noteworthy.

(E)  \[
\begin{align*}
  \neg(p \& q) & \vdash \neg p \\
  \neg(p \& q) & \vdash \neg q
\end{align*}
\]
INVALID

(F)  **Conjunctive Syllogism (CS)**  (two forms)
\[
\begin{align*}
  \neg(p \& q), p & \vdash \neg q \\
  \neg(p \& q), q & \vdash \neg p
\end{align*}
\]
VALID

Given that a conjunction is false, then at least one of its conjuncts must be false, but we may not be able to tell which — hence the invalidity of (E). However, given that a conjunction is false and that one of its conjuncts is true, then the other must be false — hence the validity of (F).

Our discussion of disjunction would not be complete without mention of the following.

(G)  **Separation of Cases (SC)**
\[
\begin{align*}
  p \vee q, p \rightarrow r, q \rightarrow r & \vdash r
\end{align*}
\]
VALID
(H) **Addition (Add)** (two forms)

\[ p \vdash p \vee q \quad \text{VALID} \]
\[ p \vdash q \vee p \quad \text{VALID} \]

(G) is clearly valid: Given that at least one of \( p \) and \( q \) is true and that \( r \) would be true in each case, it follows that \( r \) must be true. (H) is surprising, but must be valid for inclusive disjunction. For if \( p \) is true then at least one of \( p, q \) is true regardless of whether \( q \) is true or false.

Let us now use some of the above valid argument forms to establish the validity of two further argument forms by means of simple derivations:

(I) \( \neg(p \& q), p, r \rightarrow q \quad \vdash \neg r \)

1. \( \neg(p \& q) \) Premise
2. \( p \) Premise
3. \( r \rightarrow q \) Premise
4. \( \neg q \) 1, 2 CS (= (F))
5. \( \neg r \) 3, 4 MT (= (A))

(J) \( (p \vee q) \rightarrow \neg r, r \vee s, p \vdash s \)

1. \( (p \vee q) \rightarrow \neg r \) Premise
2. \( r \vee s \) Premise
3. \( p \) Premise
4. \( p \vee q \) 3 Add (= (H))
5. \( \neg r \) 1, 4 MP
6. \( s \) 2, 5 DS (= C)

We turn, finally, to two important logical equivalences:

(H) **Double Negation (DN)**

\[ p \quad \vdash \neg \neg p \quad \text{VALID EQUIVALENCE} \]

(I) **De Morgan’s Laws (DeM)** (two forms)

\[ \neg(p \& q) \quad \vdash \neg p \vee \neg q \quad \text{VALID EQUIVALENCE} \]
\[ \neg(p \vee q) \quad \vdash \neg p \& \neg q \quad \text{VALID EQUIVALENCE} \]

Given the meanings of “\( \neg \),” “\( \vee \)” and “\( \& \)” it is not difficult to see why these equivalences hold. It is important for students to be conscious of the English equivalences corresponding to DeM. Thus “not both” is equivalent to “either not ... or not ...” but not to “both not.” Likewise, “neither ... nor ...” is equivalent to “both not” but not to “either not ... or not ....”

As an example of this last point, consider: 147
Cheryl Carolus was neither a cabinet minister nor a member of the Gauteng executive council, which, in line with DeM, is equivalent to

Cheryl Carolus was not a cabinet minister and was not a member of the Gauteng executive council.

It is not, however, equivalent to

Either Cheryl Carolus was not a cabinet minister or she was not a member of the Gauteng executive council.

For, unlike (2) and (3), (4) leaves open the possibility that Cheryl Carolus had one of the two positions mentioned.

Exercise Set 7.4

I. Give good counterexamples to the following invalid argument forms.

(1) \( \neg(p \land q) \vdash \neg q \) (= the second form of (E), p.146)

(2) \( p \lor q, p \vdash \neg q \) (= the first form of (D), p.146)

II. Which of argument forms (3)–(5) are valid and which are invalid? In each case support your answer by identifying a fallacy or giving a derivation or counterexample (as appropriate), or by means of any other form of reasoning of your own choice.

(3) \( p \rightarrow \neg q, q \vdash \neg p \)

(4) \( p \lor q, r \land \neg q \vdash p \)

(5) \( p \rightarrow q, \neg(p \lor r) \vdash \neg q \)

III. Symbolize arguments (6) and (7), and indicate whether the argument forms expressed by their symbolizations are valid or invalid. Support your answer.
(6) If either KOMESHNI or SUDESHNI kisses Ahmed, then he will be HAPPY. Even though Komeshni won’t kiss Ahmed, Sudeshni will. Thus Ahmed is going to be happy.

(7) Ahmed would be HAPPY if either SUDESHNI or KOMESHNI kissed him, but neither of them will. Thus Ahmed is not going to be happy.
Appendix on Truth

Although the concept of truth is used throughout this text, the philosophical question “What is truth?” is beyond the scope of elementary logic. But there is no need to make a mystery of truth, for the claim that an ordinary proposition is true says no more or less than that proposition itself. For example,

(1) It is true that it is raining

makes the same claim as

(2) It is raining.

Likewise,

(3) It is true that cyanoacrylate dissolves in acetone

is equivalent to

(4) Cyanoacrylate dissolves in acetone.

Thus when we get down to the level of individual propositions, the concept of truth is dispensable. It nonetheless remains useful for formulating a variety of general claims in logic, but these involve no heavy metaphysical commitments.

What is crucially important for students to appreciate is that truth, even on the most homely understanding, is seldom purely subjective. Whether (it is true that) Angie is pregnant is not a matter of whether she or anyone else believes that she is pregnant, but whether an embryo or foetus is growing in her uterus. Even social and institutional truths, which depend in complex ways on what people in the relevant communities believe, never depend simply on what a single individual believes. The common but

1 For example, it is true that certain kinds of items are money in a given community only because it is generally believed in that community that those items are money, i.e., that they can be used to purchase goods and services, pay debts, etc.
unfortunate expression “true for me” is therefore extremely misleading.
When people insist that a proposition is “true for me,” what they really
mean is merely that they believe the proposition firmly and are not willing
to consider evidence that might count against it. This does not, however,
make the proposition true. Someone can, e.g., believe as confidently as
possible that he will fly if he jumps off the top of the tallest building in town,
but believing it won’t make it so. You are accordingly advised to avoid the
phrase “true for me” completely.