Peter Smith, *Introduction to Formal Logic* (CUP, 2nd edition)

Exercises 1: Some informal arguments

What are the premisses, inference markers, and conclusions of the following arguments? Which of these arguments do you suppose involve deductively valid reasoning? Why? (Just improvise, and answer the best you can!)

(1) *Most politicians are corrupt. After all, most ordinary people are corrupt – and politicians are ordinary people.*

> Premiss: Most ordinary people are corrupt.
> Premiss: Politicians are ordinary people.
> Conclusion: Most politicians are corrupt.

Equally, we could take it that there is a single premiss, 'Most ordinary people are corrupt and politicians are ordinary people' – this plainly would make no difference.

'After all' here signals that what comes next are the reasons for the initial statement. The inference move is plainly invalid. It is *possible* that most ordinary people are corrupt, but all the politicians are among the exceptions!

(2) *Anyone who is well prepared for the exam, even if she doesn't get an A grade, will at least get a B. Jane is well prepared, so she will get at least a B grade.*

> Premiss: Anyone who is well prepared for the exam, even if she doesn't get an A grade, will at least get a B grade.
> Premiss: Jane is well prepared for the exam.
> Conclusion: She [Jane] will get at least a B.

We have added 'for the exam' to the second premiss, as is surely intended. And this is crucial if the argument is to work: to be well prepared for e.g. a hard night's clubbing won't guarantee a B grade! The resulting inference move, marked by 'so', is valid.

(It is worth pausing to think about the semantic role of 'even if'.)

(3) *John is taller than Mary and Jane is shorter than Mary. So John is taller than Jane.*

> Premiss: John is taller than Mary and Jane is shorter than Mary.
> Conclusion: John is taller than Jane.

Necessarily, if Jane is shorter than Mary then Mary is taller than Jane. And necessarily if John is taller than Mary and Mary is taller than Jane, then John is taller than Jane. So this is a deductive valid inference – there's no possible way the premisses can be true and conclusion false.

A point worth noting, though, is that this little argument (unlike the other examples of deductively cogent arguments we've met so far) doesn't depend for its validity on the distribution of very general logical words like 'all' or 'most' or 'some' or 'or'; rather, it is valid in virtue of the meanings of 'taller' and 'shorter'. Later, in Chapter 6, we will start marking off for special treatment the inferences whose validity depends only on the presence of very general logical words – these will be the specifically *logically* valid inferences.

(4) *At eleven, Fred is always either in the library or in the coffee bar. And assuming he's in the coffee bar, he's drinking an espresso. Fred was not in the library at eleven. So he was drinking an espresso then.*

The natural way of reading the second premiss is as a generalization. Spelling that out, the inference comes to this:

> At eleven, Fred is always either in the library or in the coffee bar.

Whenever Fred is in the coffee bar, he?s drinking an expresso.
Fred was not in the library [when I looked] at eleven.
Conclusion: Fred was drinking an expresso at eleven.

The inference is valid. Fred was not in the library at eleven. But he was then either in the library or the coffee bar (the first premiss). So he was in the coffee bar. Etc.

(5) *The Democrats will win the election. There's only a week to go. The polls put them 20 points ahead, and a lead of 20 points with only a week to go to polling day can't be overturned.*

There is no explicit inference marker here, but it is natural to read this passage as an argument with the conclusion given first.

If the second premiss had said 'a lead of 20 points *hasn't* ever been overturned', then this would be an inductive argument from past to future, and hence not deductively valid. But the second premiss says 'a lead of 20 points *can't* be overturned'.

So spelling things out, the intended argument becomes something like this.

There is a week to the election.
The Democrats are 20 points ahead in the polls
If a party are 20 points ahead in the polls a week before the election, their lead cannot be overturned by the time of the election.
Conclusion: The Democrats will win.

This inference is still not valid, however. The Democrats can still have a lead both in polling and popular vote on the day and yet lose .... To get a valid inference, we'd have to add a missing premiss ruling out that possibility.

(6) *Dogs have four legs. Fido is a dog. Therefore Fido has four legs.*

The inference 'All dogs have four legs; Fido is a dog; therefore Fido has four legs' is, of course, unproblematically valid. But our argument is different.

'Dogs have four legs' is normally understood as being a statement about typical dogs, or about how dogs are naturally, or some such. And dogs typically/naturally having four legs is compatible with poor Fido having met with an accident and having to hobble on three. So the given inference is not valid.

