Critical Reasoning:
A Romp Through the Foothills of Logic
Answers to the exercises on the slides, the 'home' exercises and supplementary exercises given:

Lecture One: The Nature of Argument

Answers to Exercises:

Exercise One (slide 18):

1. **Is it true that the retail price index has fallen? Yes.**
2. **Is it true that we need tomatoes? Yes**
3. **Is it true that are you ill? No. This sentence has interrogative, not assertoric, force. It expresses a question not a belief.**
4. **Is it true that I hereby resign from the committee? Debatable: in use this sentence constitutes the performance of an act of resigning (it is called a 'performative'). If it is a declarative sentence it is a very odd one.**
5. **Is it true that when did you see Jaz? NO. As (iii)**
6. **Is it true that close the door!? No, This sentence has imperative, not assertoric, force. It expresses a command not a belief.**
7. **Is it true that don't worry? No This sentence has expressive, not assertoric, force. It expresses a reassurance, not a belief.**

Exercise two (slide 50):

1. **This is not an argument. It is not being suggested that the clouds forming and the sky's growing darker are *reasons* for the storm's breaking, but that they happened *before* the breaking of the storm.**
2. **This is an argument (Premise one: Manchester is north of Oxford. Premise two: Edinburgh is north of Manchester. Conclusion: Edinburgh is north of Oxford.**
3. **This is an argument (Premise one: Witches are made of wood. Premise two: Wood floats. Conclusion: Witches float)**
4. **This is not an argument: it is merely being *stated* that things are a lot quieter since Jesse and his gang left town.**
5. **This is a conditional assertion not an argument (see below).**

6. **This is not an argument, but merely a statement.**

7. **This is not an argument but a recommendation.**

Lecture Two: The Analysis of Argument

Answers to Exercises:

Exercise One (slide 19): Which arguments have conclusions indicated by 'conclusion indicators'

1. **Yes, the word 'therefore' is a conclusion indicator.**
2. **No, the conclusion is 'Jane will be at the party' and it isn't indicated by anything – the only way to tell it is the conclusion is to see that it is the sentence for which the person who used this argument would be arguing.**
3. **Yes, the word 'so' is a conclusion indicator.**
4. **No. The conclusion here ('Marianne always wears jeans on a Friday') can again be identified only by the role it plays in the argument.**

Exercise Two (slide 22): Can you identify the conclusions of these arguments:

1. **Conclusion: Help is needed urgently**
2. **Conclusion: Strikes are unlikely to wither away in any democratic country so long as Communists have strong minority influence.**
3. **Conclusion: The nests of verdin are surprisingly conspiciuous.**
4. **Conclusion: The effect of ACTH on gout is not due to the increased renal acid clearance alone.**
5. **Conclusion: Some contribution to the magnetic field comes from electric currents in the upper atmosphere.**

Exercise Three (slide 32): Which of these sentences can be represented as a simple conjunction?

1. **No, this cannot be represented as 'Claude is a black cat *and* Claude is a white cat', which would change the meaning entirely.**
2. **Yes, this can be represented as 'Charles is stupid *and* Charles is a boy'**
3. **No, this cannot be represented as 'the twin was clever *and* the twin was always teasing her dim-witted sister' (because the 'clever' is being used to identify which twin was always teasing her sister)**
4. **Yes, this can be represented as 'The policeman was watching through binoculars *and* the policeman ducked just in time'**
5. **No, here the 'was watching through binoculars' picks out the policemen who ducked, rather than being just more information about him.**

Exercise Four (slide 45) Is there a controversial suppressed premise in these arguments:

1. **Controversial suppressed premise: If something is an integral part of someone's culture it should always be permitted.**
2. **Benign suppression: most people know that if you are male you can't be anyone's wife**
3. **Benign suppression: it is common knowledge that cars stop when they run out of petrol.**
4. **Controversial suppressed premise: the death penalty should be abolished if there is a risk of using it on someone who is not guilty**

Week Two's Supplementary Exercise:

Dear Participants,

At the end of last week, we finished slightly early and had time to start the argument you were going to do for homework. But we then got into a twist and didn't have time to sort it out!

I said I would discuss it at the beginning of next week But knowing what we have to do next week that would take too long.

