Workbook Unit 1:

Basic Concepts

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Overview

Logic is concerned with thinking. Unlike psychology, however, it is concerned with *correct* thinking. Furthermore logic is not only about thinking, it actually teaches us to think – to think correctly, or more precisely – to reason and argue correctly.

This unit

- gives you a preliminary and informal introduction to the subject matter of logic
- introduces an important distinction between sentences and propositions
- tells you what arguments are and how to recognize them
- distinguishes deductive and non-deductive arguments
- explains what an enthymematic argument is and how to find enthymematic premises
- distinguishes the properties of propositions and of arguments
- introduces the idea of a logical form of an argument
- explains the concepts of validity and soundness
- introduces the notion of a fallacy and discusses some of the more famous fallacies

About Workbook Exercises

This unit contains Workbook Exercises. They follow little chunks of the material and are designed to help you digest what you have been reading about. You *must* do those exercises at the time you are asked to do them. Do not wait until you've "read" the whole unit.

It is also very important for you to check that you have done the exercises correctly. The solutions are separately bound as the *Solutions to the Workbook Exercises*. Do not peek at the solutions, however, as this will destroy your learning process.

Workbook Exercises

This unit contains Workbook Exercises.

BasicConcepts Quiz

Check the Calendar for the deadlines for BasicConcepts Quiz #1 and BasicConcepts #2. See the Quiz Instructions and the Sample Quiz.

1. Sentences and Propositions (Statements)

When we reason, we use sentences. The sentence "The girl who is in love with Fred offended most of her class mates" implies, *inter alia*, the sentence "Some girl offended most of her class mates" as well as the sentence "Some girl is in love with Fred." Someone who accepts the first sentence must also accept the second sentence. However, not all sentences are suited to enter into inferential relations with other sentences. Nothing follows from such a sentence as "Heyah!" (someone might be greeting another person in this way, or someone might be calling another, or someone might be explaining to another how to say the equivalent of 'Ciao!' in English, etc.). It contains too little information to be the basis for drawing conclusions.

This is why at the very foundation of logic lies the distinction between sentences and propositions (we will also be talking about statements). Sentences are identified with the grammatically correct sentences of English. *A proposition (statement),* on the other hand, *is what an unambiguous declarative sentence asserts.* The same proposition can be asserted using different sentences. For example, the sentences:

Logic is the most boring class Jane has ever taken.

The most boring class Jane has ever taken is logic.

say the same thing – they can be both used to assert the same proposition. Moreover, the very same proposition is asserted by the following sentences:

Logic is boring. [in English]
La logique est ennuyeux. [in French]
La lógica es aburrida. [in Spanish]
Logik ist langweilig. [in German]
Logika jest nudna. [in Polish]

Logicians care about propositions (even such propositions) because propositions are the proper bearers of so-called truth-values: propositions can be true or false (in classical logic, there are two truth-values: *true* and *false*).

Let us see how these two characterizations of propositions:

- A proposition is what is asserted by an unambiguous declarative sentence.
- A proposition is either true or false.

are related to one another by reflecting on whether non-declarative sentences (like (a) exclamations or (b) questions) and ambiguous declarative sentences ((c), (d)) can be true or false.

(a) *No exclamations are propositions.* Exclamations like "Heyah!" or "Come here!" are not propositions, since they are neither true nor false. In fact, exclamations cannot be used to assert anything at all.

(b) *No questions are propositions.* Consider this question:

(1) Are you bored already?

Is this question true or false? It is good if you are puzzled since the question (in fact, no question) can be true or false. What can be true or false is the answer to this question, but not the question itself. Again, you cannot assert anything with a question.

(c) *No ambiguous declarative sentences are propositions.* Let's consider another sentence, a declarative sentence this time:

(2) The Deans did not give the students permission to demonstrate since they were skinheads.

It might look as if whoever is making this statement must be saying something that is either true or false. However, the impression is mistaken because sentence (2) is in fact ambiguous. It is unclear whether 'they' refers to the Deans or to the students. The following two sentences do capture propositions:

(2a) The Deans did not give the students permission to demonstrate since the Deans were skinheads.

(2b) The Deans did not give the students permission to demonstrate since the students were skinheads.

Here is another example of ambiguity.

(3) Susan ate the tuna in a bikini.

This sentence is again ambiguous. It is not clear who was in the bikini – Susan or the tuna:

(3a) While Susan was wearing a bikini, she ate the tuna.

(3b) Susan ate the tuna, which was put in a bikini.

(d) *No declarative sentences with indexical expressions are propositions*. There is a class of sentences containing the so-called "*indexical*" expressions (like 'I', 'he', 'she', 'there', 'now', etc.) that are notoriously ambiguous because the indexical expressions change their referent depending on the context in which they are uttered. Let us take the sentence:

(4) I am in Warsaw now.

We might think that the sentence is true, but let us consider what is actually asserted by this sentence. When I use the sentence, I mean by it:

(4a) Dr.P. is in Warsaw on November 3rd 2005.

which is true. You may use the sentence too, in which case you would mean by it:

(4b) ______________ is in Warsaw on ______________
state your first and last name state today's date

in which case the proposition (most likely) is false. The point is that depending on who utters sentence (4) (and when), it will stand for different propositions.