(7) *Jekyll isn't the same person as Hyde. The reason is that no murderers are sane – but Hyde is a murderer, and Jekyll is certainly sane.*

Valid inference to the conclusion that Jekyll isn't the same person as Hyde. Given no murderers are sane, and Hyde is a murderer, it follows that Hyde is not sane. We are given however that Jekyll is sane. So Jekyll and Hyde have different properties, hence cannot be one and the same person.

(8) *All the slithy toves did gyre and gimble in the wabe. Some mome raths are slithy toves. Hence some mome raths did gyre and gimble in the wabe.*

This has the look of an inference of the shape

All Ss are G. Some Ms are S. So, some Ms are G.

And a genuine inference of that form will of course be valid. However, our Jabberwockian example is not a genuine inference, since the premisses and conclusion are nonsense, and make no contentful claims. And if it isn't a genuine inference, where we infer a contentful claim from two other contentful claims, it can't be a valid genuine inference in particular!

(9) *Some but not all philosophers are logicians. All logicians are clever. Hence some but not all philosophers are clever.*

Imagine a world consisting of just Alex, Bev and Chris, all three clever, the first two philosophers, the second two logicians. Then it is true that some but not all philosophers are logicians,

true that all logicians are clever, false that some but not all philosophers are clever. So the premisses of our inference can be true and conclusion false, hence the inference is invalid.

Here is another way of seeing the point. Consider

> Some but not all philosophers are women. All women are human beings. Hence some but not all philosophers are human beings.

This argument is obviously hopeless – it has actually true premisses and a false conclusion. But this hopeless argument is exactly parallel to our original argument; the two arguments turn on the same pattern of inference. So the original argument can be no better than this evidently hopeless one.

(10) *No experienced person is incompetent. Jenkins is always blundering. No competent person is always blundering. Therefore Jenkins is inexperienced.*

Valid inference to the conclusion that Jenkins is inexperienced. Here's one way to see it: Suppose Jenkins is experienced. Then (by the first premiss) he must be competent; and so (by the third premiss) he isn't always blundering – which contradicts the second premiss. So the supposition that Jenkins is experienced isn't consistent with the other premisses. So it must be false, given those premisses.

(11) *Many politicians take bribes. Most politicians have extra-marital affairs. So many people who take bribes have extra-marital affairs.*

Invalid inference to the conclusion marked by 'so'. Suppose there are 1000 politicians, and 400 of them take bribes (and no one else does). And suppose the other 600 of them have extra-marital affairs (and no one else does). Then that's a world where the premisses are true, but no-one who takes bribes has extra-marital affairs!

(12) *Kermit is green all over. Hence Kermit is not red all over.*

Your verdict on this argument will depend on whether you think it is a necessary truth that nothing can be both red and green (all over, at the same time). Is it there a possible situation in which something counts as both red and green? And if not, why not?

Once upon a time, quite a bit of philosophical ink was spilt over this issue. We can't settle the question here! But the Kermit example points up a useful moral: we have said that an argument is deductively valid if, given the premisses are true, the conclusion just has to be true too. So which arguments you hold to be deductively valid in this sense will depend on your views on what is and isn't possible, and those views can be open to debate. That's one reason why later we will be concentrating on some narrower, more sharply defined, notions of logical validity.

(13) *Every letter is in a pigeon hole. There are more letters that there are pigeon holes. So some pigeon hole contains more than one letter.*

Yes, necessarily if the premisses are true, the conclusion has to be true. More generally, it is a mathematical necessity that if n items are put into m containers – more abstractly, are assigned to m sets – and $n > m$, then some container (set) must contain more than one item. This principle is indeed called the *pigeon-hole principle*!

So this counts as a valid inference by our definition; but again, like the Kermit argument, we might note that the argument turns on more than the meaning of logical words like 'all' and 'if' and 'no' etc. – so, it might be said, the validity is in some sense not a matter of pure logic: see Chapter 6 for more about this.

(14) *There are more people than there are hairs on anyone's head. So at least two people have the same number of hairs on their head.*

This is a teaser. You might be tempted to apply the pigeon-hole principle, and argue like this. Group people into sets, depending on the number of hairs on their head. Suppose the largest number of hairs on anyones head is m. And suppose there are n people, where $n > m$. Then at least one set contains more than one person.

Oops, no! You've forgotten about the possibility that someone is bald. Suppose there are 101 people, all having different numbers of hairs on their head, ranging from being completely bald to having a 100 hairs. Then there are more people than there are hairs on anyone's head, but no two people have the same number of hairs.

I mention this example, because for years I wrongly used this as an example where we can apply the pigeon hole principle, until a student gently pointed out the error of my ways. Thank you Alice!

