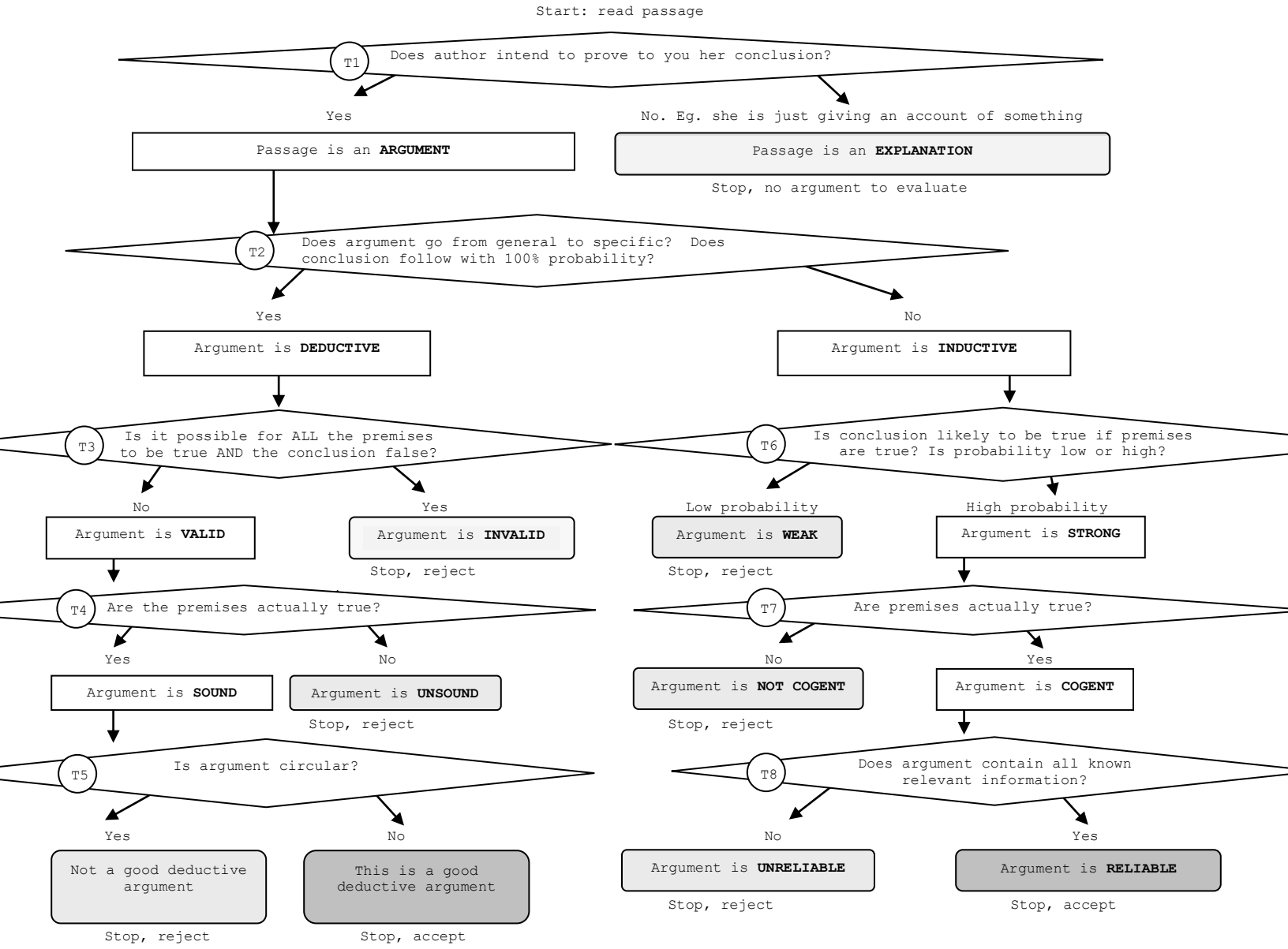
Critical Thinking I

AN OVERVIEW

Words in **bold** indicate the main concepts with which you need to be familiar. This chart may be an over-simplification, but it serves as a useful summary or a flowchart for evaluating passages.



Note: **FALLACIES** are typical flaws in the argument that would result in it being rejected.

BWT-Jan2006

UNIT A: PARTS OF AN ARGUMENT

In this unit, you will learn:

- What an argument is
- The basic components of an argument
- How to identify an argument
- How to distinguish between an argument and an explanation
- How to distinguish between premises and conclusions in arguments
- How to pick out implicit premises

A1 What is an argument?

When we think of an argument, some of us may visualize a couple of people locked in a debate or an angry dispute, but from the point of view of a logician an argument may not necessarily involve a dispute or even disagreement. In his point of view, **an argument is a set of statements (or propositions, see * below) of which one – the one being argued for – is taken to be established as true on the basis of all the others. When we want to persuade others to accept the truth of a statement, one way of doing this is to offer them reasons or evidence in support of this statement.** This is the essence of an argument.

For example, someone might say:
He must be older than he says he is. He told us he was thirty, but he has a daughter who is at least twenty-five years old.

Here, **reasons** are offered for the conclusion that 'he must be older than he says he is'.

Look at the following simple examples of an argument. As you read them, think about <u>which</u> statement the author is trying to get you to <u>accept</u> (ie. the **conclusion**), and which statements are being offered as <u>reasons</u> for accepting the conclusion (ie. the **premises**):

The bus is late. It must have broken down.

Children learn languages much more quickly and speak them more fluently if they start to learn them from an early age. So if you want your children to be bilingual, you should speak two languages to them from the time they are born.

She stood him up for their date. She obviously isn't interested in being his girlfriend. If she'd wanted a serious relationship with him she wouldn't have missed their date.

* *Propositions*:

A proposition is a sentence that is true or false.
The following are positive examples:

- Wei Lin is in RI this year
- today is Tuesday
- software piracy is unethical and illegal
- every even number is the sum of two primes
- all moral values are relative

The following are negative examples; they are NOT propositions:

- do not walk on the grass
- is today Friday?
- Oh, leave me alone
- If you want more information, get in touch with me

Why aren't these considered propositions?

A2 How to Identify Arguments

Argument indicators

Certain words are commonly used to indicate that someone is presenting a conclusion, for example 'therefore' and 'so'.

He told us he was thirty, but he has a daughter who is at least twenty-five years old. So, he must be older than he says he is.

'Hence' and 'thus' can also function in the same way as 'so'. Other words also signal the presence of a conclusion, for instance, 'must' and 'cannot'. In the example above, the word 'must' is used to show that the reasons offered force us to draw the conclusion. You can also use the word 'cannot' in a similar way: 'He cannot be as young as he says he is.'

More indicator words:

- 'it follows that'
- 'it can be concluded that'
- 'proves'
- 'implies'
- 'establishes'
- 'shows'
- 'since'
- 'because'
- 'for'
- 'follows from the fact that'
- 'is established / implied by'

These indicator words do not guarantee that an argument is being offered as they have other uses. But you can use them as a general guide to assessing whether or not the passage contains an argument.

Passages which do not contain indicator words

If there are no conclusion indicator words, look at each sentence in turn and ask:

"Does the rest of the passage give me any extra information which tells me **why** I should believe this?"

If the answer is 'no', then this sentence is not a conclusion.
If the answer is 'yes', then the sentence is a conclusion.

If none of the sentences in a passage is a conclusion, then the passage is not an argument: ***no conclusion, no argument.*** If one of the sentences in the passage is a conclusion supported by a reason or reasons in the passage, then the passage is an argument.

Arguments vs Explanations

Arguments are to be distinguished from explanations. A general rule is that arguments attempt to **demonstrate** that something is true whereas in explanations, the conclusion is **assumed** to be true already and the author is trying to explain how it happened.

T1 ! [TESTS] to distinguish arguments from explanations: not all of these are necessary each time you test for an argument; but go down the list when you are stumped by a passage that doesn't seem that clear cut.

a) The passage usually can fit the form of "R; therefore C."
b) X is an argument if the author intends to prove to you that C is true. (The presence of obligatory words – 'should', 'ought' – in C is a good indicator of such an intention.)
c) X is an explanation, not an argument, if the author assumes the truth of C.
d) When you have found a conclusion in a passage, rewrite the passage with the conclusion at the end, introduced by 'So'. Read through this re-written passage to check that it makes sense. If it does, then you can be certain that this passage is an argument. There is no need to worry about whether the premises are true, or if they conclusively support the argument.

Note: most of the time, for the short passages found in P2 Section B, due to space constraints, what is typically (as opposed to always) present are arguments rather than explanations. This guideline obviously does not apply for Section A long passages.

Explanation or Argument?

1. We should restrict the production of 'greenhouse' gases **because** they are damaging the ozone layer. Argument
2. Napoleon died **because** he was poisoned with arsenic. Explanation
3. The dinosaurs died out **because** a huge meteor crashed into the Earth. Ex

4. The scope for out-of-school play activities has been greatly diminished over recent years **because** parents want to protect their children from harm, whether from traffic or from molesting strangers. Unclear, maybe both
5. Our street lights are too dim. **That is why** we have more accidents and more crime than we should. Unclear, maybe both.