I have decided therefore to (a) give you a new argument as promised, the answer to which will be on next week's answer sheet, and (b) to explain here the analysis of the argument you were given last week here.

(a) Here is your new exercise:

If the Conservatives win the next election, then the moon is made of green cheese. For even though the opposition is a shambles, the economy has gone to the dogs and David Cameron is about to be humiliated by his backbenchers. To be sure if the economy flourishes the Conservatives will win. But grass roots support will inevitably fade if Cameron is humiliated, and unless he gets that support, his Party will only win in a flourishing economy.

This argument is adapted from the Oxford University Preliminary Exam of 1993

(b) Here is the explanation of the exercise you already have:

This was the exercise:

Exercise Five: analyse the following argument, eliminating irrelevancies, explicating suppressed premises (if there are any that should be explicated), making terms consistent and setting it out logic book style:

I'm not being cruel when I pull my cat's tail. After all I am only being cruel if I inflict pain, and of course, God would not allow the innocent to suffer. And my cat, not being a moral agent in the first place (since she's an animal and animals aren't moral agents) cannot be said to have sinned

This argument comes from the Oxford University Preliminary Exam of 1997

My analysis was:

Premise one: **Pulling my cat's tail is cruel only if my cat suffers**
Premise two: **If my cat is innocent she will not suffer**
Premise three: **My cat *is* innocent**
Conclusion: **Pulling my cat's tail is not cruel**

My paraphrasing is intended to reveal the structure of the argument more clearly. I have deemed God, and what he will allow, irrelevant (merely an explanation of *why* my cat won't suffer, when what is important to the argument is only that the cat *won't* suffer). My cat's not being a moral agent because she is an animal is also irrelevant because what matters is only that she is innocent. I have assumed that in making 'she cannot be said to have sinned' into 'my cat is innocent' I am merely making terms consistent not changing meanings (relative to this argument of course).

The worry that many of you had yesterday, I think, is that I was getting rid of stuff on an arbitrary basis. Let me explain again why God (for example) really is irrelevant to this argument.

The first thing we do in identifying an argument is identify its conclusion. Having done so, we then identify its premises – i.e. the reasons given *for that conclusion*. Anything that isn't a reason given *for that conclusion*, is neither the conclusion of that argument, *or* a premise. It is not, therefore, *part* of that argument and can safely be discarded.

If we identify the conclusion, therefore, as 'Pulling my cat's tail is not cruel' (which is what I think you did yesterday, and certainly I have), then we are looking *only* for the reasons given for *this*, not the reasons given for believing that, for example, *one of the reasons given for this* is true.

In offering an argument we often add emotional asides ('I'm fed up') and reasons for thinking one or more of our premises is true. In *evaluating* an argument we will be concerned about the truth of the premises (and possibly, therefore, we will become interested in the reasons given for believing they are true). But in *analysing* an argument (which is all we are currently doing) we are interested only in identifying the conclusion, and the reasons offered *for it* (that very conclusion).

I hope that explains things more satisfactorily?

Lecture Three: Deduction and Induction

In lecture three I made a mistake. I claimed that invalid arguments were monotonic. This is false. It is possible to strengthen an invalid argument by adding further premises. I hope I have removed all reference to this. But if not, it's not *your* mistake but mine.

Answer to last week's (new!) home exercise:

Analyse the following argument, eliminating irrelevancies, explicating suppressed premises (if there are any that should be explicated), making terms consistent and setting it out logic book style:

"If the Conservatives win the next election, then the moon is made of green cheese. For even though the opposition is a shambles, the economy has gone to the dogs and David Cameron is about to be humiliated by his backbenchers. To be sure if the economy flourishes the Conservatives will win. But grass roots support will inevitably fade if Cameron is humiliated, and unless he gets that support, his Party will only win in a flourishing economy."

This argument is adapted from the Oxford University Preliminary Exam of 1993

Premise one: **The economy has gone to the dogs and Cameron is going to be humiliated**
Premise two: **If Cameron is humiliated then grassroots support will fade**
Premise three: **Unless Cameron gets grassroots support the Conservatives will win only if the economy isn't going to the dogs**
Conclusion: **The Conservatives will not win the next election**

The sentence 'even though the opposition is a shambles' is irrelevant, as is the sentence 'to be sure if the economy flourishes the Conservatives will win'. The locution 'If P, then the moon is made of green cheese' used by an English person means 'not-P', so that is what I have as my conclusion.