This marks a general difference between sentences and propositions. In a proposition, the content is explicitly stated whereas sentences often leave some of the content to depend on the context in which the sentences are uttered. *Sentences thus depend on context*, whereas *propositions are independent of context*. The meaning of sentence (4) depends on the context in which it is uttered. If I utter sentence (4) on November 3rd in Warsaw, the meaning of (4) will be proposition (4a); if you utter the same sentence (4) today, its meaning will be proposition (4b). But the meaning of the proposition (4a) does not depend on the context in which it is uttered – it does not matter who, where or when says (4a), the truth-value of (4a) will be constant. If the proposition "Dr. P. is in Warsaw on November 3rd 2005" is true when uttered by me on November 3rd, 2005, it will remain true when uttered by you today.

You will sometimes find that logicians speak about statements and propositions interchangeably.

Exercise "Propositions"

Which of the following sentences express a proposition?

- ☐ Dick Cheney overcooked the cauliflower.
- ☐ There is no force that could stop you.
- ☐ It was very dark there.
- ☐ My friends went to the forest to pick mushrooms.
- ☐ Henry Fonda sneaked into the kitchen.
- ☐ Hillary Clinton attached herself to the newly painted wall.
- ☐ If Fred Astaire were not a dancer, Greta Garbo would not be an actress.
- ☐ If only children knew more than their parents!
- ☐ Will Henry ever come to like girls?
- ☐ Bill Clinton is a woman.

2. Arguments

2.1. What Is an Argument?

In an argument we accept one proposition (the so-called **conclusion**) on the basis of other propositions (the so-called **premises**). The premises are said to contain *evidence* for the conclusion; the conclusion is said to *follow from* the premises. In most general terms, we can say that an **argument** is a group of propositions where one proposition (the conclusion) is claimed to *follow from* the others (the premises). Consider the following classical example of an argument:

All humans are mortal. Socrates is a human.	premises
So, Socrates is mortal.	conclusion

The conclusion is sometimes separated off from the premises with a horizontal line.

An argument must have at least one premise though it can have many premises.

An argument must have *at least one premise.*

However:

An argument has *exactly one conclusion*.

That an argument has only one conclusion is a matter of convention. Logicians have simply agreed that they will use the term ‘argument’ in such a way that there is a one-to-one correspondence between arguments and conclusions. Now, of course, it is sometimes possible to draw two conclusions from the same premises. In such a case, however, we speak of there being two arguments. Consider an example of such situation. Let us adopt the following set of premises:

> Whoever reads Dostoyevski will not be able to look at the world in the same way.
> Everybody in Susan’s class read Dostoyevski.

There are a couple of conclusions we can draw. For instance, we can draw the conclusion that Susan (who is in Susan’s class, of course) will not be able to look at the world in the same way. In doing so, we are making the following argument:

Whoever reads Dostoyevski will not be able to look at the world in the same way.
Everybody in Susan’s class read Dostoyevski.

So, Susan will not be able to look at the world in the same way.

But we can also make the following argument:

Whoever reads Dostoyevski will not be able to look at the world in the same way.
Everybody in Susan's class read Dostoyevski.

So. Nobody in Susan's class will be able to look at the world in the same way.

So here we have made two arguments from the very same premises – because we have drawn two conclusions from this set of premises.

Exercise "Arguments"

Which of the following sentences are true? Which are false?

☐ **True** ☐ **False** All arguments have exactly one premise.

☐ **True** ☐ **False** All arguments have at least one premise.

☐ **True** ☐ **False** All arguments have at least two premises.

☐ **True** ☐ **False** It is possible for an argument to have no premises.

☐ **True** ☐ **False** It is possible for an argument to have only one premise.

☐ **True** ☐ **False** It is possible for an argument to have only two premises.

☐ **True** ☐ **False** It is possible for an argument to have one hundred premises.

☐ **True** ☐ **False** It is impossible for an argument to have no premises.

☐ **True** ☐ **False** It is impossible for an argument to have exactly seven premises.

☐ **True** ☐ **False** All arguments have exactly one conclusion.

☐ **True** ☐ **False** All arguments have at least two conclusions.

☐ **True** ☐ **False** It is possible for an argument to have no conclusions.

☐ **True** ☐ **False** It is possible for an argument to have two conclusions.

☐ **True** ☐ **False** In an argument one accepts one proposition on the basis of others.

☐ **True** ☐ **False** In an argument one accepts one sentence on the basis of others.

2.2. Recognizing Arguments

You have just learned what an argument is. For most of our purposes, arguments will be presented to you in a standardized format where it will be clear what the premises are and what the conclusion is. Arguments, however, usually occur in less perspicuous forms in real life. In fact, the more logic one does the better one becomes at understanding arguments and then at identifying arguments in practice. You should not expect this skill of yourself just yet. Still it is useful to learn a few points.