Note: it isn't always clear from the context of a passage whether the author intends certain statements to be explanations or arguments; sometimes, he could well mean both.

Other non-arguments

Do note that there are passages that are considered non-arguments, but that aren't classified as explanations. These include

- expository passages (that only elaborate the topic without argument)
- illustrations (that provide examples for understanding, without introducing new arguments)
- simple noninferential texts (like warnings or commands that do not claim that anything is being proved).

But we will not go into the details of these here because they are usually more easy to tell apart from arguments than explanations.

A3 How to Distinguish Premises from Conclusions

Definition of premises:

- A starting point / a building block of an argument.
- Not proven by logic.
- If premises are true, then argument has the potential to be sound (provided inference is a valid deductive one).
- A premise must make a claim that is either true or false – i.e., it must be a piece of propositional knowledge, or 'knowledge that.' Does not include commands or questions or exclamations.

Definition of conclusions:

- The end point / product of an argument. The result of a chain of inference which reasoning justifies and supports.
- We can logically arrive at a conclusion regardless of whether or not the premise is true.

One of the most important tasks in the analysis of passages is being able to distinguish between premises and conclusions. If what is thought to be a conclusion is really a premise, and vice versa, the subsequent analysis cannot possibly be correct. It is therefore important to get this step right. The following indicators can cue us about when a proposition is a premise, a conclusion, or neither.

Premise Indicators	Conclusion Indicators	Neither
As As indicated by Because For For the reason that Given that	Accordingly As a result Consequently Entails that For this reason Hence	Nevertheless However

Aside from analyzing passages, you can also use the indicator lists above to help you select proper conjunctions in any essay you write. Be sure not to confuse conclusion and premise indicators in your writing.

Premises VS Examples

Premises are different from Examples: the former is a statement that forms part of an argument, the latter is evidence or proof to back up a certain premise.

For example, converting Q5 from the earlier exercise into Standard Argument Form (SAF):

P1: We have more accidents than we should
P2: If P1, then our street lights are too dim
C: Our street lights are too dim (P1, P2; modus ponens)

Here, the statements in Q5 are obviously premises. Consider however if we were to add the following:

The global average of accidents in a single year is 15,000. In our city however, we have had 17,000 accidents this year.

The above 2 statements are not premises per se. Rather, they are the evidence for P1 above. Oftentimes, we can infer a premise from an example, especially if the premise has not been explicitly stated.

For example, modifying Q5:

Our street lights are too dim. That is why even though the global average of accidents in a single year is 15,000, we have had 17,000 accidents instead.

P1 above (We have more accidents than we should) is thus implied from the examples given above.

A4 How to pick out implicit premises

As you can now see, not all premises and conclusions are made explicit within an argument. There is a special kind of argument, an *enthymeme*, where one or more premises and/ or conclusions are implicitly suppressed even though they

are intended as present. This is usually done when the premise/ conclusion is so obvious that it does not even require mentioning (or when it is implied from the examples given, as above).

Examples
All men are mortal. So Socrates is mortal.

What is the implicit premise?

The match will be cancelled if it rains or snows, but one of these will happen.

What is left unsaid?

It will either rain or snow. So the match will be cancelled.

What is left unsaid?

It is very important to pick out such implicit or suppressed premises as sometimes, such premises are *smuggled* into the argument such that the argument appears valid and sound. In such cases, one should always pick out the enthymeme and attack it.

Exercise A

I. For each of the following passages:

a) Decide whether each of the following cases contains an argument. If it does not, write 'N/A'.
b) If it does, identify its premises and conclusion by underlining the appropriate propositions and writing 'C' under the conclusion and 'P' under the premises. Pull out the implicit premises

Eg.
Bob is a dog and all dogs are black. So Bob is black.
P1 P2 C

Note: there is always an infinite number of possible implicit premises; what matters is to find the crucial ones that actually make a difference to the arguments.

1. Pets are good for you. Research has shown that pet owners are less likely than other people to be depressed or to suffer from high blood pressure.

2. A disease found in the faeces of cats can cause miscarriages if it infects pregnant women. Most cat owners are probably immune to this disease. Rabbits can spread listeriosis and salmonella.

3. Children who are good at spelling usually have a good visual memory. Poor spellers have not learnt to look at words carefully. Practice in reading does not necessarily help poor spellers.

4. In the Victorian era, cannabis was used to treat all kinds of conditions, such as muscle spasms, menstrual cramps and rheumatism. Now, its use, even for medicinal purposes, is illegal. It has been found to be helpful in relieving the symptoms of multiple sclerosis.

5. By making violence real in the cinema, you show people how horrific its consequences are, and put them off acting violently themselves. Hard violence on screen may not therefore be as harmful as many people claim. It's the soft, light-hearted treatment, where fighting is depicted as glamorous, which encourages people to be aggressive. These films are the ones which should be banned, not those that depict real brutality.

6. I think Emma should sue the local council. They have admitted that they were negligent in not mending the cracked pavement that she tripped over when she broke her ankle and that's sufficient grounds for compensation.

7. My ex-partner was always telling me to change my appearance, so I changed my partner.

8. Lay up for yourselves treasures in heaven, where neither moth nor rust destroy and where thieves do not break in and steal. For where your treasure is, there your heart will be also.

9. *A mammal is a vertebrate animal that nurses its offspring. Thus, cats and dogs are mammals, as are sheep, monkeys, rabbits, and bears.

10. *If North Korea is developing nuclear weapons, North Korea is a threat to world peace.

11. *If it is justifiable to assume that other human beings feel pain as we do, is there any reason why a similar inference should be unjustifiable in the case of other animals?

12. Whether or not to smoke is a conscious decision, made in the light of an abundance of information on the lethal effects of tobacco. Surely those who choose unwisely should bear the cost of any resulting ill health.

UNIT B: Arrow Diagrams

In this unit, you will learn:

- How to put arguments into the form of an arrow diagram

Our attempts to engage in critical thinking are sometimes frustrating. This is often because even when we feel certain that there is something wrong with an argument, we find it hard to explain exactly what is wrong with it. Hence, one of the primary aims of teaching critical thinking is to learn concepts and techniques that will help us to express clearly what is wrong with an argument.

There are two main reasons why we may find it difficult to explain what is wrong with an argument:

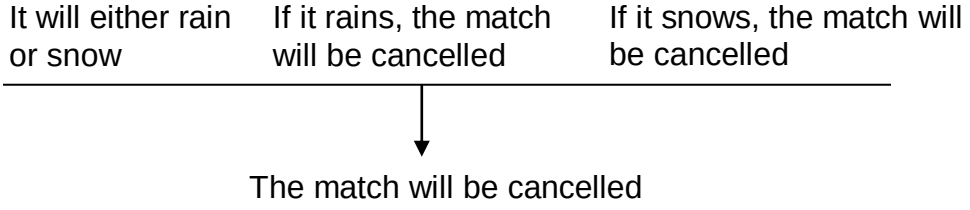
- First, confronted with an argument, we find it hard to hold the whole thing clearly before our mind's eye – we find it difficult to say exactly what reasoning it is that we think must be mistaken. This is addressed by techniques and strategies for **argument reconstruction** – the clear representation of arguments in standard form – so as to give us a clear and comprehensive view of them.
- Second, even when we do succeed in laying out the argument before us clearly, we find it hard to describe or explain what is wrong with it. This is addressed by techniques and concepts of **argument assessment**, the determination of whether arguments provide good reasons for accepting their conclusions.

In this unit, we are concerned with argument reconstruction.

Argument in standard prose

It will either rain or snow. If it rains, the match will be cancelled. Likewise, if it snows. So the match will be cancelled.

Argument in Arrow Diagram

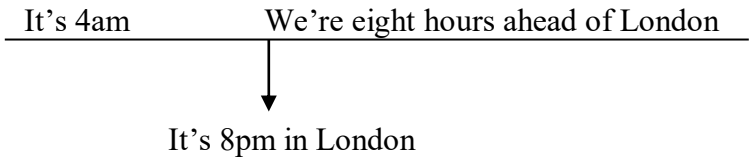


Putting the argument in such a form shows you at a glance how many possible weak points there are in an argument. The weak points are represented by the premises (are they true?) and the arrow (is the argument valid or strong?), which represents the 'flow' of the argument. Hence, in evaluating any argument, these are points which are either attacked or defended (and possibly both).

Applying this to the above example, there are thus 4 possible weak points.

Which is correct?

It's 4am. So it's 8pm in London. We're 8 hours ahead of London.