Answers to Week Three's Exercises:

Exercise One (slide 17):

1. **There are no states of affairs that are physically possible but logically impossible**
2. **….**
3. **Are the following physically impossible, logically impossible or such that we can't tell?**

    1. **By means of genetic manipulation we can produce pigs that are able to fly – *physically impossible, logically possible***
    2. **John has exactly twice as many siblings as Janet: He has Susan and his twin brothers – *logically impossible***

3. **Muon neutrinos can travel faster than the speed of light in a vacuum – *physically impossible (we think), logically possible***
4. **Physicists have succeeded in building a time machine – *we don't know***

Exercise Two (slide 23):

Which of the following arguments is truth-preserving (i.e. is a good deductive argument):

1. **Tom is a banker. All bankers are rich. Therefore Tom is rich. *Truth-preserving***

2. **Sue and Tom lead similar lives but Sue smokes and Tom doesn't. Therefore Sue is more likely to die from heart disease than Tom. *Not Truth -preserving***

3. **All dogs are mortal. Lucy is mortal. Therefore Lucy is a dog. *Not truth-preserving***

4. **Killing is wrong. Therapeutic cloning involves killing. Therefore therapeutic cloning is wrong. *Truth-preserving***

5. **Every person with Huntington's Disease who has been examined, has had the HD gene on chromosome 4. Therefore everyone with HD has the HD gene on chromosome 4. *Not truth-preserving***

6. **If this liquid is acidic it will turn litmus paper blue. This liquid does not turn litmus paper blue. Therefore this liquid is not acidic. *Truth-preserving***

Exercise Three (slide 52): Which of these arguments is such that its being good or bad is an either/or matter, and which a matter of degree?

1. **Tom is a banker. All bankers are rich. Therefore Tom is rich. *(Either/or)***
2. **Sue and Tom lead similar lives but Sue smokes and Tom doesn't. Therefore Sue is more likely to die from heart disease than Tom. *(Matter of degree)***
3. **All dogs are mortal. Lucy is mortal. Therefore Lucy is a dog. *(Either/or)***
4. **Killing is wrong. Therapeutic cloning involves killing. Therefore therapeutic cloning is wrong. *(Either/or)***
5. **Every person with Huntington's Disease who has been examined, has had the HD gene on chromosome 4. Therefore everyone with HD has the HD gene on chromosome 4. *(Matter of degree)***

6. **If this liquid is acidic it will turn litmus paper blue. This liquid does not turn litmus paper blue. Therefore this liquid is not acidic.** ***(Either/or)***

Exercise Four (slide 64): Can we evaluate these arguments a priori or not?

1. **Jennifer is tall. Jennifer is the bank manager. Therefore the bank manager is tall. (Yes)**

2. **Crocodiles are dangerous. James's dog is dangerous. Therefore James's pet is a crocodile. (Yes)**

3. **It is wrong to tell a lie. Jane's telling her mum her hair looked good was a lie. Therefore Jane's telling her Mum her hair looked good was wrong. (Yes)**

4. **Tomato plants that have been fed well, kept warm and watered frequently usually thrive. This tomato plant has been fed well and watered frequently but it is dead. Therefore this tomato plant hasn't been fed properly. (No)**

5. **If this liquid is acidic it will turn litmus paper blue. This liquid turns litmus paper blue. Therefore this liquid is acidic. (Yes)**

6. **The last two springs were hot and sunny, but the summers were awful. This spring was hot and sunny. Therefore this summer will be awful. (No)**

<u>Lecture Four: Deductive Validity</u>

<u>Answer to week three home exercise:</u>

<u>Are the following arguments deductive or inductive? Are they good or bad?</u>

1. **All serial relations are transitive, aliorelative and connected. The relation 'greater than' is a serial relation. Therefore the relation 'greater than' is transitive, aliorelative and connected.** *(This is a good deductive argument)*

2. **The 'games-makers' at the Olympic Stadium were all marvellous. Therefore all British people are marvellous.** *(This is a weak inductive argument)*

3. **The Coalition has become steadily more unpopular as the recession has deepened. Therefore the Coalition will be dissolved before the next election.** *(This is an inductive argument – not clear whether it is weak or strong)*

4. **If you are a nurse you would know how to give an injection. You are not a nurse. Therefore you don't know how to give an injection.** *(This is a bad deductive argument)*

5. **The jet stream is to the north of us again. So next week is going to be wet, cold and grey.** *(This is an inductive argument, probably strong)*

You might amuse yourself by trying to formalise the deductive arguments!