The first thing that is crucial is to identify the conclusion in an argumentative passage, i.e. the claim that someone is arguing for. At the same time, you will be identifying the premises, i.e. the claims that serve as evidence for the conclusion. There is no general full-proof recipe for identifying argument-parts. Often the premises are mentioned first, but sometimes it is the conclusion that appears first in the passage. Consider:

> God does not exist because the Bible, which is the sole evidence that God exists, has been written by Ancients, who have been wrong on countless occasions.

The conclusion of this argument is the proposition "God does not exist." The premises of the argument include the propositions: "The Bible is the sole evidence that God exists," "The Bible has been written by Ancients," "The Ancients have been wrong on countless occasions."

Once one identifies the premises of the argument it also becomes easier to evaluate the argument. Is it really true, for example, that the Bible is the sole evidence that God exists? And we might also worry about the occasions on which the Ancients have been wrong etc. Our purposes for now, however, are only with the recognizing of arguments and their minimal structure (their premises and conclusion). We will leave the task of evaluating arguments for later parts of the course.

In recognizing the conclusions and premises, it is helpful to note words that typically indicate conclusions (also called "conclusion-indicators"):

therefore	thus	consequently
accordingly	entails that	hence
it must be that	it follows that	for this reason
implies that	so	as a result
in conclusion	we may infer	we may conclude

Likewise, it is useful to take note of words that typically indicate premises (also called "premise-indicators"):

since	because	for
as	given that	for the reason that
inasmuch as	in that	seeing that
owing to	as indicated by	may be inferred from

Consider an example:

> Ann will not get an A in logic since she did not study hard enough and only students who study very hard get an A in logic.

The conclusion here is the proposition "Ann will not get an A in logic," and the premises include the propositions: "Ann did not study hard enough for logic" and "Only students who study very hard get an A in logic." This argument could of course be formulated in different ways. Here are some examples (note how the order in which the premises and the conclusion appear may change).

> The reason why Ann will not get an A in logic is that she did not study hard enough and only students who study very hard get an A in logic.
>
> Only students who study very hard get an A in logic. Due to the fact that Ann did not study hard enough, she will not get an A in logic.
>
> I'm afraid that Ann did not study hard enough for logic. As only students who study very hard get an A in logic, I'm quite certain that she will not get an A.
>
> It is quite well known that only students who study very hard get an A in logic. However, Ann did not study hard enough, so she Ann will not get an A.
>
> Only students who study very hard get an A in logic, but Ann did not study hard enough. Hence, she will not get an A.

All of these are formulations of the same argument, which can be put into the standard form thus:

Only students who study very hard get an A in logic.
Ann did not study hard enough for logic.
___
So, Ann will not get an A in logic.

Exercise "Argument Recognition"

In each of the following arguments, identify the premise(s) and the conclusion.

(a) If the stock market never fluctuated, then stock would have no market risk. Of course, the market does fluctuate, so market risk is present.

(b) If utilitarianism is true, …then it is better that people should not believe in utilitarianism. If, on the other hand, it is false, then it is certainly better that people should not believe in it. So either way, it is better that people should not believe in it.

(B. Williams, *Morality: Introduction to Ethics*)

(c) Pregnant women should never use experimental drugs for such a use may have a detrimental impact on the development of the fetus.

(d) Since the good, according to Plato, is that which furthers a person's real interests, it follows that in any given case when the good is known, people will seek it.

(A. Stroll, R. Popkin, *Philosophy and the Human Spirit*)

(e) Artists and poets look at the world and seek relationships and order. But they translate their ideas to canvas, or to marble, or into poetic images. Scientists try to find relationships between different objects and events. To express the order they find, they create hypotheses and theories. Thus the great scientific theories are easily compared to great art and great literature. (D.C. Giancoli, *The Idea of Physics*)

(f) The fact that there was never a land bridge between Australia and mainland Asia is evidenced by the fact that the animal species in the two areas are very different.

(T. D. Price, G.M. Feinman, *Images of the Past*)

(g) The classroom teacher is crucial to the development and academic success of the average student, and administrators simply are ancillary to this effort. For this reason, classroom teachers ought to be paid at least the equivalent of the administrators at all levels.

(h) It would be immoral and selfish not to use animals in research today, given the harm that could accrue to future generations if such research were halted.

(i) Changes are real. Now, changes are only possible in time, and therefore time must be something real. (I. Kant, *The Critique of Pure Reason*)

(j) …Wagner's music [is] better than anybody's. It is so loud that one can talk the whole time without people hearing what one says. (O. Wilde, *The Picture of Dorian Gray*)

(k) To name causes for a state of affairs is not to excuse it. Things are justified or condemned by their consequences, not by their antecedents.

(J. Dewey, "The Liberal College and Its Enemies")

2.3. Deductive vs. Non-Deductive Arguments

There are two general types of arguments: deductive and non-deductive. Deductive arguments are logically valid in the sense that someone who accepts the premises *must* accept the conclusion (in other words, the conclusion cannot be false if the premises are true). In non-deductive arguments, there is always a logical gap between the premises and the conclusion – they are fallible, it is possible for someone to accept premises and not accept the conclusion. In non-deductive arguments, the conclusion is said to follow with some probability.