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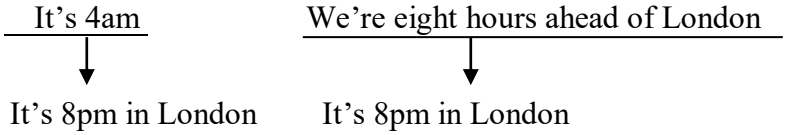
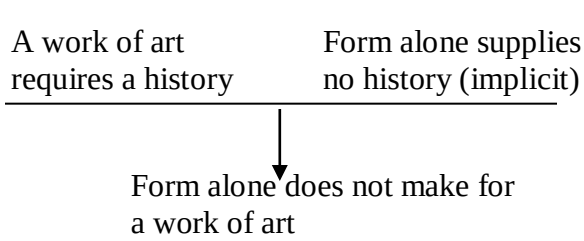
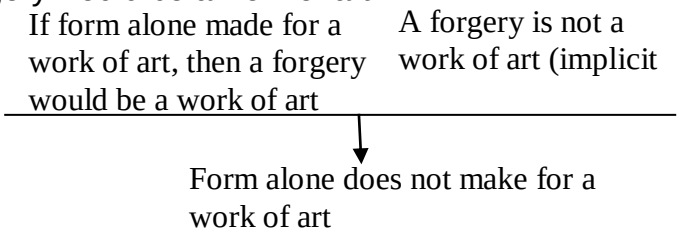


Two Arguments, not one

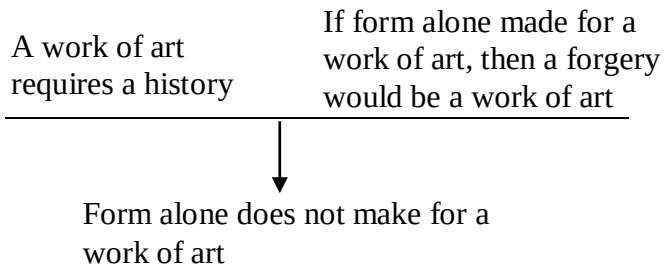
Form alone does not make for a work of art since a work of art requires a history.

If form alone made for a work of art, then a forgery would be a work of art.





Incorrect Argument Reconstruction



Why? Because the 2 premises do not work together

Incorrect Argument Reconstruction

A work of art requires a history

If form alone made for a work of art, then a forgery would be a work of art

Form alone does not make for a work of art

The above form seems to follow the form presented in standard prose. Why is it wrong then?

This is because the above argument is obviously invalid. Hence, the author cannot obviously mean for the argument to proceed in such a manner. While you might be eager to knock down your opponent's argument, we need to apply the principle of charity always (more on that later).

Two Conclusions from One Premise

Sometimes, you can get two conclusions from one premise. Here is one example

It will rain soon. So the streets will be wet. The weather will also get cooler.

It will rain soon → The streets will be wet

It will rain soon → The weather will get cooler

It will rain soon → The streets will be wet and the weather will get cooler

Incorrect reconstruction

It will rain soon → The streets will be wet → The weather will get cooler

While it may be true that the weather will get cooler if the streets are wet, this is not what the author meant (note the word 'also' instead of 'therefore').

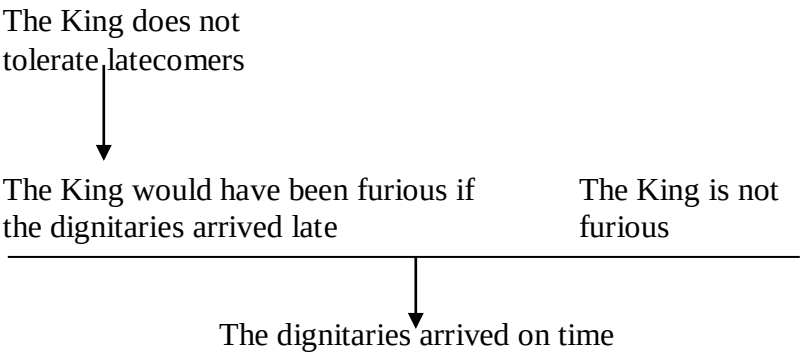
Acceptable reconstruction with implicit premise

It will rain soon; Rain causes the streets to be wet and the weather to get cooler (implicit)

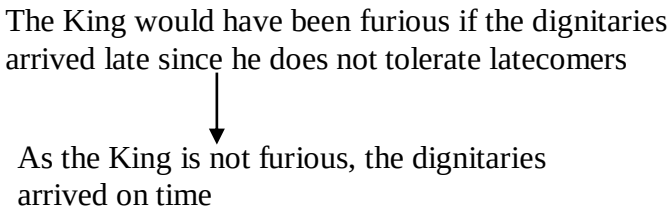
∴ The streets will be wet and the weather will get cooler

Two Arguments in a Chain

The King would have been furious if the dignitaries arrived late since he does not tolerate latecomers. As the King is not furious, they must have arrived on time.



Incorrect Argument Reconstruction



The whole point about Arrow Diagrams is to do away with premise and conclusion indicators.

Exercise B

Reconstruct the following arguments in the form of an Arrow Diagram.

1. If the bull charges, we'll be in trouble. Since it's sleeping, it won't charge. So we're safe.

2. I believe that was a goal. If there was a foul, the referee would have whistled. But he didn't whistle. And that was a goal if there was no foul.

3. If Napoleon attacks, India will fall. If India falls, Asia will fall. But Napoleon won't attack. So Asia won't fall.

4. No man is happy alone since man is fundamentally a social creature. As Jack persists in isolating himself from family and friends, he will be unhappy.

5. I do not know if I am awake! Although it seems to me that I am awake, dreaming of being awake is indistinguishable from actually being awake. So whenever it seems to me that I am awake, I cannot rule out the possibility that I am just dreaming of being awake.

6. The self is supposed to be a fixed and unchanging feature of one's conscious experience. But if so, then one is never conscious of the self since one can be conscious of something only if it is a potentially varying feature of one's conscious experience. (A man exposed only to red things would never be conscious of red.) But we have no reason to believe in the existence of anything that we are never conscious of. So we have no reason to believe in the existence of the self.

7. If neither the butler nor the gardener did it, then the maid must have done it. Had the butler been away, he could not have done it. And unless the butler is lying, the gardener did not do it. But the butler was out of town. Also, he never lies. In this case, Watson, we are forced to conclude that the maid did it.

UNIT C: DEDUCTION VS INDUCTION

In this unit, you will learn:

- How to distinguish between a deductive and an inductive argument.

C1 Definitions of Deductive and Inductive arguments

Arguments can be divided into two groups: deductive and inductive.

A **deductive** argument is an argument in which the arguer claims that it is **impossible** for the conclusion to be false given that the premises are true. In such arguments the conclusion is claimed to **follow necessarily** from the premises.

On the other hand, an **inductive** argument is an argument in which the arguer claims that it is **improbable** that the conclusion be false given that the premises are true. In such cases the conclusion is claimed to follow only **probably** from the premises.

Thus, deductive arguments are those that involve **necessary reasoning** and inductive arguments are those that involve **probabilistic reasoning**.

Which of the following two arguments is deductive, and which is inductive?

The meerkat is closely related to the suricat.
The suricat thrives on beetle larvae.
Therefore, the meerkat thrives on beetle larvae.

The meerkat is a member of the mongoose family.
All members of the mongoose family are carnivores.
Therefore, it follows that the meerkat is a carnivore.

C2 Telling apart deductive from inductive arguments

The distinction between a deductive and an inductive argument lies in the strength of the argument's inferential claim. In other words, it lies in how strongly the conclusion is claimed to follow from the premises. However, often, the strength of this claim is not explicitly stated, so we must evaluate it ourselves.

T2 !

[TESTS] to distinguish deductive from inductive arguments:

There are 3 criteria that influence our decision about this claim:

a) The occurrence of special indicator words;
b) The actual strength of the inferential link between the premises and the conclusion – in other words, does the conclusion follow with 100% probability?; and
c) The form or style of the argumentation that the arguer uses; Does the argument go from general to specific?

These criteria are spelt out in more detail below:

a) Special indicator words include:

Type of argument	**Special indicator words**			
Inductive	Probably	Plausible	Likely	Reasonable to conclude
Deductive	Certainly	Absolutely	Definitely	Necessarily

Note 1: the phrase "it must be the case" is ambiguous; "must" can indicate either probability or necessity.
Note 2: the presence of indicator words, if they conflict with the other criteria, should be ignored.

b) Actual strength of the inferential link:

Deductive	If the conclusion follows necessarily (with 100% probability) from the premises; impossible for the premises to be true and the conclusion to be false.
Inductive	If the conclusion follows probably (<100% probability) from the premises.

Examples:
All entertainers are extroverts.
David Letterman is an entertainer.
Therefore, David Letterman is an extrovert.

The vast majority of entertainers are extroverts.
David Letterman is an entertainer.
Therefore, David Letterman is an extrovert.

Which argument is deductive, and which is inductive? Why?

c) The form or style of the argumentation that the arguer uses

Deductive	The argument goes from general rules to a specific case.
Inductive	The argument goes from specific instances to general rules.

What kind of reasoning does Scientific Reasoning fall under?

Examples of Deductive Argument

- An argument based on mathematics;
- An argument from definition.

