#### INTRODUCTION TO LOGIC AND CRITICAL THINKING

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#### What is the study of Logic all about?

#### Logic

Logic is about both how the world works and how we think. If there were not such commonality then it is hard to see how we could understand or even function in the world. Logic is more than just the ability to solve problems and make valid reasoning's, although, it is true that studying logic will help you reason. The real difference between us and animals is our conceptual ability, the lizard sunning itself on a rock has no concept of rock, see no similarity between one rock and another. Such conceptual ability develops somewhere as animals become more advanced but really only develops highly with the development of language. It is conceptual ability that allows language and language enhances conceptual ability. Logic is the framework upon which language hangs that allows the, inherently meaningless sounds, convey meaning between speakers of a language. Understanding logic helps to form a finer conceptual "grain" and to eliminate erroneous concepts and conceptual frameworks

So advantages of studying logic in summary;

Enhances problem solving ability
Enhances reasoning ability
Enhances critical facilities
Enhances conceptual ability

Logic incorporates two methods or types of reasoning: deductive and inductive. Deductive reasoning relies on facts, certainty, syllogisms, validity, truth of premises sound arguments and supported conclusions. Inductive reasoning relies on diverse facts, probability, generalizations, hypotheses, analogies and inductive strength.

#### Problem Solving Through Logic

A logic problem is like any problem. It requires:

* Understanding the problem. In other words, listen, read & take heed.
* Identifying all of the “unknowns” as well as the “knowns.”
* Interpreting relationships between them (visual aids can help).
* Generating a strategy from steps two and three.
* Applying the strategy and solving the problem.
* Repeating the process if it is necessary.

**WHY IS LOGIC SO IMPORTANT?**

**Logic** is an important subject because it teaches relation. This has far reaching effects beyond mathematics, where it is often studied. It teaches deductive reasoning, such as the difference between reason and fallacy.Logic is an important subject because it teaches relation. This has far reaching effects beyond mathematics, where it is often studied.

1)It teaches deductive reasoning, such as the difference between reason and fallacy.

**For example, while it may be true that all rich people have money, it is not true that all people who have money are rich.**

**2)**It also allows you to utilize deductive reasoning to interpret statements such as “Four out of five \_\_\_\_ agree that \_\_\_\_\_\_\_.”

**While this statement appears to be founded in statistics, it actually leaves out just how many were asked the question that led to the results. That is, there is a difference between 4 out of 5 and 80 out of 100, even though they are the same percentage; 4 out of 5 tricks the mind to be “better” than 80 out of 100, because there is less gap between the numbers.**

**3)**It enforces critical thinking. I recall from my high school math class that taught logic : “Critical thinking is the desire to seek, the patience to doubt, the fondness to meditate, and the slowness to assert” – Francis Bacon (1605).For example:

* + **When using critical thinking, you seek out information, not settling for what is given. Take the previous example of “4 out of 5.” Seeking information allows you to question how many people were surveyed, and what their relation to the question is. It allows you to open yourself to ask what may have influenced their answer.**
	+ **The patience to doubt opens one to question the information, instead of just taking it for fact. “The sun will rise tomorrow” may be a fact, but doubting it allows you to deductively verify or disprove that statement.**
	+ **The fondness to meditate allows a person the ability to pause and think about the information presented, instead of just reacting**.
	+ **The slowness to assert allows one to think about the information they are presenting, or presented, and analyze it in a meaningful way.**

Example:

* All birds have feathers. (TRUE)
* Turkeys have feathers. (TRUE)
* Therefore, all birds are turkeys. (FALSE). (A chicken is a bird, and is not a turkey)

Enhances reasoning ability
Enhances critical facilities
Enhances conceptual ability

**WHAT ARE THE TYPES OF REASONING?**

The following are a few major types of reasoning.

* Deductive Reasoning.
* Inductive Reasoning.
* Abductive Reasoning.
* Backward Induction.
* Critical Thinking.
* Counterfactual Thinking.
* Intuition.

We are constantly being given reasons to do and believe things: to believe that we should buy a product, support a cause, accept a job, judge someone innocent or guilty, that fairness requires us to do some household chore, and so on. Assessing the reasons we are given to do or believe these things calls upon us to think critically and logically. Perhaps surprisingly, however, people are not very good at thinking logically and critically. No matter how clever or educated we are, or what our walk of life is, we are all rather easily led astray by common psychological obstacles or reasoning fallacies**.**

**COMMON BARRIERS OR OBSTACLES TO LOGICAL AND CRITICAL THINKING**:

* Confirmation bias - when we tend to only consider what we have already experienced.
* Heuristics - mental shortcuts we use to simplify decision making.
* Framing - when how we are presented with a problem affects the way we see it.
* Common fallacies - some common ways that we use reasoning that are not logical or critical.