In a good (i.e. logically valid) deductive argument, it is impossible for the conclusion to be false given that the premises are true.

In a good non-deductive argument, it is improbable for the conclusion to be false given that the premises are true.

We have already considered some examples of deductive arguments. Let's bring them together:

All humans are mortal.
Socrates is a human.

So, Socrates is mortal.

Whoever reads Dostoyevski will not be able to look at the world in the same way.
Everybody in Susan's class read Dostoyevski.

So. Nobody in Susan's class will be able to look at the world in the same way.

Only students who study very hard get an A in logic.
Ann did not study hard enough for logic.

So, Ann will not get an A in logic.

Here are some examples of non-deductive arguments (note that the conclusion bar is double so as to distinguish them from deductive arguments):

Tim is older than Jenny.

===

So, Tim is more experienced than Jenny.

The majority of Americans live on the American continent.
George U. Bush is an American.

===

So, George U. Bush probably lives on the American continent.

Taking the "Introduction to Logic" course was a great experience for most students.

===

So, taking the "Introduction to Logic" course will be a great experience for ______________________.
[your name]

All observed ravens have been black.

===

So, all ravens are black.

The formula $E=mc^2$ applies to all observed physical phenomena.

So, the formula $E=mc^2$ applies to all physical phenomena.

Sometimes non-deductive arguments are called “inductive arguments”; other times the term ‘inductive argument’ is used more narrowly (the last two arguments are prime examples of this narrower usage).

We will not concerns ourselves further with inductive arguments. If, at this point, you are worried that you cannot really distinguish between these two types of arguments, you should not worry too much. It takes practice and exercise to be able to do so. You might take solace in the fact that you actually already have the power to reason deductively. Fill in the conclusion in this example:

John will take either Ann or Betty to a restaurant.
John will not take Ann out, since she is already going out with Ken.

So,

I take that it that you did not have any doubt at all that, given those premises, it follows that John will take Betty to a restaurant. And the fact that it was impossible for you to conclude otherwise is an important feature of deductive reasoning. Nobody who accepts the premises can think that John will not take Betty to a restaurant. – That is the power of logical reasoning.

Exercise “Deductive Validity in Practice”

Fill in the conclusions of the following arguments. If a question is asked (in square brackets), answer it.

Example:

If Calvin is sick, he stays in bed.
If Calvin’s father is sick, he goes to work.
Calvin and his father fell sick yesterday.

So, Calvin stayed in bed but his father went to work.

(a) If Philadelphia Eagles win the game with Dallas Cowboys they will enter the playoffs.
The Eagles did not enter the playoffs.

So, [Did the Eagles win the game?]

(b) All spaniels have long ears.
Missy is a spaniel.

So,

(c) You can't go wrong on this salad: if you follow the recipe, it will be perfect.
The salad did not turn out perfect.

So,

(d) If it rains, Abe always takes an umbrella.
If Abe takes an umbrella, he's uncomfortable.
Yesterday, Abe was not uncomfortable.

So, [Did it rain?]

(e) If you get either 85 or 86 points on a quiz you get a B.
Al got 85 points on a quiz.

So,

(f) If it either rains or snows, Joe never goes out.
Joe did go out yesterday.

So,

(g) All metals conduct electricity.
But no sotones conduct electricity.

So, [Are any sotones metals?]

2.4. Enthymematic Arguments

One important fact about ordinary discourse is that it is often economical – we do not always explicitly say what is (or what we take to be) obvious to the hearer. The problem is that sometimes it is obvious and other times not. This points to another problem in the logical reconstruction of ordinary arguments – sometimes we need to add something to make the argument explicit. Consider a very simple example:

Abortion is wrong since all killing is wrong.

It is clear that the conclusion here is the proposition "Abortion is wrong." Moreover, the conclusion is said to follow from the premise "All killing is wrong." It is clear, however, that the conclusion will only follow if also accepts the premise "Abortion is a killing." After all, if one did not believe that abortion is a killing, one would have no reason to believe that abortion is wrong on the basis that all killing is wrong. Thus, the argument properly reconstructed would look thus:

All killing is wrong.
Abortion is a killing.

So, abortion is wrong.

Arguments that contain hidden premises are also called "enthymematic arguments" or "enthymemes." The premise that is hidden is sometimes called the "enthymematic premise."

The identification of hidden premises often helps to afford progress in a debate. For sometimes the hidden premises are obvious neither to the hearer nor to the speaker. When one brings them to light, makes them explicit, they can become the object of debate themselves. It may then turn out that even the proponent of the argument will agree that the hidden premise is objectionable.

Exercise "Hidden Premises"

Identify the conclusion and all the (including the hidden) premises in the following arguments.

(a) Sally has never received a violation from the Federal Aviation Administration during her 16-year flying career. Sally must be a great pilot.

(LSAT, Sample)

(b) The government of Zunimagua has refused to schedule free elections, release political prisoners, or restore freedom of speech; therefore, no more financial aid from the United States should be provided to Zunimagua.