Examples of Inductive Argument

In general, inductive arguments are such that the content of the conclusion is in some way intended to "go beyond" the content of the premises. For example:

- Predictions about the future (based on our knowledge of the past or present);
- Arguments from analogy (depends on similarity between two things);
- Inductive generalizations (eg. the use of statistical probability to show that as 3 oranges selected from a crate were sweet, the rest of the oranges in that crate are also sweet);
- Arguments from authority (based on something that an expert or an authority said); and
- Causal inferences (proceeds from knowledge of a cause to a claim about an effect, or vice versa).
- Scientific findings that draw a general conclusion based on a study with a limited sample size.

However, note that arguments that occur in science can be either inductive or deductive, depending on the circumstances. In general, arguments aimed at the discovery of a law of nature are usually considered inductive.

Eg. if we want to discover a law that governs the time required for a falling body to strike the earth, we drop bodies of various weights from various heights and measure the time it takes for them to fall. Comparing the measurements, we notice that the time is approximately proportional to the square root of the distance and make a conclusion about the law governing this. Such an argument is best interpreted as an inductive generalization.

Exercise C

Determine whether the following arguments are best interpreted as being inductive or deductive. Also state the criteria you use in reaching your decision:

(b) the presence of indicator words
(c) the nature of the inferential link between the premises and the conclusion
(d) the form / style of the argumentation.

1. *No email messages are eloquent creations. Some love letters are eloquent creations. Therefore, some love letters are not email messages.

2. *Paying off terrorists in exchange for hostages is not a wise policy since such action will only lead them to take more hostages in the future.

3. World-renowned physicist Stephen Hawking says that the condition of the universe at the instant of the Big Bang was more highly ordered than it is today. In view of Hawking's stature in the scientific community, we should conclude that this description of the universe is correct.

4. When the Romans occupied England, coal was burned. Since coal produces quite a bit of soot and sulphur dioxide, there must have been days almost 2,000 years ago when the air in the larger towns was badly polluted. (Stanley Gedzelman, The Science and Wonders of the Atmosphere)

5. The Simpson incident had shown me that a dog was kept in the stables, and yet, though someone had been in and had fetched out a horse, he had not barked enough to arouse the two lads in the loft. Obviously the midnight visitor was someone whom the dog knew well. (A. Conan Doyle, Memoirs of Sherlock Holmes)

6. *Most Dutch men are tall. Marco is Dutch. Therefore Marco is most likely tall.

7. *We must consider what eugenics can do to improve our country's talent pool….. If we are to be concerned about a country's human capital, then we must consider what eugenics can do to improve our country's talent pool…. As a country's leaders, we are to be concerned about its human capital.

UNIT D: Principle of Charity

Argumentation is for the sake of discovering or establishing truth, not winning a verbal contest of wills. Hence, arguing for the sake of arguing, eristics (the art/practice of debate), is to be shunned, whereas arguing for the sake of truth, dialectics, is to be courted and pursued.

Successful cultivation of the art of dialectics requires cultivation of a few virtuous habits and attitudes that promote the principle of charity.

The principle of charity suggests that to do justice to an argument or claim, we should construct as strong a case for, and preserve as much truth as possible within, the position under investigation.

Example:
Suppose someone is protesting outside an abortion clinic, and shouts, "Abortion kills a human being, therefore it is wrong." How should we reconstruct the argument? At least, we need to add the missing premise:

P1. Abortion is an act that kills a human being.
P2. If abortion is an act that kills a human being, then abortion is morally wrong.

C. Therefore, abortion is morally wrong.

Even so, it is not clear that the protester has anything so simple in mind. Instead, we might attribute to the protester the slightly more sophisticated version:

P1. Abortion is an act that kills an innocent human being.
P2. If abortion is an act that kills an innocent human being, then abortion is morally wrong.

C. Therefore, abortion is morally wrong.
Yet even this is a pretty flimsy argument.

Is it possible to improve upon it? **You should ask yourself this question even if you are pro-choice and think there can be no completely satisfactory version of this general line of argument**. It might be best to simply sit down and talk with the person about his/her views. But even then it's likely that he or she is not a philosopher and has not made the time to make his/her position the best it could be. If you want to dismiss his/her argument, it is up to you to think about the best possible form the argument could take. **If the argument is not sound even in its best possible form, then and only then can you dismiss it in a philosophically responsible way**.

One aspect of the principle of charity is that an argument should always be reconstructed with a logically valid argument form as far as possible. As we have seen, an invalid argument can sometimes be made valid by the addition of a premise. This applies even when an argument appears to be logically invalid. Here's an example straight from a book in ethical theory by a well-known philosopher:
Total pacifism might be a good principle if everyone were to follow it. But not everyone does, so it isn't (Gilbert Harman, The Nature of Morality).

If interpreted literally, the argument appears to have the following form:

P1. If everyone follows total pacifism, then total pacifism would be a good idea.
P2. Not everyone follows total pacifism.

C. Total pacifism is not a good idea.

This argument form is invalid. But it's probably not what he really meant. He probably meant instead something like:

P1. Total pacifism is a good idea if and only if everyone follows total pacifism.
P2. Not everyone follows total pacifism.

C. Total pacifism is not a good idea.

Now this form is valid. You can think for yourself about whether or not it's sound.

UNIT E: EVALUATING DEDUCTIVE ARGUMENTS

In this unit, you will learn:

- How to evaluate deductive arguments
- Deductive validity
- Deductive soundness
- To identify basic forms of valid deductive arguments
-

Having learnt how to reconstruct arguments and putting it into the form of an arrow diagram, we shall now learn how to assess arguments.

E1 Deductive validity

Consider the following:

A P1) The Prime Minister's dog is infested with fleas.
P2) Fleas are bacteria.
C) The Prime Minister's dog is infested with bacteria.

B P1) Colette owned a dog.
P2) All French bulldogs are dogs.
C) Colette owned a French bulldog.

The conclusion of A does follow from its premises while the conclusion of B does not. What you are recognizing is that A is valid while B is invalid (remember the 'All-Only' difference?)
Remember that for a deductive argument to be valid, it would be impossible for its premises to be true and its conclusion to be false. You are not required to evaluate whether the premises are true or not (eg. whether fleas are really bacteria or not). In other words, **deductive arguments are valid or invalid because of their form, regardless of their content**.

When you consider B, you should recognize that even if the premises are true, it would still be possible for the conclusion to be false. The conclusion does not follow and therefore, the argument is invalid.

Even if Colette's dog was a French bulldog and the 2 premises in argument B are true, this does not mean that argument B is valid.

To say that an argument is valid is to say: It would be impossible for all the premises of the argument to be true, but the conclusion false.
To say that an argument is valid is to say: If the premises are (or were) true, the conclusion would also have to be true.

Both these definitions of validity are equivalent and you are free to make use of the one you find easier to work with.

T3 !

[TEST] for validity:
Whether or not the premises are actually true, pretend or suppose that they are true; then in that situation, aside from how things really are, could the conclusion conceivably be false? If it could **not** be, then the argument is valid. If it could, then the argument is invalid.
In short, is it possible for ALL the premises to be assumed true AND the conclusion false? If yes, then the argument is invalid.

Try this out:
All television networks are media companies.
NBC is a television network.
Therefore, NBC is a media company.

All automakers are computer manufacturers.
United Airlines is an automaker.
Therefore, United Airlines is a computer manufacturer.

All banks are financial institutions.
Wells Fargo is a financial institution.
Therefore, Wells Fargo is a bank.

Only banks are financial institutions.
Well Fargo is a financial institution.
Therefore, Wells Fargo is a bank.

NB: "All" and "Only" are NOT the same!

How about this?
Australia is surrounded by water
All islands are surrounded by water
Australia is an island

Ducks lay eggs.
Human beings are not ducks.
So human beings don't lay eggs.

What about this?
This argument is valid
So I am Goh Chok Tong

E2 Deductive Soundness

A sound argument is a deductive argument that is **valid** and has **all true premises**.

Sound argument = Valid argument + All true premises

T4

[TEST] for soundness:

- Is the deductive argument valid?
- Are the premises (including implicit ones) all true?

Note: An unsound argument is one where the answer to either or all of the above 2 questions is "No". Hence, it is possible for an argument to be valid and still unsound due to the presence of one or more false premises. See the table below for an illustration of this.

	Valid	**Invalid**
True premises **True conclusion**	All wines are beverages. Chardonnay is a wine. Therefore, chardonnay is a beverage. [sound]	All wines are beverages. Chardonnay is a beverage. Therefore, chardonnay is a wine. [unsound]
True premises **False conclusion**	None exist	All wines are beverages. Ginger ale is a beverage. Therefore, ginger ale is a wine. [unsound[
False premises **True conclusion**	All wines are soft drinks. Ginger ale is a wine. Therefore, ginger ale is a soft drink. [unsound]	All wines are whiskeys. Chardonnay is a whiskey. Therefore, chardonnay is a wine. [unsound]
False premises **False conclusion**	All wines are whiskeys. Ginger ale is a wine. Therefore, ginger ale is a whiskey. [unsound]	All wines are whiskeys. Ginger ale is a whiskey. Therefore, ginger ale is a wine. [unsound]

Finally, not all sound deductive arguments can be accepted. Sound arguments must also be **non-circular** first before they can be accepted, though this last criterion is often assumed because it is obvious. Circular reasoning occurs when the reasoner begins with what he or she is trying to end up with. The following will illustrate:

A bullfighter is and should be a man.
Therefore, women shouldn't fight bulls, even though they have rights.