**Critically Evaluating the Logic and Validity of Information**

**What is Validity-**In Logic it is the property of an [argument](https://www.britannica.com/topic/argument-logic) consisting in the fact that the [truth](https://www.britannica.com/topic/truth-philosophy-and-logic) of the [premises](https://www.merriam-webster.com/dictionary/premises) logically guarantees the truth of the conclusion. Whenever the premises are true, the conclusion must be true, because of the form of the argument. Some arguments that fail to be valid are acceptable on grounds other than [formal logic](https://www.britannica.com/topic/formal-logic) (e.g., inductively strong arguments), and their conclusions are supported with less than logical necessity. Where the support yields high probability of the conclusion relative to the premises, such arguments are sometimes called inductively valid. In other purportedly persuasive arguments, the premises actually provide no rational grounds for accepting the conclusion; such defective forms of argument are called fallacies

**Meaning of Fallacies**: In [logic](https://www.britannica.com/topic/logic) it is [erroneous](https://www.merriam-webster.com/dictionary/erroneous) [reasoning](https://www.britannica.com/topic/reason) that has the appearance of soundness. A fallacy comes from incorrect patterns of reasoning. However, it does not always mean that the conclusion is false, but it does underscore the fact that the reasoning used to support it is not: valid, based on true premises, or complete and does not include all necessary relevant information:

**TYPES OF FALLACIES**

### 1. **The ‘Who are you to talk?’, or ‘You Too’, or Tu Quoque Fallacy**

### Rejecting an argument because the person advancing it fails to practice what he or she preaches.

###  For example:

###  Doctor: You should quit smoking. It’s a serious health risk.  Patient: Look who’s talking! I’ll quit when you quit.

Responses like that probably sound familiar. But the doctor’s failure to look after her own health is irrelevant to the argument, resting on a concern for the patient’s health, that the patient should quit smoking.

### **2. THE RED HERRING FALLACY.**

An arguer tries to sidetrack his or her audience by raising an irrelevant issue and then claims that the original issue has effectively been settled by the irrelevant diversion.

There is a good deal of talk these days about the need to eliminate pesticides from our fruits and vegetables. But many of these foods are essential to our health. Carrots are an excellent source of vitamin A, broccoli is rich in iron, and oranges and grapefruits have lots of Vitamin C.

Plans to eliminate or reduce pesticides probably don’t entail stopping the production of common vegetables: the suggestion that they do is an irrelevant red herring.

### **3. THE STRAWMAN FALLACY.**

Someone distorts or caricatures an opponent’s arguments or views, and then attacks the weakened version rather than the real argument.

Margaret: “We have to do something about greenhouse gases. The government should raise vehicle fuel efficiency standards to cut down the amount of CO2 we release over the next 20 years”.
Roger: “Margaret’s solution would be a disaster. It would kill the economy. How would people get to work without cars?”Roger claims that Margaret is proposing measures that would eliminate cars. Margaret has not said anything equivalent to that. It’s a strawman.A positive message from the Strawman: the importance of being charitable.Showing that a strawman version of a position we oppose may win a debate, but it is unlikely to move us toward the truth. If we can show that even the strongest version of a position we oppose is flawed, we may make progress.So good logical and critical thinking leads to the principle of charity: When representing an argument that you do not agree with and are attempting to evaluate, it is important to represent that argument in a way that is reasonably faithful to the argument as it is made by the originators, and as strong as possible.

### **4. THE AD HOMINEM OR ‘AT THE PERSON’ FALLACY.**

Rejecting someone’s argument by attacking the person rather than evaluating their argument on its merits.

“Dear Editor, The current campaign against combining drinking with driving is terrorising law-abiding people. Many law-abiding people are cutting their alcohol consumption because they are afraid of being caught by random breath testing. But research shows that the average drink-driver in a fatal accident has an average blood alcohol level of more than twice the legal limit. The current campaign against drinking and driving is failing to achieve what should be our top priority; getting the heavy and hardened drinkers of the road.” Douglas Myers. CEO, Dominion Breweries.

“Dear Editor, I read Doug Myer’s letter yesterday but he is the CEO of a major brewing company! He has a vested interest in keeping alcohol sales up, and the anti-drink-driving campaign threatens to reduce alcohol sales. We shouldn’t take any notice of his views about drinking and driving”.

But if Myer has given arguments in favour of his view, we should evaluate them like any other argument – are they valid? strong? sound? cogent? (we’ll explain these terms in the course) – rather than writing them off because of facts about him.

Sometimes, however, an arguer’s position may be a reason to examine their arguments more carefully than we might otherwise.

The following does not appear fallacious:

“Burton Wexler, spokesperson for the American Tobacco Growers Association, has argued that there is no credible scientific evidence that cigarette smoking causes cancer. Given Wexler’s obvious bias in the matter, his arguments should be treated with care.”

### **5. FALLACIOUS APPEAL TO AUTHORITY**.

Relying upon the view of apparent (as opposed to genuine) authorities to settle the truth of a statement or argument.

Richard Long, a respected retired New Zealand newsreader featured in advertising campaigns for Hanover Finance. Long had no financial expertise.