(LSAT, Sample)

(c) Pregnant women should never use experimental drugs for such a use may have a detrimental impact on the development of the fetus.

(d) Since the good, according to Plato, is that which furthers a person's real interests, it follows that in any given case when the good is known, people will seek it.

(A. Stroll, R. Popkin, *Philosophy and the Human Spirit*)

(e) …Wagner's music [is] better than anybody's. It is so loud that one can talk the whole time without people hearing what one says. (O. Wilde, *The Picture of Dorian Gray*)

(f) To name causes for a state of affairs is not to excuse it. Things are justified or condemned by their consequences, not by their antecedents.

(J. Dewey, "The Liberal College and Its Enemies")

(f) Russia’s aggressive fishing in the prime fishing grounds of the Northern Pacific has led to a sharp decline in the populations of many fish and a general increase in the retail price of fish. This same pattern has occurred with far too many of our scarce vital natural resources, resulting in high prices for many products. It is likely then, that fish prices will continue to rise in the near future.
In making the argument above, the author relies on all of the following assumptions *except*:
(i) The scarcity of fish is a determining factor in its price.
(ii) The decline in the number of fish available will result in higher prices for fish in stores.
(iii) There will not be any substantial decrease in other costs involved in the fishing process that could keep the price of fish from increasing.
(iv) Fish populations will not recover in the near future.
(v) Fishing practices can substantially influence the demand for fish.

(LSAT, Sample)

3. Logical Properties of Propositions and Arguments

You now know what propositions are and what arguments are. In logic we investigate, among others, the so-called logical properties of propositions and arguments. In ordinary language, we do not distinguish sharply between those propositions but it is crucial that you learn to distinguish them.

Some properties of

propositions	arguments
true / false (truth-value)	valid / invalid
logically true / contingently true / logically false / contingently false	sound / unsound

It is logical nonsense to say that

an argument is true (false). 

The premises of an argument (which are always propositions) may be true. The conclusion of the an argument (which is likewise a proposition) may be true. But an argument cannot be true.

It is likewise logical nonsense to say that

a proposition is valid (invalid). 

One way to understand why the distinction is needed is to remember that an argument involves an inference (a movement, so to speak) from the premises to the conclusion. When we evaluate an argument we evaluate how good is the inference. And this evaluation is quite different from the evaluation of the premises. It is also important to remember that *one can reason well (validly) given false premises*. Consider this argument:

All stars emit light.
Venus is a star.

So, Venus emits light.

This is a logically valid argument. Here someone reaches a false conclusion reasoning validly from a false premise (Venus is a planet, not a star).

4. Validity and Soundness

In this section, we will learn a little bit more about validity and introduce another feature of arguments, viz. soundness, but before we can do this we need to understand one incredible feature of reasoning, viz. its formal nature.

4.1. Logical Form

Consider the innocently looking example from the Exercise "Deductive Validity in Practice"

(g) All metals conduct electricity.
But no sotones conduct electricity.

So, [Are any sotones metals?]

The conclusion that you have surely written down is that no sotones are metals. (It stands to reason: If all metals conduct electricity, and sotones don't, they can't be metals.) You wrote the right conclusion even though you did not know what sotones are. How do I know that you do not know what sotones are? Well, because I don't either. This is a term I invented. – And yet, and this is quite incredible, if you think about it, we could reason about sotones!

This is all because reasoning is a formal affair. What matters to an argument is not so much the content of a proposition as its logical structure also called logical form. Arguments are valid (or invalid) in virtue of exhibiting a certain logical form. This is why you can sometimes reason correctly about things (like sotones) that you have no idea about.

We will spend quite a bit of time understanding the idea of logical form in the light of various logical theories. For now, it is important for you to get an intuitive grasp of what logical form is. Let's start by filling in the conclusions to these arguments:

(i) John will turn right or left.
John did not turn left.

(ii) Kay will have fruit or ice-cream.
Kay did not have ice-cream.

(iii) Tim will get a rabbit or a hamster.
Tim did not get a hamster.

(iv) Rose will go to the cinema or theater.
Rose did not go to the theater.

As before, you most surely did not have any problems in drawing the right inferences. But in this case, you may also have noted that despite the fact that the arguments here are all different, they nonetheless share something. They have the same logical form. Let us write one of the examples in a more detailed fashion, so that we can explicitly see all the propositions involved.

Tim will get a rabbit or Tim will get a hamster.
It is not the case that Tim got a hamster.

So, Tim got a rabbit.

Use a colored pen to mark the same sentences – in this way you will see the structure more clearly. (Don't laugh at this request. There is a reason why you use color to learn math in elementary school!)

All of the above arguments have a common structure which can be represented thus:

or
It is not the case that

So,

(Again, mark the boxes with two different colors – the square boxes in one color, say, red, the round boxes in another color, say, blue.) The different boxes stand for different propositions (note that the same proposition must always go into the same box). What you see outside the boxes – the phrases 'or', 'it is not the case that' are so-called logical constants. It is the study of their behavior that is the proper task of a logical theory, as you will see starting with the next unit.