The president is saying basically that women shouldn't fight bulls because women shouldn't fight bulls. This reasoning isn't making any progress toward determining whether women should fight bulls. Circular arguments like this cannot be accepted[1].

[1] A note on deductive circularity: Sometimes, a deductively valid argument can appear 'contained' in the premises from which it is deduced. This containing might seem to be a case of presupposing, and thus any deductively valid argument might seem to be arguing in a circle. It is still an open question among logicians as to why some deductively valid arguments are considered to be begging the question and others are not:

Some logicians suggest that, in informal reasoning with a deductively valid argument, if the conclusion is psychologically new insofar as the premises are concerned, then the argument isn't an example of the fallacy.

Other logicians suggest that we need to look instead to surrounding circumstances, not to the psychology of the reasoner, in order to assess the quality of the argument. For example, we need to look to the reasons that the reasoner used to accept the premises. Was the premise justified on the basis of accepting the conclusion?

T5 ! [TEST] for circular reasoning:
- Is the conclusion of the argument already fully stated in the premise(s)?

- To sum up this section, a deductive argument is only accepted if the following conditions are ALL (not just individually) met:
  a) the argument must be valid
  b) the premises must all be true
  c) the argument must be non-circular

E3 Basic Forms of Valid Deductive Arguments

In constructing or evaluating arguments, it is most useful to know what some of the basic valid forms of arguments are. Some of them follow, along with their customary names:

Modus ponens (MP) If A, then B. A. Therefore, B.	**Modus tollens (MT)** If A, then B. Not B. Therefore, not A.
Hypothetical syllogism (HS) If A, then B. If B, then C. Therefore, if A, then C.	**Disjunctive syllogism (DS)** Either A or B. Not A. Therefore, B.
Barbara All M are P. All S are M. Therefore all S are P.	**Celarent** No M are P. All S are M. Therefore no S are P.
Darii All M are P. Some S are M. Therefore some S are P.	**Ferio** No M are P. Some S are M. Therefore some S are not P.

Exercise D

I. The following arguments are deductive. Determine whether each is valid or invalid, whether the premises and conclusion are true or false, and whether the argument is sound or unsound (where possible). Draw an arrow diagram first.

1. Since Moby Dick was written by Shakespeare, and Moby Dick is a science fiction novel, it follows that Shakespeare wrote a science fiction novel.

A third group of logicians say that, in deciding whether the fallacy is committed, we need more. We must determine whether any premise that is key to deducing the conclusion is adopted rather blindly or instead is a reasonable assumption made by someone accepting their burden of proof. The premise would here be termed reasonable if the arguer could defend it independently of accepting the conclusion that is at issue.

2. Since some fruits are green, and some fruits are apples, it follows that some fruits are green apples.

3. Unless some historians have told lies, there were miracles during the first century. Some historians have told lies. Therefore, there were no miracles during the first century.

4. All weak persons are tempted to lie, so John being tempted to lie shows that he is weak.

5. *If the rate of inflation is to fall, the money supply has to be held steady. It has been held steady. So the rate of inflation will fall.

6. If the advertising of cigarettes is banned, then the government will lose revenue from smaller tobacco sales. No government will tolerate a loss of revenue. So cigarettes advertising will not be banned.

7. *Most RJC students are science students and most science students take chemistry. So most RJC students take chemistry.

8. If Lee Kuan Yew owned more than 3 condominiums in Singapore, then he would be wealthy. Lee Kuan Yew does not own 3 condominiums in Singapore. Therefore, Lee Kuan Yew is not wealthy.

9. *If the police on this island are as incompetent as everyone says they are, and the local people are the compulsive criminals they are reputed to be, you would expect there to be many instances of crime against unsuspecting tourists. Actually, there hasn't been a single crime committed in the three weeks we've been here, so it is pretty obvious that the criminal reputation of the locals is widely exaggerated.

II. Which of the following statements are false?

a) It is impossible for the premises of a valid argument to be false.

b) It is possible for the conclusion of a valid argument to be false.

c) It is possible for a deductively sound argument to have a false conclusion.

d) A valid argument cannot have true premises and a false conclusion.

e) A valid argument cannot have false premises and a true conclusion.

f) *When the conclusion of a deductive argument is true, the argument must be sound.

g) *When the premises of a deductive argument are true, the conclusion is always true as well.

UNIT F: EVALUATING INDUCTIVE ARGUMENTS

In this unit, you will learn:

- How to assess the strength, cogency, and reliability of inductive arguments
- To identify common types of inductive arguments

F1 Assessing the strength of inductive arguments

Previously, we learnt that **an inductive argument** is one in which the arguer claims that it is improbable that the conclusion be false given that the premises are true. If this claim is true, then the argument is said to be strong.

Therefore, **a strong inductive argument** is an inductive argument in which it is improbable that the conclusion be false given that the premises are true. Conversely, **a weak inductive argument** is an argument in which the conclusion does not follow probably from the premises, even though it is claimed to.

T6 !

[TEST] for the **strength** of inductive arguments:
1. Assume that the premises are true.
2. Based on that assumption, is the conclusion like to be true? If and only if the conclusion is likely to be true (assuming the premises are true), then the argument is strong.

Example:
All dinosaur bones discovered to this day have been at least 20 million years old. Therefore, the next dinosaur bone to be found will probably be at least 20 million years old.

In this argument, the premise is actually true, so it is easy to assume that it is true. The conclusion is probably true too, so this is a strong inductive argument.

What happens when the premise is obviously false?

All meteorites found to this day contain bananas. Therefore, probably the next meteorite to be found will contain bananas.

But if we assume that the premise is true, then based on that assumption, the conclusion would probably be true. Thus, the argument is strong.

What about the following argument from analogy?

When a lighted match is immersed in water, the flame will be extinguished. But kerosene is a liquid, just like water. Therefore, when a lighted match is immersed in kerosene, the flame will be extinguished.

In this example, the premises are actually true and the conclusion is probably false. Thus, if we assume that the premises are true, then based on that

assumption, it is not probable that the conclusion is true. Therefore, the argument is weak.

The difference between strong inductive arguments and valid deductive arguments:

In a **deductive** argument, if the conclusion is necessarily true independently of the premises, the argument is considered **valid**.

In an **inductive** argument, if the conclusion is probably true independently of the premises, the argument is **strong**.

The strength or weakness of an inductive argument results not from the truth or falsity of the premises and conclusion, but from the probabilistic support that the premises give to the conclusion.

In other words, **any inductive argument whose conclusion follows with low probability is weak.**

Unlike deductive arguments, the strength of inductive arguments consists of degrees. To be considered a strong inductive argument, the likelihood that the conclusion is true must be at least more than 50%. As the probability rises, the argument becomes stronger.

Consider the two arguments below. Which argument is weak and which argument is strong?

This drawer contains 100 pens.
Three pens selected at random were found to be blue.
Therefore, probably all the pens are blue.

This drawer contains 100 pens.
Eighty pens selected at random were found to be blue.
Therefore, probably all the pens are blue.

Note: it is not always possible to determine inductive strength in an a priori manner, i.e. we may need additional empirical data to determine strength.

F2 Assessing the cogency of inductive arguments

T7

[TEST] for a **cogent** inductive argument:

- Is the inductive argument strong?
- Are the premises true?

Note: An inductive argument that is not cogent is one where the answer to either or all of the above 2 questions is “No”. Hence, it is possible for an argument to be strong and still not cogent due to the presence of one or more false premises.

Cogent argument = Strong inductive argument + All true premises

This is the analogue of a sound deductive argument, which, as you may recall, is:
Sound argument = Valid deductive argument + All true premises

The table below may help to clarify cogency.

	Strong	**Weak**
True premise **Probably true conclusion**	All previous American Presidents were men. Therefore, probably the next American President will be a man. [cogent]	A few American Presidents were Christians. Therefore, probably the next American President will be a man. [not cogent]
True premise **Probably false conclusion**	None exist	A few American Presidents were Christians. Therefore, probably the next American President will be a Christian. [not cogent]
False premise **Probably true conclusion**	All previous American Presidents were television debaters. Therefore, probably the next American President will be a television debater. [not cogent]	A few American Presidents were Libertarians. Therefore, probably the next American President will be a television debater. [not cogent]
False premise **Probably false conclusion**	All previous American Presidents were women. Therefore, probably the next American President will be a woman. [not cogent]	A few American Presidents were Libertarians. Therefore, probably the next American President will be a Libertarian. [not cogent]

F3 Assessing the reliability of inductive arguments

In assessing inductive arguments, a further step than cogency needs to be taken. Inductive arguments must not only be cogent to be accepted; they must be reliable. That is, they must also not ignore important pieces of evidence that entail a different conclusion.

