Critical Thinking
University of St Andrews March 2007

• Bullet point material is not on the students’ copies. Feel free to use the material as you see fit, depending on timing, ability, enthusiasm etc.

Good luck!

Critical thinking is about arguments: what are arguments, what types of arguments are there, why are some arguments better than others?

• Distinguish (argument = row/disagreement) from (argument = reasons presented in support of a conclusion)

A. Arguments are made up of statements, which can be either true or false.

Which of the following are statements?

1. The Sun goes round the Earth.
2. I like chocolate.
3. Mmm, chocolate…
4. Watch out for pickpockets in this area.
5. Pickpockets are at work in this area.
6. Coffee can be bitter if you drink it without milk or sugar.
7. Windfarms are a necessary part of the solution to global warming.
8. We should build windfarms now.
9. What could be worse than having a windfarm outside your front door?
10. Windfarms now!

• Statements vs questions, imperatives, exclamations
• This distinction is read quite literally in the syllabus: e.g. 9 isn’t to be paraphrased into ‘nothing could be worse than…’, though you might discuss the possibility that this is a ‘hidden premise’ if someone asks.
• A statement can be ‘subjective’ e.g. 2, 6, 8 are statements.
• A good test is whether ‘It’s true/false that…’ is an appropriate prefix.
B. An argument has a structure, with premise(s) and a conclusion.

The premises are supposed to act as reasons to believe the conclusion. Which of the following are arguments, and which are just lists of statements? For each argument, what is the conclusion?

- It may be easiest to identify which are arguments by looking for a conclusion.

1. Before they start school, all children need to acquire many skills, for example, speaking, dressing, washing, identifying colours. Parents are perfectly capable of teaching these skills. Instead of spending money on nursery education, we should spend it on educating people to become good parents.

2. Red squirrels can eat yew berries, hawthorn berries and rosehips. Grey squirrels can eat none of these. However, grey squirrels eat acorns which red squirrels cannot eat.

3. Averting global warming is the most important problem facing humanity right now, and windfarms are an essential element in combating global warming. So the Executive should license as many windfarms as possible.

4. In recent years, the demand for computer-literate personnel has increased. More students are graduating in computing science than before. Some companies find that these graduates require further training before embarking on a career in computing.

5. The North American Wildlife Federation, which sponsors an annual watch for endangered species, reports that sightings of the bald eagle between 1978 and 1979 increased by 35 per cent. In 1979, 13,127 sightings were reported, 3,400 over the 1978 count. This indicates considerable growth in the bald eagle population.

6. To make an assessment of modern art is an impossible task. For one can assess a work of art only when there are accepted rules and conventions. Modern art has no rules and conventions.
7. Oddly enough, a reduction in the present penalty for drunk driving would have a beneficial effect. A mild penalty makes the jury more ready to convict.

An argument is often signalled by words like ‘so’, ‘therefore’, ‘thus’, ‘for’, ‘since’, but this is only a rule of thumb, and some arguments are not explicitly signalled.

- 1, 3, 5, 6 and 7 are arguments.
- 4 might point towards an implicit conclusion that there’s something wrong with university teaching of computing.
- Discuss which have explicit indicators and which do not.
- Can they think of other indicators? e.g. hence, because, this means, this shows that. Some indicators e.g. ‘For’ and ‘since’ point backwards to premises, others e.g. ‘so’ point forwards to conclusion.
- Does the conclusion always come last?
- There is some discussion on the syllabus of hidden premises, so go with this if it comes up.

C. Some arguments are valid and some are invalid.

When we judge validity, we judge the internal structure of the argument. We do not judge whether the premises are true. When we say that an argument is valid, we say that if the premises were true then the conclusion would have to be true. In other words, it’s impossible for the premises to be true and the conclusion false.

- Acknowledge that in everyday speech we talk of ‘a valid point’ or ‘a valid opinion’ = worthy of respect. This is not the sense we are using here.
- Distinguish truth/falsity (applies to premises/conclusion i.e. statements) from validity/invalidity (applies to arguments as a whole)

What are the conclusions of the following arguments, and which arguments are valid?

- Take this in two steps: lay out the structure of the argument (premises, conclusion), then discuss validity.
- Obvious traps: equating validity with truth of conclusion, or invalidity with falsity of premises/conclusion.
1. St Andrews is by far the biggest city in Scotland. The capital of a country is always its biggest city. So St Andrews is the capital of Scotland.

2. St Andrews is a medium-sized town on the east coast. Glasgow is the largest city in Scotland. So Glasgow is to the west of St Andrews.

3. To make an assessment of modern art is an impossible task. For one can assess a work of art only when there are accepted rules and conventions. Modern art has no rules and conventions.

4. If imprisonment worked as a deterrent to potential criminals, the more people we had in prison to serve as examples, the more would their lesson be conveyed to those outside prison. But clearly imprisonment is not an effective deterrent, for today we have record numbers of people in prison, and a crime rate which is growing, not decreasing.

• you could also look back to the arguments in section B

Could there be a valid argument with:

1. all true premises and true conclusion?
2. some true premises, some false premises, and a true conclusion?
3. all false premises and a true conclusion?
4. all true premises and a false conclusion?
5. some true premises, some false premises and a false conclusion?
6. all false premises and a false conclusion?