Newsreaders look well informed, but they are essentially presenters. They are well known because they’re on the news: not because they know about investments. If we rely upon a newsreader’s endorsement to settle which investment fund we should trust, we would be accepting a claim without adequate evidence. That would be a fallacious appeal to authority.

Appeals to authority also conflict with the basic tenet of good logical and critical thinking which calls upon us to take responsibility for evaluating the grounds for our beliefs. Adopting a belief merely because someone else simply told us it was true is a way of avoiding good logical and critical thinking.

Sometimes, however, good logical and critical thinking will itself lead us to rely on genuine authorities. If I can’t assess the investment option for myself, I might reason that I should trust the advice of a genuine investment advisor. That’s not avoiding logical and critical thinking: it’s reasoning about a matter related indirectly to the question I’m trying to settle.

When I consider whether I should rely on a genuine authority, I should consider the following questions:

1. Is the authority a genuine authority: are they experts?
2. Are they giving advice in the areas within which they are a genuine authority? (We should listen to actors about acting; not so much about investing or medicine).
3. Is there a broad consensus among authorities in the area? If not, we should not decide to believe X solely because an authority says X is true, since other genuine authorities say that X isn’t true.
4. Is the authority speaking sincerely (they might be giving an endorsement because they’re paid to do so) and are they free of obvious bias?

Only if the answer to all four of these questions is “yes” should we accept a claim because an authority endorses it, and even then, we should only do so if we are not in a position to evaluate the evidence for the claim ourselves.

### **6. THE FALLACY OF COMPOSITION.**

Arguing that what is true of the parts must be true of the whole. (All of the parts of the object O have the property P. Therefore, O has the property P.)

Rugby players Ma’a Nonu, Jerome Kaino and Charles Piatau are all great players. In 2012, they all played for the Auckland Blues. Therefore, the 2012 Auckland Blues were a great team.

Sadly, for Tim, a long-suffering Blues Fan, the conclusion of this argument was false even though the premises were true.

And, showing that famous philosophers are not immune:

“Should we not assume that just as the eye, hand, the foot, and in general each part of the body clearly has its own proper function, so man too has some function over and above the function of his parts?” Aristotle, Nichomachean Ethics

### **7. THE FALLACY OF DIVISION.**

**Arguing that what is true of the whole must be true of the parts. (The opposite of the fallacy of composition: Object O has the property P. Therefore all the parts of the object O have the property P.)**

Men are, on average, taller than women. Therefore, Tim is taller than Maria Sharapova.

Tim would have to be taller than 188cm/6ft 2in to be taller than Sharapova: he’s not.

### **8. EQUIVOCATION**.

**A key word is used in two or more senses in the same argument and the apparent success of the argument depends on the shift in meaning**.

Any law can be repealed by the proper legal authority. The law of gravity is a law. Therefore, the law of gravity can be repealed by the proper legal authority.

When the two senses of ‘law’ (laws regulating human conduct vs. uniformities of nature) are made explicit, it is apparent that the first premise is irrelevant, hence a fallacious argument.

And, showing that famous philosophers are not immune again, we see John Stuart Mill arguing that happiness is desirable:

“The only proof capable of being given that an object is visible, is that people actually see it. The only proof that a sound is audible, is that people hear it… In like manner, I apprehend, the sole evidence it is possible to produce that anything is desirable, is that people do actually desire it… [T]his being a fact, we have not only all the proof which the case admits of, but all which it is possible to require, that happiness is a good. ” John Stuart Mill, Utilitarianism.

But ‘desirable’ is used in two different ways in this passage, to mean ‘can be desired’ (just like ‘visible’ means ‘can be seen’) and ‘worthy of being desired’.

### **9. APPEAL TO POPULARITY.**

**Arguing that a claim must be true because lots of people believe it.**

Essential Bible Blog’s Top 10 Reason the Bible is True:

Reason 8. Leader Acceptance. A majority of the greatest leaders and thinkers in history have affirmed the truth and impact of the Bible.

Reason 9. Global Influence. The Bible has had a greater influence on the laws, art, ethics, music and literature of world civilization than any other book in history.

Perhaps the Bible is true, but the fact lots of people believe it to be so is irrelevant to whether it is or not. We should investigate and evaluate their reasons for believing it, rather than taking the mere fact that they believe it as a reason to do so.

But … sometimes a consensus among properly informed people may be a fairly good guide to the truth of a claim: see the circumstances in which an appeal to authority might not be fallacious.

### **10. Appeal to Tradition**.

Like appeals to popularity except the appeal is to how long something has been believed, rather than to the number of people who have believed it

People have believed in astrology for a very long time, therefore, it must be true.

But all of the objections to arguments from majority belief apply here, too.