T8

[TEST] for a **reliable** inductive argument:

- Does the cogent inductive argument contain all known relevant information? Is it possible to insert additional premises that would change the probability of the conclusion?

Reliable argument = Cogent inductive argument that contains all known relevant information.

Example:
Swimming in the sea is usually lots of fun. Today, the water is warm, the waves are gentle and there are no dangerous jellyfish lurking around. Therefore, it would be fun to go swimming now.

If the fact that there are several large dorsal fins cutting through the water is ignored, then obviously the argument is unreliable and cannot be accepted.

Therefore, in assessing the reliability of inductive arguments, important facts must not be overlooked. This is called the **total evidence requirement**.

F4 Common Types of Inductive Arguments

Inductive reasoning is used often in the following areas:

- Use of analogy in legal and moral fields
- Causality in science
- Generalizations in science
- Statistics and probability

Over time, several types of inductive arguments have arisen. They are explained here.

a) Argument from analogy

The use of analogy in reasoning is the most fundamental and common of all rational processes. For instance, you may decide to get your hair cut at this salon as you recall that your friend got an especially good haircut at the same place last week. Another person who might be deliberating between buying either Nike or Adidas shoes and, after recalling that other types of Nike shoes were good, decide in favour of that brand. You may recall that the last three novels by Stephen King were thrilling and conclude that his latest book is also thrilling.

Analogical reasoning depends on the similarity of circumstances. If the instances are sufficiently similar, the decision reached in the end is usually a good one; if not, the decision may not be good.

Simple arguments from analogy have the following structure:

Entity A has attributes *a, b, c* and *z*.
Entity B has attributes *a, b, c*.
Therefore, entity B probably has attribute *z* also.

If a, b, and c are connected in an important way to z, the argument is usually strong. If they are not so connected or are irrelevant to z, then the argument is usually weak.

Analogical arguments are similar to generalizations. In a generalization, the arguer begins with one or more instances and then proceeds to draw a conclusion about all the members of a class.

An example of an argument from analogy is as follows:
"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 round 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." - William Paley, argument for the existence of God.

Here are some questions that are useful in evaluating most arguments from analogy. Legal reasoning and types of legal cases are used as examples. Do note that many of the arguments used by lawyers in America and Canada to support a case at trial are analogical arguments.

1. **How relevant is the analogy?**

Two buildings in New York were burnt down and in each instance, ten people died. The comparison of the two cases is pointless if the issue in the first instance is whether the insurance company should pay damages and if the issue in the second is whether someone is guilty of arson.

2. **How many similarities are there between the instance and the analogy?**

3. **What about the nature and degree of disanalogy?**

4. **Is there more than one instance of such a precedent being set?**

If there are 50 previous courts which have followed this rule, then the precedent is stronger than if only one court had followed this rule.

5. **Does this rule turn up in a broad range of cases?**

If a certain rule turns up in a broad range of cases, it provides a stronger precedent than if it only turns up in one type of case.

6. **The more specific the conclusion, the weaker the argument becomes. How specific is the conclusion?**

*If a person who was injured by a surgeon during an operation who left a needle in the body during a knee operation, and he was awarded one million dollars, then the argument that another person injured in the same way by another doctor should be awarded **exactly** that amount of money is a weaker argument, compared to the argument that the person should be awarded **approximately** the same amount of money.*

In other words, arguments by analogy are cogent if and only if:

- the premises are true
- there is a systematic or causal connection between the analogical properties (a, b, c) and the projected property (z)

Try this out yourself. Do you think the following inductive argument from analogy should be accepted?

> *If the world's first automobile loses control and plows up your garden, how do courts 'follow existing valid law' when no law whatsoever refers to automobiles?*

b) Inductive generalization

N% of a sample S is F
Therefore N% of the population from which S is drawn is F.

For example:
A questionnaire was given to 50 students in all schools and years. 45 said they are opposed to the new grading system. So 90% of all the students in this university are opposed to the new grading system.

This type of inductive argument is cogent if and only if the premise is true, and S is randomly selected and is of sufficient size.

c) Statistical syllogism

N% of F are G (where 0<N<100)
a is F
Therefore a is G
For example:
Most brightly colored frogs are poisonous.
This frog is brightly colored.
Therefore, this frog is poisonous.

This type of inductive argument is cogent if and only if the premises are true and N is greater than 50%.

d) Argument from authority
An argument that bases its argumentative force on the source being an authority in a given field.

For example:
Amnesty International say that prisoners are mistreated in Turkey.
So prisoners are mistreated in Turkey.

This type of inductive argument is strong if and only if the supposed 'authority' is indeed an authority in the given field. If not, it is a fallacy.

e) Inference to the best explanation (IBE, following Occam's Razor)
An argument where one does not know for certain what the actual explanation is and makes the best possible inference.

For example:
Most of the students in course X got A+.
So the instructor is a lenient marker.

This type of inductive argument is strong if and only if the explanation offered is *really* the best explanation possible. If not, it is a fallacy.

f) Argument about causes

A similar kind of argument to IBE but more information is provided such that one can infer the cause of some event X

For example:

Deaths from heart disease are three to four times lower in France than they are in Britain. Yet known risk factors such as smoking levels and fat or cholesterol consumption are similar in the two countries. The French, however, consume much more alcohol than the British. And in particular, they drink a lot of red wine – which everyone now knows is full of anti-oxidants. Therefore, it must be red wine that is reducing the French incidence of heart disease.

This type of inductive argument is strong if and only if the 'cause' offered is *really* the cause of event X. If not, it is a fallacy.

It is imperative to note that arguments d-f easily become fallacies if one is not careful. This will be covered in unit G.

A short digression: Sufficient VS Necessary Conditions

A sufficient condition may or may not be a necessary condition.
Dropping a brick on a bare foot is a sufficient condition for feeling pain.
It is not a necessary condition since pain may be obtained in other ways.

Getting full marks is a sufficient condition for getting an A.
It is not a necessary condition since it is possible to get an A with less than full marks.

Similarly, a necessary condition may or may not be a sufficient condition.
Being a man is a necessary condition for being a bachelor.
It is not a sufficient condition since one may be a married man.

The presence of oxygen is a necessary condition for the presence of fire
It is not a sufficient condition. Otherwise, this classroom would right now be in flames.

Being above 21 is a sufficient condition for being able to vote
It is also a necessary condition since those below 21 cannot vote.

Translating this into conventional logical terminology,

"If" signals a **sufficient** condition
You'll feel pain if you drop a brick on your foot
NOT you'll feel pain only if you drop a brick on your foot

"Only if" signals a **necessary** condition
You're a bachelor only if you're a man
NOT you're a bachelor if you're man

"If and only if" signals a **necessary and sufficient** condition
You can vote if and only you are above 21

In logical form,

p only if q
= q is a necessary condition for p You're a bachelor only if you're a man
= **If not q, then not p** If you're not a man, then you're not a bachelor
= **If p then q** If you're a bachelor, then you're a man

p if q
= q is a sufficient condition for p You'll feel pain if you drop a brick on your foot
= **If q, then p** If you drop a brick on your foot, then you'll feel pain

If p is sufficient for q, then q is necessary for p (and vice versa)
You're a man if you're a bachelor (Bachelor –p- is sufficient for maleness –q-)
You're a bachelor only if you're a man (Maleness –q- is necessary for bachelorhood –p-)

p iff. q means that both p and q fall or stand together

Exercise E

I. The following arguments are inductive. Determine, where possible, whether each one is:

- strong or weak
- cogent or not cogent
- reliable or unreliable

1) The grave marker says that David Marshall is buried here. It must be the case that David Marshall is really buried here.

2) Franklin Roosevelt said that we have nothing to fear but fear itself. Therefore, women have no reason to fear serial rapists.

3) People have been listening to rock and roll music for over a hundred years. Probably people will still be listening to it a year from now.

4) *Coca-Cola is a very popular soft drink. Therefore, probably someone, somewhere, is drinking a Coke right now.

5) *When a random sample of 600 voters was taken on the eve of the presidential election, it was found that 53% of those sampled intended to vote for Kerry and 47% for Bush. Therefore, Kerry will probably win.

6) When Neil Armstrong landed on the moon, he left behind a gold-plated Schwinn Bicycle which he used to ride around on the moon's surface. Probably that bicycle is still up there on the moon.

II. Which of the following statements are false?

a) A strong argument may have false premises and a probably false conclusion.

b) A strong argument may have true premises and a probably false conclusion.
c) A cogent argument may have a probably false conclusion.
d) A cogent argument must be inductively strong.
e) An argument may legitimately be spoken of as “true” or “false”.

Exercise F
Evaluate the following arguments. Draw an arrow diagram first.

1. *A ship has gone down in the ocean and half the passengers have been killed. Your best friend Angela was on board but you do not know if she was one of the survivors. At once, you utter a prayer to God that she survived.