Because it would be hard for logicians to use differently-colored or differently-shaped boxes, they have adopted the convention of using so-called propositional variables, which simply name such boxes, i.e. places where propositions can be inserted. It is accepted as a convention that propositional variables are written by means of the small letters of the alphabet starting with *p*, *q*, *r*, etc. The logical form of the above arguments can thus be written:

$$\begin{array}{c} p \text{ or } q \\ \underline{\text{It is not the case that } q} \\ p \end{array}$$

(Put a small red square box around *p*, put a small blue round box around *q* and you will see that the structures are indeed identical.)

This logical argument form has in fact its Latin name, it's called *modus tollendo ponens*, and it is better known as the disjunctive syllogism. It is important that you see how the above arguments (i)-(iv) fit this form. When an argument fits a certain logical form, we say that the arguments *instantiates* or exhibits this logical form. Arguments (i)-(iv) all instantiate the logical form called disjunctive syllogism. We can also say that arguments (i)-(iv) are all *instances* of disjunctive syllogism. Do the following exercise.

Exercise "Logical Form – Disjunctive Syllogism"

(a) Color the square boxes in red, the round boxes in blue. (b) Write in the expanded versions of the arguments (i)-(iv) (p. 1-17) in the boxes, making sure that each box contains a proposition. You will thus need to rephrase the statement "John will turn right or left" into the logically more perspicuous "John will turn right or John will turn left."

(i)

[ ] or [ ]

It is not the case that [ ]

So, [ ]

(ii)

[ ] or [ ]

It is not the case that [ ]

So, [ ]

(iii)

	or	
It is not the case that		

So,

(iv)

	or	
It is not the case that		

So,

4.2. Validity and Logical Form

Now that you have acquired some idea of what a logical form is, you are prepared to learn about, though not yet to understand, an important fact.

> Arguments (instances) are valid (invalid, resp.) in virtue of their logical form.

This means that an argument (instance) is valid if and only if its argument form is valid. This in turn means that all instances of an argument form will be valid. (The same is true for invalidity.)

This is quite an incredible fact given that there are an infinite number of instantiations of any given logical form. (This is because theoretically, though not in practice of course, we can form an infinite number of statements.) One question that you might be asking yourself is how on Earth could we know such a fact. And believe it or not, we will find an answer to this in the coming units.

4.3. Validity and the Force of the Logical 'must'

I have already said that if an argument is valid, someone who accepts the premises *must* accept the conclusion. Another way to put this point is: in a valid argument, the conclusion logically follows from the premises. It will pay to pause a little to think about what this 'must' means. You might think to yourself: "I live in a free country, nobody will force me to do anything!"

To wit, logic recognizes your right to refuse accepting the conclusion of a valid argument but *only if* you also refuse to accept one of the premises of that argument. If, on the other hand, you *do* accept the premises of a valid argument then you indeed *must* accept the conclusion of that argument. And if you see the argument as valid (i.e. if you see the conclusion as following from the premises), you will in fact have no trouble at all in seeing that someone who accepts the premises cannot but accept the conclusion.

Here are a couple of controversial but valid arguments to convince of this. Those arguments are controversial because people disagree about the question whether the premises are true – they all agree that the arguments are valid.

Example 1

Consider the following argument:

If an omnipotent (all-powerful), omnibenevolent (all-good) and omniscient (all-knowing) being existed, there would be no evil in the world.
There is evil in the world

So, An omnipotent, omnibenevolent and omniscient being does not exist.

This is a logically valid argument in the sense that someone *who does accept* both premises *must accept* the conclusion. As you probably know, this is the central argument in the age-long debate between theists and atheists, which has come to be known as the "problem of evil." The participants in the debate agree that the argument is logically valid. What they disagree about is whether the premises are true. (One can undermine the first premise and claim that an omnipotent, omnibenevolent and omniscient being might have good reasons to allow evil to exist because, for instance, such a being would want to endow humans with free will and it would be impossible to create free human beings without allowing for the possibility of there being evil.) The important fact for us is that the only way to deny the conclusion of a logically valid argument is to deny one of its premises. Nobody who accepts the premises can deny the conclusion. For, in deductive arguments, the truth of the premises guarantees the truth of the conclusion.

Example 2

It is morally wrong to kill human beings.
Abortion involves the killing of a fetus.
A fetus is a human being.

So, abortion is morally wrong.

Again, the argument is logically valid because someone *who does accept* the premises *must accept* the conclusion. Of course, we may deny the conclusion but only if we deny one of the premises. Logical validity concerns only a formal property of reasoning. To say that an argument is logically valid is not to say that its premises are true!

This idea is captured in the definition of logical validity thus:

Definition of validity

An argument is logically valid iff[1] it is impossible for the conclusion of that argument to be false while the premises of that argument are true.

We will come back to this definition in later units.

4.4. Soundness

Logically valid arguments need not have true premises. In fact, the relationship between truth and validity is a very complex one and we will study it in more detail in a later unit. However, logicians have introduced a special term to cover those valid arguments that also have true premises. They have called such arguments "sound."