### **11. APPEAL TO IGNORANCE: ARGUMENTUM AD IGNORANTIAM.**

**The arguer asserts that a claim must be true because no one has proven it false, or that a claim must be false because no one has proven it to be true.**

Note: When we describe someone as ignorant, we often mean it as an insult. Here we use it to describe the situation in which we do not know (are ignorant of) something. In this sense, the smartest of us are ignorant of quite a lot. (We don’t want any equivocation in our use of the term ‘ignorant’).

There must be intelligent life on other planets: No one has proven there isn’t.

There isn’t any intelligent life on other planets: No one has proven there is.

Both claims assume that the lack of evidence for (or against) a claim is good reason to believe that the claim is false (or true). Ignorance – in the sense of a lack of knowledge – features as part of the proof of the conclusion. But in general, the mere fact that a claim has not yet been proven is not enough reason to think that claim is false.

However, are there some non fallacious appeals to ignorance?

a) If qualified researchers have used well-designed methods to search for something for a long time, without success, and it’s the kind of thing people ought to be able to find, then the fact that they haven’t found it might constitute some evidence that it doesn’t exist.

b) Some practices (e.g. law – see week 6) require us to reject a claim until a certain standard of proof is met: the presumption that defendants are innocent until proven guilty beyond a reasonable doubt for example.

### **12. APPEALS TO EMOTION – E.G., PITY, AFFECTION.**

**An arguer attempts to evoke feelings of pity or compassion, when such feelings are not logically relevant to the arguer’s conclusion.**

Student to Lecturer: I know I missed most of the lectures and all of my tutorials. But my family will be really upset if I fail this course. Can’t you find a few more marks?

Daughter:Can we get a puppy?
Father: No.
Daughter: If you loved me, we’d get a puppy.

That would be an appeal to emotion, in this case love. Note that the persistent child might continue:

Daughter: A puppy would grow up and protect us. Can’t we get a puppy?
Father: No.
Daughter: If you wanted to keep us safe you’d get a puppy! You don’t care about us!

That would be a strawman, not contemplated by the father or entailed by his actual view, and attacking that. Being able to spot the common fallacies can be very useful in the home.

Remember, there are three species of fallacies. The Fallacies of Relevance sketched so far attempt to introduce premises that are irrelevant to the conclusion.

## Fallacies of Unacceptable Premises

Fallacies of Unacceptable Premises attempt to introduce premises that, while they may be relevant, don’t support the conclusion of the argument.

### **13. BEGGING THE QUESTION.**

**In philosophy, unlike in many other areas, ‘begging the question’ does not mean ‘raises a question which must be answered’. In philosophy, when someone begs the question, they state or assume as a premise the very thing they are trying to prove as a conclusion.**

Arthur: God exists.
Barbara: How do you know?
Arthur: Because it says so in the Bible.
Barbara: How to you know what the Bible says is true?
Arthur: Because the Bible is divinely inspired. Everything it says is true.

The Bible could only be divinely inspired if God existed. So Arthur’s appeal to the Bible to prove the existence of God assumes the very thing he’s trying to prove.

### **14. False Dilemma or False Dichotomy.**

**Occurs when an argument presents two options and gives the impression that only one of them may be true, never both, and that there are no other possible options.**

Either Shakespeare wrote all the plays attributed to him, or Bacon did. There’s good reason to think Shakespeare didn’t write all the plays attributed to him. Therefore, Bacon wrote all the plays attributed to Shakespeare.

It’s possible that Shakespeare didn’t write all of the plays attributed to him, but that doesn’t mean Bacon did: there are other possibilities.

In the Shakespeare/Bacon case the false dilemma was explicit (either Shakespeare wrote all the plays … or Bacon did), but often the dilemma is implicit.

If I spend all of the week partying, I won’t have time to study and I’ll fail.

If I spend all week studying, I’ll be over-prepared and stressed and I’ll fail.

So I’m going to fail either way. I might as well spend the week partying.

Here the dilemma is unstated – “The only options are to spend all week studying or to spend all week partying” – and once stated it surely isn’t plausible: the student could spend some of the week studying and some of the week partying?

### **15. DECISION POINT FALLACY OR THE SORITES PARADOX.**

**Sometimes the conditions that make the use of a term appropriate vary along a continuum and there is no sharp cut off between circumstances in which the term is correctly applied and those in which it is not.**

If an arguer claims that because we cannot identify a precise cut-off or decision point, we cannot distinguish between correct and incorrect uses of the term, they are arguing fallaciously.

One grain of wheat doesn’t make a heap. Suppose 1 million does. Take one away. Surely we still have a heap: if a million makes a heap, surely 999,999 does too. One grain can’t turn a heap into a non-heap. Take another away. Surely we still have a heap: if 999,999 does, surely 999,998 does too. One grain … etc. Take another away. Surely we still have a heap …. etc etc etc.
But if one grain doesn’t make a difference, then it seems that we will be forced to conclude that 1 grain does make a heap. But that means we can’t talk about heaps of wheat at all: we don’t know when we can describe a collection of grains of wheat as a heap and when we can’t.