“Your prayer is pointless. For your prayer is superfluous if Angela survived. And if she did not survive, then God can hardly answer your prayer since, despite all His powers, he cannot do the impossible, and it is impossible to alter the past.”

2. Whatever consists mostly of empty space isn’t solid. But the chair I sit on consists mostly of empty space since it consists of billions of atoms, each of which consists mostly of empty space. This last is true since each atom consists of a tiny central core surrounded by tiny electrons situated at a relatively large distance from the core. It follows that the chair I sit on isn’t solid. How on earth does it support my weight?

3. Either that bomb is going to kill me or it is not. If it is going to kill me, then any precautions I take will be ineffective. But if it is not going to kill me, then any precautions I take will be superfluous. So any precautions I take against that bomb are either ineffective or superfluous. So there is no point going into that bomb shelter.

4. President Sarkozy is a man of no political integrity, willing to do whatever needs to be done in order to triumph at the elections. Just look at his recent actions. Less than three weeks before the first round of the presidential election, one of the biggest crackdowns on suspected radical Islamists in recent French memory happened. The timing and the presence of the television crew are as much linked to electioneering as to anti-terrorist crime prevention. In likening the Toulouse killings to France's 9/11, Sarkozy is obviously using the opportunity to style himself as the only trustworthy protector of the nation in the face of the serious threat. The danger, it now seems, is Islamist fundamentalism and terrorism, when just a month ago, it was impending financial meltdown!

5. The progressive proposal to build a large beach resort in the national park in Bali should be endorsed unreservedly. Fidelity, the largest bank in the country, and the one likely to make the biggest loans to the various merchants who will set up store there, has conducted a business survey report and concluded that this business venture is a viable one; they also point to the recent success of a beach resort in Melbourne. The main stakeholders, the local merchants, are also very supportive of this venture. The only opposition comes from narrow-minded, do-gooder environmentalists who care more about trees than they do about people. At a time when unemployment is on the rise and economic crises abound, all tree-huggers care about is just that: tree-hugging. The fate of the typical man on the street does not concern them, they whose moral values are 'superior' to ours. All they care about is their own moral sensibilities and woe to those who dare to talk about the fate of the average Joe to them.

6. ***A teacher announces to her class that she will hold a “surprise” exam on exactly one of the five days (Monday to Friday) of the next school week. The exam will be a “surprise” (she explains) in the sense that the students will not know the day of the exam

Most of the students sigh and resign themselves to a weekend of studying. But one clever student argues instead that what the teacher says is impossible. “No such surprise exam can take place!”, he exclaims, offering the following reasons:

“Clearly, the exam will not be held on Friday (the last day of the school week), because, if it *were* held on Friday, then we would know about this by the end of Thursday, seeing that no exam had yet been held, and only one day was left. But the teacher said that we would not know the day of the exam until that day itself. This shows that the exam will not take place on Friday.

But in that case, the exam will not be held on Thursday either! For if it were held on Thursday, then we would know about this by the end of Wednesday, seeing that no exam had yet been held and only two days (Thursday and Friday) were left, *but we have already ruled out Friday*! But the teacher said that we would not know the day of the exam until that day itself. This shows that the exam will not take place on Thursday either.

In the same way, it is easy to see that the exam cannot take place on Wednesday, Tuesday or even Monday. So no such surprise exam as the teacher announced can take place!”

This is the so-called “surprise exam paradox”. There is something fishy going on in the student’s argument but it is not clear where exactly his argument has gone wrong. The best way to go about this is to ‘pull out’ all his premises and intermediate conclusions to see the exact structure of his argument, but be careful, there are a lot of implicit premises! This, unfortunately, is not easy. So go for something simpler. Since the first step in the student’s argument is to show that Friday is definitely not the day of the exam, draw an arrow diagram which establishes at least that much.

Don’t worry if you can’t get it. This is not easy. So don’t lose sleep over it.

UNIT G: FALLACIES

In this unit, you will learn:

- How to identify common fallacies in arguments

A fallacy is a type of incorrect argument that may seem to be correct, but that proves on examination not to be so. Fallacies do not refer to any or all mistaken arguments, but to typical errors.

G1 Formal Fallacies

Here are two formal fallacies. They look valid but in fact aren't.

Affirming the consequent (q)
If p, then q.
q.
Therefore p.

DON'T MIX UP WITH MODUS PONENS!!!

Inferring that P is true solely because Q is true and it is also true that if P is true, Q is true.

The problem with this type of reasoning is that it ignores the possibility that there are other conditions apart from P that might lead to Q. For example, if there is a traffic jam, a colleague may be late for work. But if we argue from his being late to there being a traffic jam, we are guilty of this fallacy - the colleague may be late due to a faulty alarm clock.

Of course, if we have evidence showing that P is the only or most likely condition that leads to Q, then we can infer that P is likely to be true without committing a fallacy.

Try this: Deductively invalid or inductively strong?
If it rained last night, then the streets are wet this morning.
The streets are wet this morning.
So it rained last night.

At first sight, it looks like a typical "affirming the consequent" fallacy. If so, then it is deductively invalid. However, that is probably not the intention of the author. He probably meant it to be an inductive argument. If so, then it looks like an inductively strong argument that is probably reliable. In this case, no fallacy has been committed.

Denying the antecedent (p)
If p, then q.
Not p.
Therefore not q.

DON'T MIX UP WITH MODUS TOLLENS!!!

Inferring that Q is false just because if P is true, Q is also true, but P is false.

This fallacy is similar to the fallacy of affirming the consequent. Again the problem is that some alternative explanation or cause might be overlooked. Although P is false, some other condition might be sufficient to make Q true.

Example: If there is a traffic jam, a colleague may be late for work. But it is not right to argue in the light of a smooth traffic that the colleague will not be late. Again, his alarm clock may have stopped working.

G2 Informal Fallacies
A few hundred of these are known to exist. Here are a select few of the more common ones (in alphabetical order):

Ad baculum (appeal to force)
When careful reasoning is replaced with direct or insinuated threats in order to bring about the acceptance of some conclusion. For example: The President continues to have confidence in the Attorney General and you likewise ought to have confidence in the Attorney General. If anyone has a different view or intention, he should tell me about it **because we are going to have to discuss your status.**

Ad hominem *(attacking the person)*
A theory is discarded not because of any evidence against it or lack of evidence for it, but because of the person who argues for it. Example:
A: The Government should enact minimum-wage legislation so that workers are not exploited.
B: Nonsense. You say that only because **you cannot find a good job**.

Ad ignorantiam *(appeal to ignorance)*
The truth of a claim is established only on the basis of **lack of evidence** against it. A simple obvious example of such fallacy is to argue that unicorns exist because there is no evidence against such a claim. At first sight it seems that many theories that we describe as scientific involve such a fallacy. E.g. the first law of thermodynamics holds because so far there has not been any negative instance that would serve as evidence against it. But notice, as in cases like this, there is evidence for the law, namely positive instances. Notice also that this fallacy does not apply to situations where there are only two rival claims and one has already been falsified, then we may justly establish the truth of the other even if we cannot find evidence for or against it.

Ad misericordiam (appeal to pity)

In offering an argument, pity is appealed to. Usually this happens when people argue for **special treatment** on the basis of their need. E.g. a student argues that the teacher should let him/her pass the examination because he/she needs it in order to graduate. Of course, pity might be a relevant consideration in certain conditions, as in contexts involving charity.

Ad populum *(appeal to popularity / bandwagon argument)*

The truth of a claim is established **only** on the basis of its **popularity** and **familiarity**. This is the fallacy committed by many commercials. Surely you have heard of commercials implying that we should buy a certain product because it has made to the top of a sales rank, or because the brand is the city's "favourite".

Ad Verecundiam *(appeal to inappropriate or false authority)*

When the premises of an argument appeal to the judgment or some party having **no legitimate claim to authority** in the matter at hand. For example: an argument about morality that makes an appeal to the opinions of Darwin, an authority in biology, would be fallacious.

Begging the question (petitio principii)

See petitio principii.

Complex question or loaded question

A question is posed in such a way that a person, no matter what answer he/she gives to the question, will inevitably commit him/herself to some other claim, which should not be presupposed in the context in question.

A common tactic is to ask a yes-no question that tricks people to agree to something they never intended to say. For example, if you are asked "Are you still as self-centred as you used to be?", then no matter you answer "yes" or "no", you are bound to admit that you were self-centred in the past. Of course, the same question would not count as a fallacy if the presupposition of the question is indeed accepted in the conversational context.

Composition *(opposite of division)*

The whole is assumed to have the same properties as its parts. Anne might be humorous and fun-loving and an excellent person to invite to the party. The same might be true of Ben, Chris and David considered individually. But it does not follow that it will be a good idea to invite all of them to the party. Perhaps they hate each other and the party will be ruined.

Division *(opposite of composition)*

The parts of a whole are assumed to have the same properties of the whole. It is possible that, on a whole, a company is very effective, while some of its departments are not. It would be inappropriate to assume they all are.