Definition of soundness

An argument (instance) is sound iff it is logically valid and all of its premises are true.

Exercise "Soundness"*

Using the definition of validity (p. 1-21) and the definition of soundness (p. 1-21), explain why the conclusion of a sound argument must be true.

5. Fallacies (Tempting Forms of Invalidity)

In the course of their study of valid arguments, logicians have also encountered a number of arguments that are in fact invalid, though often times, they appear to be valid on their surface. Here are just some instances of the most famous fallacies.

5.1. Equivocation

One of the most famous of the fallacies is the fallacy of equivocation. The name of the fallacy comes from the Latin 'equi voce' [same sound]. The fallacy consist in our using one word-sound to cover to two different concepts (word meanings). An example will help to bring out what is wrong.

Anyone with grass in his/her possession violates US drug laws.
President Bush has grass growing all around the White House.

So, President Bush violates the U.S. drug laws.

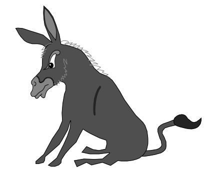
This argument has the structure of a valid argument form, of which the following argument is also an instance: Anyone who has a valid M.S. driver's license has the right to drive a car in the U.S.A; John Smith has a valid M.S. driver's license; so, John Smith has the right to drive a car in the U.S.A. And we could go on in citing other valid arguments that have this form. In fact, the logical form in question (All As are B, c is A [individual c has the property A]; so, c is B) is valid. So, what's the problem?

[1] 'iff' is short for, and read as, 'if and only if'.

The problem is that the word ‘grass’ has multiple meanings. And, as it turns out, it occurs in one of its meanings in the first premise and in quite a different meaning in the second premise. If we make this explicit, we will see that the argument no longer appears valid:

Anyone with marijuana in his/her possession violates US drug laws.
President Bush has carpetgrass growing all around the White House.

So, President Bush violates the U.S. drug laws.



This is clearly an invalid argument.
Indeed, it is prerequisite of all valid arguments that the terms that appear in them never use words in their different meanings.

Exercises “Fallacies – equivocations”

For each of the following equivocations, explain what ‘word’ is used ambiguously.

(a) Only men are rational creatures. No woman is a man. So, no woman is rational.

(b) We are made of over 90% of water. Water is worth approx. $1 a gallon. So, a normal person is worth less than $20.

(c) Happiness is the end of life. The end of life is death. So, happiness is death.

(d) “Let’s discuss that bane of modern liberalism, *discrimination*. Frankly, I’m getting tired of the word — at least the way it is used most of the time today. The fact of the matter is that I’ve been discriminating a lot lately. Sometimes discrimination is a good thing.

“For instance, I’ve been searching for a new place to live… I have loved some and I have found others to be lacking. In other words, I have discriminated… Therefore, discrimination is not always bad, is it? …[But] liberals have … the idea that discriminating among people, places, and things for any reason is wrong.” (Limbaugh, p. 172)

5.2. Question-Begging Arguments

An interesting form of fallacy is the fallacy of question-begging. Consider this example:

> Obviously there is a God. The Bible says so, and we may accept what the Bible says as true because, after all, the Bible is the word of God.

The argument may be reconstructed as follows:

The Bible says that God exists.
What the Bible says is true (because the Bible is the word of God).

So, God exists.

When reconstructed thus it is evident that the argument is logically valid. Moreover, for all we know, it might be that the argument's premises are true and so that its conclusion is true. Certainly, many people believe that is the case. So, what is wrong here?

Well, the problem is that the argument has no persuasive power at all. That is because in order to accept the second premise "What the Bible says is true" we must accept that it is the word of God and in order to accept that we must accept that God exists (i.e. the conclusion of the argument!). This argument purports to show that God exists on the basis of our already accepting that God exists. It is circular, in other words. Nobody who does not already accept that God exists will accept the conclusion.

Here are two more examples of this same fallacy:

> *Consumer Reports* is a reliable consumer magazine. It has recently published an article evaluating the reliability of consumer magazines where it was ranked very highly.
>
> Women are not fit to be priests because a priest's job is appropriate only for men.

5.3. Argument from Ignorance

People sometimes argue from ignorance, i.e. they take it that the absence of positive or negative evidence proves something. It never does. Here are a couple of examples:

> There is no evidence that the Pill is harmful. So, the Pill is safe.
>
> All of the examined arguments for the existence of God are fallacious. So, God does not exist.
>
> No evidence has been found to support the theory of evolution. So, the theory of evolution is false.

5.4. *Ad Hominem* Fallacy

A very old fallacy, often employed in politics, is the so-called *ad hominem* fallacy. It consists in an attack on the person rather than the views held by the person. As you are reading through the examples you might catch yourself feeling less certain that a fallacy is at stake. This is because of some additional norms to which we hold people, but in all these cases, the fallacy is committed.