At conception an embryo is not a person. At birth, a baby is a person. There is no non-arbitrary way of determining exactly when the embryo became a person. Therefore, there is no moral difference between the embryo and the baby at birth.

But we can tell the difference between people who are bald and not bald, between heaps and non-heaps, and embryos and babies, even if we can’t tell exactly when something stopped being one thing and became the other.

### **16. THE SLIPPERY SLOPE FALLACY**.

**Arguers say that an innocent-looking first step should not be taken because once taken, it will be impossible not to take the next, and the next, and so on, until you end up in a position you don’t want to be in**.

Don’t get a credit card. If you do, you’ll be tempted to spend money you don’t have. Then you’ll max out your card. Then you’ll be in real debt. You’ll have to start gambling in the hope of getting a big win. But you’ll normally lose. Then you’ll have to steal money to cover your losses. Then your partner will leave you. And you won’t be able to feed the dog, and it’ll die. And it would be bad if the dog died. So you mustn’t get a credit card.

Slippery Slope arguments are fallacious if it is possible to stop at one of the steps: couldn’t I get a credit card with a maximum, or exercise a bit of control, or get the local animal protection society to help me feed the dog?

### **17. HASTY GENERALISATIONS**.

**Arguer draws a general conclusion from a sample that is biased or too small.**

The oldest woman in the world, Jeanne Calment (122 years, 164 days) smoked until her early 110s. Therefore smoking isn’t really bad for you.

Andrew Wakefield claimed to have shown a correlation between the MMR vaccine, bowel disorders and autism, but – among other flaws – his research focused on children already thought to have the conditions he claimed were caused by the vaccine.

The claim that smoking carries significant health risks isn’t falsified by a single case and trials drawing population wide conclusions must recruit representative study-populations.

### **18. FAULTY ANALOGIES.**

**The conclusion of an argument depends upon a comparison between two (or more) things that are not actually similar in relevant respects, or without pointing out how the two differ and why it does or does not matter**. (See reasoning by analogy in Week 6).

I need a new car. My last three cars have all been reliable, and they were blue. So I’m going to buy a blue car.

A letter to the editor following a report someone had been turned away from an after-hours medical clinic because she couldn’t pay for treatment for her feverish, vomiting child:
“Why do people attend private clinics for medical treatment with insufficient funds to cover fees? Do these same people go to the petrol station, fill up, toss $5 out the window and say “I’ll be back with the rest later,” or perhaps after dining out one evening, pay for the meal and promise to return next week, month or year to pay for the wine? I think not. The answer is simple - don’t go to private clinics.”

Are visits to after-hours medical clinics with a sick child analogous to visits to a gas station or a restaurant?

### **19. AND … THE FALLACY FALLACY!**

**The fallacy of inferring that merely because an argument contains a fallacy, its conclusion must be false.**

Bob told me that I shouldn’t steal because everyone knows that stealing is wrong, but I recognised immediately that argument contained the popularity fallacy, so I concluded that it was ok to steal the apple.

The conclusion of an argument may be true, even if the argument contains a fallacy. Finding a fallacy just means that the arguer needs to look for other, better reasons in support of their conclusion.

## Formal Fallacies

The third species of fallacy are Formal Fallacies. Some arguments are fallacious not because of their content – because of what they say – but because of their form or structure. Any argument with these forms or structures will be invalid, no matter what content we put into them.

Patrick will talk a little more about the standard forms or structures of arguments in weeks 2 to 4. The most familiar versions have some number of premises, followed by a conclusion, and if they’re valid (Patrick will talk about that in week 3) the truth of the premises guarantees the truth of the conclusion.

There are some common argument forms, however, which look quite like the valid versions, but which are not valid. Here we’re just going to identify two formal fallacies that will come up later in the course.

### **20. AFFIRMING THE CONSEQUENT**.

Suppose I have a guard dog, Brutus, and I’m confident he will bark if an intruder comes into my house.

I might reason like this:

P1P2CIf there’s an intruder, then Brutus will bark. Brutus hasn’t barked. Therefore,There's no intruder.

That’s valid: If it’s true that Brutus will bark if there’s an intruder, and if Brutus hasn’t barked, then there can’t be an intruder.

If the premises are true, then the conclusion must be true too.

But what if I reason like this:

P1P2CIf there’s an intruder, then Brutus will bark. Brutus has barked.Therefore,There's an intruder.

That’s not valid. Why? Well the premises might be true, but the first premise doesn’t say that Brutus will bark if and only if there’s an intruder.

The first premise can be true – that is it can be the case that Brutus will bark if there’s an intruder – even if Brutus occasionally barks for other reasons as well.

Notice that you can’t respond here “Oh, the burglar might have fed Brutus tranquilized steak. That’s why he hasn’t barked. There is a burglar!” That rejects the first premise (If there’s an intruder, Brutus will bark), and we’re seeing what happens if the premises are true. So here, if the premises are true, the conclusion must follow.