• It may be harder for the students to think in this abstract way, but worth a shot; see below for tips.

• You can have valid arguments fitting any these except 4.
What about an invalid argument?

- you can have invalid arguments fitting any of these
- One way to explain this: if situation 4 is possible, this dooms the argument. So if situation 4 is the actual situation, you know the argument is doomed (i.e. invalid). But if any of the other situations is actual, that doesn’t tell you whether 4 is possible, so the argument might be either valid or invalid. In that case, you need to look at the structure of the argument, not just whether the premises and conclusion are true or false.
- Lead into discussion of why validity isn’t all we want from an argument.

D. Some arguments are sound, and some are not.

To be sound, an argument must be valid and have all true premises. Skills of reasoning can help us tell whether an argument is valid, but to detect soundness we must rely on our general knowledge of what’s true and what’s false.

- scope of logic? the a priori if they’re looking keen.

Why are sound arguments particularly valuable?

- because if the argument’s valid, and the premises are true then…..
- i.e. it’s a way of extending our knowledge, and, if we can persuade others of the soundness of our arguments, of making other people agree with us.

E. Some arguments are deductive and some are inductive.

A deductive argument is one which aims to be valid, i.e. absolutely watertight. An inductive argument is one in which the premises are supposed to give you good grounds to accept the conclusion, but without guaranteeing that the conclusion is true.

- it’s quite difficult to say anything straightforward about the differences between bad ‘deductive’ and bad ‘inductive’ arguments (different norms?).
Which of the following arguments are deductive, and which are inductive?

• identify the conclusion first, then look the support offered.

1. Jenny won’t be there on time, she’s almost always late.

2. Every student here today has a copy of the handout, Jenny is a student here today, so she has a copy of the handout.

3. Every student here today was given a copy of the handout this morning. Jenny is a student here today, so she has her handout with her now.

4. Tests have repeatedly indicated a correlation between watching TV amongst young children and obesity in later life. If we want to tackle obesity, we must tackle the menace of Cbeebies.

5. Watching TV in early childhood causes obesity in later life. If we want to tackle obesity, we must tackle the menace of Cbeebies.

• Cbeebies is a children’s TV channel. There are issues about hidden premises in 4 and 5, but you should focus on the inductive/deductive contrast.

Sound deductive arguments are the most reliable but interesting ones are difficult to find, and most scientific and everyday arguments are inductive.

F. How arguments fail

An argument can fail by having false premises, or by having premises which do not support the conclusion.

• recap difference between inductive and deductive support, though as before distinguishing ways of failing is not straightforward.

Some common ways in which arguments can fail are called ‘fallacies’. Learning about fallacies can help us spot failing arguments – our own or other people’s.

Some fallacies give rise to false premises, e.g. ‘false dilemma’: either you support the war in Iraq or you support terrorism.

• what argument could this be a premise in? (you don’t support the war, so…)

• point out that mostly you just need general knowledge to spot false premises.

Other fallacies give rise to premises which do not support the conclusion. E.g.
‘Begging the question’:

1. We shouldn’t test cosmetics on animals, because that’s not the sort of practice we should be involved in.
   
   • distinguish from ‘begging the question’ = prompting the question. But what about:

2. Euthanasia is wrong because life is sacred.
   
   • is this begging the question, or a statement of basic principle?

‘Affirming the consequent’:

3. If she was secretly in love with me, she’d ignore me all the time. She ignores me all the time, so she must be secretly in love with me.
   
   • explain ‘antecedent’ and ‘consequent’.
   
   • the fallacy is misleadingly named: it’s not asserting the consequent which is fallacious, but inferring the truth of the antecedent. But what about:

4. If dinosaurs used to roam the Earth, we would find their remains today. We find dinosaur remains today. So dinosaurs used to roam the Earth.
   
   • inference to the best explanation has the form of affirming the consequent

‘Denying the antecedent’:

5. If you’re in Glasgow right now, then you’re in Scotland. You’re not in Glasgow, so you’re not in Scotland.
   
   • again, misleadingly named: the fallacy is not to deny the antecedent but to infer the falsity of the consequent. But what about:

6. If he really wants to be here, he’ll be here on time. He doesn’t really want to be here, so he won’t be on time.
   
   • is there a natural ‘hidden premise’ to the effect that he’ll only be on time if he really wants to be here?

‘Slippery slope’:

7. We wouldn’t want the whole of Scotland to be covered in windfarms, so we mustn’t allow any to be built.
• are there cases where once you start you just can’t stop? What about:

8. If we let one student have the answers before the test, we’ll have to let them all. So we shouldn’t let anyone have the answers before the test.

• other fallacies you could discuss if there’s time include:

  post hoc ergo propter hoc (assuming correlation is cause)

  (irrelevantly) attacking the person

  appeals to irrelevant consequences (wouldn’t it be awful/great if A was true/false)

  appeals to ignorance (we don’t know that A is false, so it’s true)

• in each of these cases you should point out that arguments of this form aren’t always fallacious