Amphiboly *(Greek for 'two in a lump')*
When one of the **statements** in an argument has **more than one plausible meaning**, because of the loose or awkward way in which the words in that statement have been combined. The arguer typically selects the unintended interpretation and proceeds to draw a conclusion based upon it. For example: Nothing is better than wine. Sandwiches are better than nothing. Thus, sandwiches are better than wine. To say that "nothing is better than wine" could mean that there is nothing better than wine **or** that empty space is better than wine. The argument would be valid if the latter meaning was used but such a premise (empty space is better than wine) would be false. On the other hand, if we were to take the true premise (there is nothing better than wine), then we would have an invalid argument.

Equivocation
Putting forward an argument where the conclusion depends on the fact that a **word** (NOT a statement) is used, explicitly or implicitly, in two different senses. For example, Sean Connery is a star. All stars are in orbit in outer space. So Sean Connery is in orbit in outer space. Stars in the 1st premise refer to a celebrity while it means a celestial body in the 2nd premise.

Note: It is common to confuse equivocation and amphiboly. There are 2 ways in which they are different. First, equivocation is always traced to an ambiguity in the meaning of a *word* or *phrase*, whereas amphiboly involves a syntactical ambiguity in a *statement*. Second, amphiboly usually involves a mistake made by the arguer in interpreting an ambiguous statement made by someone else, whereas the ambiguity in equivocation is typically the arguer's own creation.

False dilemma
Presenting a **limited set of alternatives** when there are others that are worth considering in the context. Example: "Every person is either my enemy or my friend. If he/she is my enemy I should hate him/her. If he/she is my friend I should love him/her. So I should either love him/her or hate him/her." Obviously, the conclusion is too extreme because most people are neither your enemy nor your friend.

Gambler's fallacy
Assumption is made to take some independent statistics as dependent. The untrained mind tends to think that, e.g. if a fair coin is tossed five times and the results are all heads, then the next toss will more likely be a tail. It will not be, however. If the coin is fair, the result for each toss is completely independent of the others. Notice the fallacy hinges on the fact that the final result is not known. Had the final result been known already, the statistics would have been dependent.

Genetic fallacy
Thinking that because X dervies from Y, and Y has a certain property, X must have the same property also. Example: "His father is a criminal, so he must also

be up to no good."

Non sequitur
A conclusion is drawn which does not follow from the premise. This is not a specific fallacy but a very general term for a bad argument. So a lot of the examples above and below can be said to be non sequitur.

Petito principii (circular argument)
Latin word for question begging. When one **assumes in the premises** of an argument the **truth** of what one seeks to establish in the **conclusion** of that argument. In other words, arguer uses circular reasoning. For example, many studies have shown that teenagers have quicker reactions than do persons in their twenties. The reason cited in these studies is that the older persons do not react as quickly.

False cause *(Non Causa Pro Causa)*
When one treats as the cause of a thing what is **not really the cause** of that thing, or more generally, when one blunders in reasoning that is based upon causal relations. For example: Whenever I wear green socks my logic grade goes up. That is why I save my green socks to wear only on the days of the test.

Post hoc, ergo propter hoc *(literally, "after this, therefore because of this")*
A variation of false cause. Inferring that X must be the cause of Y just because X is followed by Y.
For example, having visited a graveyard, I fell ill and infer that graveyards are spooky places that cause illnesses. Of course, this inference is not warranted since this might just be a coincidence. However, a lot of superstitious beliefs commit this fallacy.

Red herring
Within an argument some **irrelevant** issue is raised which diverts attention from the main subject. The function of the red herring is sometimes to help express a strong, biased opinion. The red herring (the irrelevant issue) serves to increase the force of the argument in a very misleading manner.

For example, in a debate as to whether God exists, someone might argue that believing in God gives peace and meaning to many people's lives. This would be an example of a red herring since whether religions can have a positive effect on people is irrelevant to the question of the existence of God. The good psychological effect of a belief is not a reason for thinking that the belief is true.

Slippery slope
Arguing that if an opponent were to accept some claim C1, then he or she has to accept some other closely related claim C2, which in turn commits the opponent to a still further claim C3, eventually leading to the conclusion that the opponent is committed to something absurd or obviously unacceptable.

This style of argumentation constitutes a fallacy only when it is inappropriate to think if one were to accept the initial claim, one must accept all the other claims.

An example: "The government should not prohibit drugs. Otherwise the government should also ban alcohol or cigarettes. And then fatty food and junk food would have to be regulated too. The next thing you know, the government would force us to brush our teeth and do exercises everyday."

Straw man

Attacking an opponent by **attributing to him/her an implausible position** that is easily defeated when this is not actually the opponent's position.

Example: When many people argue for more democracy in Hong Kong, a typical reply is to say that this is not warranted because it is wrong to think that democracy is the solution to all of Hong Kong's problems, or to say that one should not blindly accept democracy. But those who support democracy never suggest that democracy can solve *all* problems (e.g. pollution), and they might also agree that *blindly* accepting something is rarely correct, whether it is democracy or not. Those criticisms attack implausible "strawman" positions and do not address the real arguments for democracy.

Suppressed evidence

Where there is contradicting evidence, only confirming evidence is presented. This fallacy usually applies to the interpretation of some data or quotation. E.g. history of science often reveals the fact that scientists, even famous ones like Ampere, sometimes eliminate contradicting data such that on the whole their experiments support their theories.

Exercise G

Identify the Fallacies in the following passages and explain how each specific passage involves that fallacy or fallacies:

1. It is necessary to confine criminals and to lock up dangerous lunatics. Therefore, there is nothing wrong with depriving people of their liberties.

2. The army is notoriously inefficient, so we cannot expect Major Smith to do an efficient job.

3. God exists because the Bible tells us so, and we know that what the Bible tells us must be true because it is the revealed word of God.

4. Congress shouldn't bother to consult the Joint Chiefs of Staff about the military appropriations. As members of the armed forces, they will naturally want as much money for military purposes as they think they can get.

5. Narcotics are habit-forming. Therefore if you allow your physician to ease your pain with an opiate, you will become a hopeless drug addict.

6. Cooks have been preparing food for generations, so our cook must be a real expert.

7. More young people are attending high schools and colleges than ever before in the history of our nation. But there is more juvenile delinquency than ever before. This makes it clear that to eliminate delinquency among the youth we must abolish the schools.

8. You say we ought to discuss whether or not to buy a new car now. All right, I agree. Let's discuss the matter. Which should we get a Ford or a Chevy?

9. Anyone who deliberately strikes another person should be punished. Therefore the middleweight boxing champion should be severely punished, for he assaults all of his opponents.

10. Everyone said that the soup had a very distinctive taste, so they must all have found it very tasty.

11. If we want to know whether a state is brave we must look at its army, not because the soldiers are the only brave people in the community, but because it is only through their conduct that the courage or cowardice of the community can be manifested.

-- R. L. Nettleship, *Lectures on the* Republic *of Plato*

12. My client is the sole support of his aged parents. If he is sent to prison, it will break their hearts, and they will be left homeless and penniless. You surely cannot find it in your hearts to reach any other verdict than "not guilty."

13. There is no proof that the secretary "leaked" the news to the papers, so she can't have done it.

14. Diamonds are seldom found in this country, so you must be careful not to mislay your engagement ring.

15. Was it through stupidity or through deliberate dishonesty that the Administration has hopelessly botched its foreign policy? In either case, unless you are in favor of stupidity or dishonesty, you should vote against the incumbents.

16. Since all men are mortal, the human race must some day come to an end.

(From Copi, *Introduction to Logic,* pp. 85-88)

In Summary

To consolidate your learning, you may want to use the following checklist to see if you've understood all the necessary concepts in this package.

Do you know what each of the following mean? Can you explain how they differ from each other?

- Premises
- Missing Premises (assumptions)
- Conclusions
- Arrow Diagrams
- Explanation
- Argument
- Deduction
- Induction
- Validity
- Soundness
- Truth value
- Principle of Charity
- Fallacies / Flaws in the argument

To help with your revision, it may be helpful to draw a mindmap of these concepts and summarize their definitions and the various tests involved. (The flowchart on the first page of this handout is a good example). This will allow you to review the concepts quickly without having to read the entire set of notes.

Further Exploration

Students in search of good supplementary material can find them at the following sources.

Highly Recommended Textbook
Patrick Hurley's A Concise Introduction to Logic, Wadsworth Publishing, 2005. Available in the RI SF library. Read only chapter 1. Call number: E16 160 HUR

Useful Online Resources

a) The Argument Clinic
http://www.univnorthco.edu/philosophy/clinic.html

b) Arguments and their evaluation
http://www.univnorthco.edu/philosophy/arg.html

c) Basic information on arguments, logic, scientific reasoning, moral reasoning, fallacies, plus some computer-generated, interactive exercises that come with answers. Highly recommended.
http://philosophy.hku.hk/think/arg/analogy.php

d) Logic tests available here:
http://philosophy.lander.edu/logic/index.html

e) Fallacy readings:
http://www.fallacyfiles.org