### 21. Denying the Antecedent.

Suppose I hear barking and reason like this:

P1P2CIf it barks, then it’s a dog.It's barking.Therefore,It's a dog.

That’s valid. If the premises are true – if it’s true that if it barks it’s a dog and it barks – then the conclusion must be true too.

But what if I reason like this:

P1P2CIf it barks, then it’s a dog.It's not barking.Therefore,It isn't a dog.

That’s not valid. The first premise says that if something barks then it’s a dog (i.e., that only dogs bark), but it doesn’t say that every dog barks. So we can’t be sure that the conclusion of this second argument is true even if the premises are true.

It might be true that something doesn’t bark (i.e., the antecedent is false, or denied, as the second premise says), but is a dog.

#### Meaning of Logic: Logic incorporates two methods or types of reasoning: deductive and inductive. Deductive reasoning relies on facts, certainty, syllogisms, validity, truth of premises sound arguments and supported conclusions. Inductive reasoning relies on diverse facts, probability, generalizations, hypotheses, analogies and inductive strength.

#### Meaning of Argument:An argument is a claim, which is used to persuade that something is (or is not) true, or should (or should not) be done. An argument contains three basic elements: an issue, one or more reasons or premises, and one or more conclusions. An argument can be either valid or invalid based on its structure and only premises & conclusions are reached, which are either true or false.The goal of critical thinking is to implement a sound argument, which has both a valid or proper structure and contains true premises. This is where using logic makes all the difference.

#### Meaning of Language:Thinking can’t be separated from language since both tend to have three primary purposes: to inform, persuade and explain. Language denotes (designates meanings) and connotes (implies or suggests something), and relies heavily on the use of metaphors. Metaphors are powerful language tools, which are able to influence how individuals think and problem solve. These figures of speech give great color and depth to one’s language. Metaphors can be short phrases, stories, or even poetic renditions and is a verbal message that listeners can easily interpret and visualize.

#### Meaning of Emotion:Trying to leave emotion out of almost anything is impossible as it is part of everything people do and think. Emotions are the number one cause of creating and putting into place thinking and operating barriers, which are continually used as a defense mechanism. Critical thinkers do not ignore or deny emotions but learn to accept and manage them.

#### Meaning of Assumptions:Assumptions are central to critical thinking. They tend to be implied, where individuals are not always conscious of them. Assumptions are not always bad and often rest on the notion that some ideas are obvious. They tend to make individuals comfortable with their present beliefs, shutting out any alternatives.

#### Meaning of Perception:Perception is considered to be the manner in which individuals receive, interpret and translate experiences. How individuals perceive things works to define how they think. Perception tends to provide individuals a significant filtering system.

**What is soundness**: A sound argument is a valid argument that has true premises. Firstly, a sound argument is a deductive argument. It’s trying to establish conclusive support for its conclusion. Secondly, the argument is valid: the premises, if true, would guarantee that the conclusion is also true. And on top of all that, the premises are actually true. Therefore, a sound argument guarantees that its conclusion is true.

We say that a sound argument is a good argument. It is a good argument because it guarantees that the conclusion is true. It would be irrational for you not to believe the conclusion of a sound argument.

Of course, sound arguments are very rare, because they’re very hard to establish. But, some arguments are sound.

For example:The province of Québec is part of Canada. Patrick was born in Québec. Therefore, Patrick was born in Canada.

This is a valid argument. Can you see why?

Furthermore, the premises are true: Québec is indeed part of Canada, and Patrick was indeed born in Québec. Hence, you can be absolutely certain that Patrick was born in Canada, and you ought to believe that Patrick was born in Canada. There’s no way around it.

Here are some more examples of sound arguments:

I drank coffee this morning; therefore, I drank something this morning.

Patrick got married on January 4, 2014. Patrick has not been divorced, and Patrick is not a widower. Therefore, Patrick is not a bachelor.

It is true that Patrick got married on January 4, 2014, that he has not divorced and that he is not a widower. So Patrick is not a bachelor because a bachelor is an unmarried male, by definition.

**COGENT ARGUMENTS**

**Definition: A cogent argument is a strong non-deductive argument that has true premises.**

And again, we say that cogent arguments are good. A cogent argument is by definition non-deductive, which means that the premises are intended to establish probable (but not conclusive) support for the conclusion.

Furthermore, a cogent argument is strong, so the premises, if they were true, would succeed in providing probable support for the conclusion. And finally, the premises are actually true. So the conclusion indeed receives probable support.

Here’s an example:

Patrick was born in North America and Patrick wasn’t born in Mexico. It’s thus quite probable that Patrick was born in the USA.

That is a cogent argument. If all you know about Patrick is what’s contained in the premises, and those premises are true (they are!), then that’s a fairly strong argument, because the population of the USA is over 300 000 000, whereas that of Canada is under 40 000 000. This means that the odds that Patrick was born in the USA are roughly 88%, which makes the support for the conclusion quite strong. Furthermore, the premises are true. Therefore, the argument is cogent, and so it is a good argument.