Answers to Week Four's Exercises:

Exercise One (Slide 18): Can you think of counterexamples to the following arguments:

1. **If anyone is caught cheating they will be sent down. Bill was sent down. So Bill must have been cheating.** *(Bill was sent down for failing to do any work)*

2. **It is not possible to assess the art of Damien Hirst because it would be possible to assess his art only if he were following rules and conventions. But he follows neither rules nor conventions.** *(This argument is valid, there is no counterexample)*

3. **If you live alone or only with someone who is mentally ill you are treated as a single person for the purposes of council tax. Jennifer pays council tax as a single person. Therefore either Jennifer lives alone or with a person who is mentally ill.** *(If there are ways of paying council tax as a single person other than being single or living with a mentally ill person))*

4. **If Higgins was born in Bristol then he is not Cockney. Higgins is either Cockney or an impersonator. Therefore Higgins was born in Bristol.** *(Higgins is a cockney who was not born in Bristol)*

Exercise two (Slide 38): Are the following statements true or false?

1. **If an argument is invalid it will have a false conclusion.** *(No, an invalid argument can have a true conclusion (see slide30)*

2. **If an argument has true premises and a true conclusion it will be valid.** *(Not necessarily, see slide 30 again)*

3. **If the premises of an argument contradict each other the argument will be invalid.** *(Yes, because if the premises contradict each other there cannot be a logically possible situation in which the premises are all true together)*

4. **An argument is valid if its premises are true and its conclusion false.** *(No, this is precisely the situation in which an argument cannot be valid)*

Lecture Five: Inductive Strength

Answer to week four home exercise:

Are the following arguments good? If so are they good in the everyday sense of 'good' or only in the logicians' sense of 'good'?

1. **Since many newly emerging nations do not have the capital resources necessary for sustained growth and they need sustained growth, they will continue to need capital resources from industrial nations.** *(This is good in the everyday sense, though if we were analysing it properly we might need to make explicit the premise that newly emerging nations can get capital resources only from industrialised nations)*

2. **Economic growth continues to be elusive. If economic growth continues to be elusive it will be necessary to engage in quantitative easing. But luckily the economy is growing. Therefore quantitative easing isn't necessary.** *(The argument can be called 'good' only in the logicians' sense of 'valid' because its validity depends on its premises being contradictory.)*

3. **Premarital sex is wrong because premarital sex is fornication and fornication is a sin.** *(The argument can again be called 'good' only in the logicians' sense of 'valid'. It is a circular argument, and so valid because as its conclusion is amongst its premises, there is no possible situation in which the premises are true and the conclusion false.)*

4. **There is no-one named 'Bill' here: we have only female students and no female is named 'Bill'.** *(This is a good argument in the everyday sense – though we might question the premise that no female is named 'Bill').*

Exercises for week five:

Exercise (slide 28): Can you classify these inductive arguments by type:

1. **Many undergraduates like to get drunk at the weekend, so I should imagine that as it is Saturday, James may be in the pub. (Inductive Generalisation)**

1. **Jesame is the Chief Executive Officer so if she said expenses won't be paid today then expenses won't be paid today. (Authority)**

1. **Often, after I have been in an aeroplane I have developed a cold, I am travelling to Johannesburg on Saturday so I am expecting to have a cold by Tuesday (Inductive (or maybe causal) generalisation)**

1. **Bankers are like vampire bats, they suck our blood and should be destroyed. (Analogy)**

1. **The last three times I have asked Susan what was on at the cinema she misled me, so I shan't ask her again. (Inductive Generalisation)**

1. **Many children have developed autism shortly after having been given the MMR jab, therefore the MMR jab causes autism. (Causal Generalisation)**

<u>Answer to week five home exercises:</u>

Evaluate these inductive generalisations (slide 35):

1. **Those on the third generation pill have a huge risk of a blood clot: taking the third generation pill *doubles* the risk.**
   (the doubling of a small risk is still a small risk)

2. **About 1,755,637 square kilometers (677,855 square miles) of Greenland are covered in ice throughout the year, therefore Tasilaq (which is a city of 6,000 people in Greenland) is ice bound.**
   (81% of Greenland is icebound throughout the year, but most of Greenland's towns and cities including Tasilaq, are on the coast so they are not icebound throughout the year.