Moral: we can all go wrong even in our simple logical reasoning!

(15) *Miracles cannot happen. Since, by definition, a miracle is an event incompatible with the laws of nature. And everything that happens is always consistent with the laws of nature.*

Invalid. The premisses tell us that in fact no miracle ever happens. But they don't tell us that miracles cannot happen. Compare:

> Crimes cannot happen. Since, by definition, a crime is an act incompatible with the criminal law. And everything that happens is always consistent with the criminal law.

In a law-abiding community the premisses may be true: it doesn't follow that criminal activity is impossible!

(16) *(Lewis Carroll) No interesting poems are unpopular among people of real taste. No modern poetry is free from affectation. All your poems are on the subject of soap bubbles. No affected poetry is popular among people of real taste. Only a modern poem would be on the subject of soap bubbles. Therefore none of your poems are interesting.*

Consider this reasoning, set out a bit more formally than we have been doing so far:

(1)	No interesting poems are unpopular among people of real taste.	(premiss)
(2)	No modern poetry is free from affectation.	(premiss)
(3)	All your poems are on the subject of soap bubbles.	(premiss)
(4)	No affected poetry is popular among people of real taste.	(premiss)
(5)	Only a modern poem would be on the subject of soap bubbles.	(premiss)
(6)	All your poems are modern poems.	(from 3, 5)
(7)	All your poems are affected.	(from 2, 6)
(8)	None of your poems are popular among people of real taste.	(from 7, 4)
(9)	All interesting poems are popular among people of real taste.	(from 1)
(10)	None of your poems are interesting.	(from 8, 9)

Does this establish that the desired conclusion does indeed follow from the premisses? Lewis Carroll seems to have supposed so. But actually, the step from (1) to (9) can be challenged – does not being unpopular imply being popular? Can't something be neither popular nor unpopular, because everyone is indifferent to it??

(17) *'If we found by chance a watch or other piece of intricate mechanism we should infer that it had been made by someone. But all around us we do find intricate pieces of natural mechanism, and the processes of the universe are seen to move together in complex relations; we should therefore infer that these too have a maker.'*

This is a version of the Argument from Design for some form of theism. Here is William Paley in a famous passage written at the very beginning of the nineteenth century:

> In crossing a heath, suppose I pitched my foot against a stone, and were asked how the stone came to be there; I might possibly answer, that, for anything I knew to the contrary, it had lain there forever: nor would it perhaps be very easy to show the absurdity of this answer. But suppose I had found a watch upon the ground, and it should be inquired how the watch happened to be in that place; I should

> hardly think of the answer I had before given, that for anything I knew, the watch might have always been there. ... There must have existed, at some time, and at some place or other, an artificer or artificers, who formed [the watch] for the purpose which we find it actually to answer; who comprehended its construction, and designed its use. ... Every indication of contrivance, every manifestation of design, which existed in the watch, exists in the works of nature; with the difference, on the side of nature, of being greater or more, and that in a degree which exceeds all computation.

Plainly, it wouldn't be *deductively* valid to infer a maker from an intricate mechanism. The interesting question can only be if this sort of argument is a cogent non-deductive argument which renders its conclusion probable. (A Darwinian will deny that it is, claiming that what look like intelligently designed 'mechanisms' can in fact arise from the blind workings of natural selection.)

(18) *'I can doubt that the physical world exists. I can even doubt whether my body really exists. I cannot doubt that I myself exist. So I am not my body.'*

This line of argument seems to be endorsed by Descartes in the *Meditations* (though we can argue about the attribution). Leibniz, with his typical logical acumen, saw that the argument won't do. He wrote

> It is not valid to reason: 'I can assume or imagine that no corporeal body exists, but I cannot imagine that I do not exist or do not think. Therefore I am not corporeal, nor is thought a modification of the body.' I am amazed that so able a man [as Descartes] could have based so much on so flimsy a sophism. ... Someone who thinks that the soul is corporeal ... will admit that you can doubt (as long as you are ignorant of the nature of the soul) whether anything corporeal exists or does not exist. And as you nevertheless see clearly that your soul exists, he will admit that this one thing follows: that you can still doubt whether the soul is corporeal. But no amount of torture can extort anything more from this argument.

In short, Descartes's premisses about what we can imagine to be the case show – at most – that we can imagine that we are distinct from our bodies: and this isn't sufficient to show that we really are separate from our bodies. For more on this see e.g. Peter Smith and O. R. Jones, *The Philosophy of Mind*, Chapter 3 (now an old book, but it still has its moments!).