This means that we can have good arguments that have false conclusions!

Here’s another example:

I had coffee this morning. Therefore, it’s quite likely that I drank something this morning.

This is a strong argument with true premises, so it is cogent and therefore, good. But the conclusion is not guaranteed. It may be that I had coffee this morning by eating it, or by some other means. But of course, this is very unlikely, so the argument is strong, though it’s still possible that the conclusion is false. Still, this is cogent and therefore, a good argument.

Many articles and essays are not written to present information clearly and directly; instead, they might be written to persuade you to accept a particular viewpoint, to offer an opinion, or to argue for one side of a controversial issue.  Consequently, one must recognize and separate factual information from subjective content.

Subjective content is any material that involves judgment, feeling, opinion, intuition, or emotion rather than factual information.  Recognizing and evaluating subjective content involves distinguishing between facts and opinions, identifying generalizations, evaluating viewpoints, understanding theories and hypotheses, weighing data and evidence, and being alert to bias.

***Evaluating Various Types of Statements***

*Distinguishing between Facts and Opinions*

Facts are statements that can be verified or proven to be true or false.  Factual statements from reliable sources can be accepted and used in drawing conclusions, building arguments, and supporting ideas.

Opinions are statements that express feelings, attitudes, or beliefs and are neither true nor false.  Opinions must be considered as one person's point-of-view that you are free to accept or reject.  With the exception of informed opinions or testimony\*, opinions have little use as supporting evidence, but they are useful in shaping and evaluating your own thinking.

\* Informed opinion or testimony - the opinion of an expert or authority

*Recognizing Generalizations*

A generalization is a statement made about a large group or class of items based on observation or experience with a portion of that group or class.  It is a reasoned statement about an entire group based on known information about part of the group.  It involves a leap from observed evidence to a conclusion which is logical, but unproven.  Because writers do not always have the space to describe all available evidence on a topic, they often draw the evidence together themselves and make a general statement of what it shows.  But generalizations need to be followed by evidence that supports their accuracy, otherwise the generalization is unsupported and unusable.  A generalization is usable when these two conditions exist:

1. Your experiences are sufficient in number to merit a generalization.
2. You have sampled or experienced enough different situations to draw a generalization.

*Testing Hypotheses*

A hypothesis is a statement that is based on available evidence which explains an event or set of circumstances.  Hypotheses are simply plausible explanations.  They are always open to dispute or refutation, usually by the addition of further information.  Or, their plausibility may be enhanced by the addition of further information.  Critical thinking and reading requires one to assess the plausibility of each hypothesis.  This is a two-part process.  First, one must evaluate the evidence provided.  Then one must search for information, reasons, or evidence that suggests the truth or falsity of the hypothesis.  Ask questions such as:

1. Does the hypothesis account for all known information about the situation?
2. Is it realistic, within the realm of possibility and probability?
3. Is it simple, or less complicated than its alternatives? (Usually, unless a complex hypothesis can account for information not accounted for by a simple hypothesis, the simple one has greater likelihood of being correct.)
4. What assumptions were made?  Are they valid?

*Weighing the Adequacy of Data and Evidence*

Many writers who express their ideas use evidence or data to support their ideas. One must weigh and evaluate the quality of this evidence; one must look behind the available evidence and assess its type and adequacy.  Types of evidence include:

* Personal experience or observation
* Statistical data
* Examples, particular events, or situations that illustrate
* Analogies (comparisons with similar situations)
* Informed opinion (the opinions of experts and authorities)
* Historical documentation
* Experimental evidence

Each type of evidence must be weighed in relation to the statement it supports.  Evidence should directly, clearly, and indisputably support the case or issue in question.

***Evaluating Persuasive Material***

While the main purpose of textbooks is to explain and present information that can be accepted as reliable, other sources may have very different purposes.  Some materials are intended to convince or persuade rather than to inform, and these sources need to be carefully and critically evaluated.  Persuasive writers use both language and logical argument to exert influence.

*Recognizing Persuasive Language*

A writer's or speaker's choice of facts and the language used to convey them may influence the reader's or listener's response.  Careful choice of details to describe an event shapes a reader's perception of the incident.  Selective reporting of details is known as slanted writing.  Careful choice of words allows one to hint, insinuate, or suggest ideas without directly stating them.  Through deliberate choice of words, one can create positive or negative responses.  This is often accomplished through manipulation of the connotative meanings.

*Identifying Biased and Slanted Writing*

***Bias*** is when a statement reflects a partiality, preference, or prejudice for or against a person, object, or idea.  Much of what you read and hear expresses a bias.  As you read biased material keep two questions in mind:

1. What facts has the author omitted?
2. What additional information is necessary?

***Slanting*** is when a writer or speaker uses a selection of facts, choice of words, and the quality and tone of description, to convey a particular feeling or attitude.  Its purpose is to convey a certain attitude or point of view toward the subject without expressing it explicitly.  As you read or listen to slanted materials, keep the following questions in mind:

1. What facts were omitted?  What additional facts are needed?
2. What words create positive or negative impressions?
3. What impression would I have if different words had been used?