3. **Met Office figures show that between 1997 to 2012 there was no discernible rise in global temperature. This means that human-induced climate change is a myth.**
   (There is a difference of opinion on whether 15 years is long enough to have any relevance to climate change. But it is unlikely, given the other evidence, to show that human induced climate change is a *myth*).

4. **Nearly every time I have rung my bank I have been put on hold and forced to listen to irritating music for ages. I bet no-one ever gets through to their bank without this problem.**
   (Have I always rung when in a hurry? On a weekend? How often have I rung?)

5. **About 1/3 of Britons have used controlled drugs at some point in their lives, nearly 1/10 during the past year, this shows that legalising drugs is the only way to go.**
   (Do the only arguments against legalising drugs rest on claims about the appalling consequences of drug-taking? Might there be a way I which some take drugs that safeguards them against the worst consequences?)

Explain what is wrong with the following causal generalisations (slide 39):

1. **Sleeping with your shoes on gives you headaches.**

(Or are both headaches and sleeping with your shoes on caused by having had too much to drink the night before?)

2. **Zebra crossings cause accidents.**
   (or is it that because more people cross at zebra crossings there appear to be more accidents there?)

3. **Every time I have met you I have aged a year. My ageing is your fault.**
   (or could my having aged a year each time I meet you be the result of my meeting you only once a year?)

4. **I must wear my lucky red jumper to the exam, it has always worked in the past.**
   (Could there be a mechanism linking my wearing my red jumper with my passing an exam? Perhaps a psychological one. Otherwise it is surely accidental?)

5. **Since the 1950s, the atmospheric CO2 level and the crime level have increased sharply, maybe there is a causal relationship?**
   (Again the correlation is almost certainly accidental).

Evaluate these analogies (slide 42):

1. **Leaders should run the economy as if they were running a household budget. After all the former, like the latter, directly affects the lives of individuals**
   (Household budgets must balance. This is not true of national economies because governments can borrow and defer payments in ways households can't.)

2. **There is no more to genetic modification (removing and inserting genes to ensure certain phenotypical effects) than selective breeding (breeding to ensure certain phenotypical effects)**
   (But no amount of selective breeding will result in goats producing milk that contains human insulin).

3. **The soul has three parts, reason, spirit and appetite, each has its part to play but in the just man reason is the ruler. The state has three types of citizen corresponding to these parts (the rulers, soldiers and the people) and the state is just when it is ruled by the rulers. (Plato's Republic)**
   (But as an individual I can supress my appetite to achieve some end, can the state similarly suppress part of its citizenry to achieve some end?)

4. **There is no more to being visible than being seen. Similarly there is no more to being desirable than being desired. (Mill's Utilitarianism) (But are there some things that it is undesirable to desire, so although they *are* desired, they are undesirable?)**

Answer these questions about these Arguments from Authority (slide 45):

1. **In his book The Grand Design Stephen Hawking claims that philosophy is dead. Hawking is a great physicist….has he given us reason to turn our backs on philosophy?**
   (Hawking is a physicist and there is no reason to think he knows much about philosophy)

2. **In 1932 Einstein said 'there is not the slightest indication that nuclear energy will ever be obtainable. It would mean the atom would have to be shattered at will". Einstein said it and Einstein is a great physicist, surely, therefore, it must be true?**
   (This example demonstrates that even authorities speaking on the subjects about which they are authorities can be wrong).

Evaluate this abduction (slide 48):

> **My bank rang to say that my card has been 'cloned'. They asked for my security details. I asked if I could ring them back to check they were my bank and they said yes. I rang the number he gave me and the same chap answered immediately (it hardly even rang!). So it had to be the bank and I gave them my details. Should there be other hypotheses in play?**

Apparently this is becoming a common scam. The caller stays on the line so when you 'ring him back' you do indeed get him immediately but only because he was already connected.

I do hope you have enjoyed the lectures and that you'll come back to OUDCE!

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