> I don't see how you can believe that Karl Marx's theory of surplus value makes any sense. Don't you know who Marx was? He was the father of that global abomination — Godless Communism.
>
> General Baum has argued that Clinton's proposed cuts in the military budget are a bad idea for the U.S. economy. But why should we listen to the general? He knows that the cuts will hurt him and his military friends. His position is clearly self-serving. We can dismiss his opposition to Clinton.
>
> How can you believe that 'bull' Rush Limbaugh spreads about liberals? As his biographer makes quite clear, Limbaugh is an insecure guy who is

still trying to live up to his deceased father's conservative values and critical demands that he amount to something more than a college dropout who had to spin records for a living.

> There were 750,000 people in New York's Central Park recently for Earth Day. They were … listening to Tom Cruise talk about how we have to recycle everything and stop corporations from polluting. Excuse me. Didn't Tom Cruise make a stock-car movie in which he destroyed thirty-five cars, burned thousands of gallons of gasoline, and wasted dozens of tires? If I were given the opportunity, I'd say to Tom Cruise, 'Tom, most people don't own thirty-five cars in their life, and you just trashed thirty-five cars for a movie. Now you're telling other people not to pollute the planet? Shut up, sir. (Limbaugh)

> Candidate Jones has no right to moralize about the family since he cheats on his wife.

5.5. *Ad Baculum* Fallacy

Logic is about employing the force of reason. The *ad baculum* fallacy is a particularly devastating misuse of the power of words – it simply consists in threatening a person unless she agrees with the view:

> If you don't agree that Nixon was a great president, I will beat your head with an ax-handle and twist off all your fingers! Therefore, Nixon was a great president!

5.6. Irrelevant Conclusion

Another fallacy, and rhetorical figure frequently used in politics, is the argument to an irrelevant conclusion. Here is a nice illustration from the presidential debate between Quayle and Gore:

> Quayle: Bill Clinton can't be trusted to tell the truth. He's deceived the American people time after time.
>
> Gore: Dan, once again you're mistaken. Let's not forget who said "Read my lips; no new taxes."

The fact that somebody else deceived the American people does not undermine the fact that Clinton did.

5.7. Hasty Generalization

This is a fallacy that all of us fall prey to. We generalize very hastily forgetting that a generalization is an extremely powerful claim. "All Americans smile all the time." "All Germans are tidy and punctual." These are just a sample of the "nicer" prejudices to which we fall prey. What is more, we fall prey to the just after sampling a couple of instances.

> Last month our mailman was bitten by a German Shepherd for apparently no reason at all. In last Friday's paper there was a story about a Shepherd

that attacked two children without provocation. So, it’s obvious to anyone willing to face facts — German Shepherds are vicious.

5.8. The Conclusion does not follow from the Premises (Non-Sequitur)

There are many more types of fallacy. I have not discussed all of them here. But there is one final term that bags many of the fallacies without classifying them. *Non-sequitur* – the conclusion does not follow from the premises. Usually in the case of the *non-sequitur* it might look like there are structural reasons for the argument to be valid, but the argument is not valid. Here are a couple of examples (but you should not try to decipher the common structure).

Some people are bad teachers. So, some teachers are bad people.

“[According to Ehrlich]: ‘Based upon per-capita commercial energy use, a baby born in the US represents twice the disaster for Earth as one born in Sweden or the USSR, …thirty-five times one in Chad, Rwanda, Haiti, or Nepal.’ …note his phraseology: Babies, the epitome of innocence… represent disaster. And they tell us they are for family values.” (Limbaugh, 75)

“There are now more American Indians alive today than there were when Columbus arrived or at any other time in history. Does that sound like a record of genocide?” (Limbaugh, 85)

“Why were people better educated before the American Revolution with no public funding than in 1993, when we are spending in excess of $100,000 per classroom?” (Limbaugh, 175)

I saw a thief with my binoculars. So he must have stolen my binoculars

The workers were unionized, and therefore possessed no extra electrons!

Fluffy is a bear cub. Therefore, he has no fur.

The professor admitted that John is good at *philosophy*. So surely we may conclude that John is lousy at history, math, English, …

This girl’s school is little. Therefore, it’s a little girl’s school. Therefore, it’s a school for little girls.

These two women came to the party in the same dress. It must have been quite big and still they must have really squeezed to get into it.

What You Need to Know and Do

- You need to know what the distinction between propositions (statements) and sentences is.
- You need to be able to recognize sentences that are propositions and those that are not.
- You need to know what arguments are, what parts they consist of and how those parts are related.
- You need to be able to recognize arguments and their parts; you need to know what words indicate what part of the arguments.
- You need to be able to characterize the distinction between deductive and non-deductive arguments.
- You need to know what an enthymematic argument is.
- You need to be able to distinguish the properties of propositions (truth) and of arguments (validity, soundness); you must not confuse the bearers of those properties.
- You need to know what the logical form of an argument is.
- You need to be able to explain the concepts of validity and soundness.
- You need to know how logical form and validity are related.
- You need to know what fallacies are.

Further Reading

You can read about these matters further in a number of logic textbooks. I enclose the chapters titles for the textbooks I have chosen as optional.
Copi & Cohen: Ch. 1. Basic Logical Concepts, Ch. 4. Fallacies
Klenk: Ch. 1. Introduction to Logic