***Evaluating Arguments***

An argument is a logical arrangement and presentation of ideas.  It is reasoned analysis, a tightly developed line of reasoning that leads to the establishment of an end result or conclusion.  Arguments are usually developed to persuade one to accept a position or point
of view.  An argument gives reasons that lead to a conclusion.  Analyzing arguments is a complex and detailed process.  The following guidelines are useful:

1. Analyze the argument by simplifying it and reducing it to a list of statements.
2. Are the terms used clearly defined and consistently applied?
3. Is the thesis (the point to be made) clearly and directly stated?
4. Are facts provided as evidence?  If so, are they verifiable?
5. Is the reasoning sound?  (Does one point follow from another?)
6. Are counterarguments recognized and refuted or addressed?
7. What persuasive devices or propaganda techniques does the author use (examples: appeal to emotions, name-calling, appeal to authority)?

*Asking Critical Questions*

* *What is the source of the material?*  Some sources are much more reliable and trustworthy than others; knowledge of the source will help you judge the accuracy, correctness, and soundness of the material.  Articles from professional or scholarly journals are often more useful and reliable than articles in newsstand periodicals.  To evaluate a source, consider:
	+ its reputation
	+ the audience for whom the source is intended
	+ whether references or documentation are provided
* *What are the Author's Credentials?*  You must assess whether the material you are reading is written by an expert in the field who can knowledgeably and accurately discuss the topic.
* *Why was the Material Written?*  Identify an author's primary purpose.  If the author's purpose is to persuade or convince you to accept a particular viewpoint then you will need to evaluate the reasoning and evidence presented.
* *Is the Author Biased?*  Does the author display partiality, preference, or prejudice for or against a person, object, or idea?
* *Does the Author Make Assumptions?*  An assumption is an idea or principle the writer accepts as true and makes no effort to prove or substantiate.
* *Does the Author Present an Argument?*  An argument is a logical arrangement and presentation of ideas.  It is reasoned analysis, a tightly developed line of reasoning that leads to the establishment of an end result or conclusion.

#### Developing the Ability to Analyze Historical and Contemporary Information

Apply understanding & knowledge of past events to new situations.

Identify cause and effect relationships.

Practice problem solving through the use of analogies.

Synthesizing Information

Synthesis is creating something new from a number of different sources.  Synthesizing information is a process of examining and inferring relationships among sources and then making those relationships explicit.  Synthesis is also a process of combining information and ideas to create or develop a new idea, focus, or perspective.  An effective way to integrate and synthesize information is to recognize and use four particular thought patterns.  These include:

* **cause-effect**– expresses a relationship between two or more actions, events, or occurrences that are connected in time.
* **comparison-contrast** – the comparison pattern is used to emphasize or discuss similarities between or among ideas, theories, concepts, or events, while the contrast pattern emphasizes differences.
* **problem-solution** – defines a problem and conducts research to test possible solutions.
* **classification** – organize information into broad types or categories.

Using Analogies

The use of analogies to understand and interpret situations is another method for analyzing information.  Using analogies requires one to identify similar problems or situations and compare them with the problem at hand.  The use of analogies enables one to learn from the experiences of others.  Some guidelines to follow are:

1. How are the situations alike?
2. How are they different?
3. How well does the analogy apply to your situation?
4. What does it suggest that you do?

#### Appreciate the Complexities Involved in Decision-Making & Problem Solving

* Develop evidence to support views
* Analyze situations carefully
* Discuss subjects in an organized way
* Predict the consequences of actions
* Weigh alternatives
* Generate and organize ideas
* Form and apply concepts
* Design systematic plans of action

A 5-Step Problem-Solving Strategy

1. Specify the problem – a first step to solving a problem is to identify it as specifically as possible.  It involves evaluating the present state and determining how it differs from the goal state.
2. Analyze the problem – analyzing the problem involves learning as much as you can about it.  It may be necessary to look beyond the obvious, surface situation, to stretch your imagination and reach for more creative options.
	* seek other perspectives
	* be flexible in your analysis
	* consider various strands of impact
	* brainstorm about all possibilities and implications
	* research problems for which you lack complete information. Get help.
3. Formulate possible solutions – identify a wide range of possible solutions.
	* try to think of all possible solutions
	* be creative
	* consider similar problems and how you have solved them
4. Evaluate possible solutions – weigh the advantages and disadvantages of each solution.  Think through each solution and consider how, when, and where you could accomplish each.  Consider both immediate and long-term results.  Mapping your solutions can be helpful at this stage.
5. Choose a solution – consider 3 factors:
	* compatibility with your priorities
	* amount of risk
	* practicality

Keys to Problem Solving

* Think aloud – problem solving is a cognitive, mental process.  Thinking aloud or talking yourself through the steps of problem solving is useful.  Hearing yourself think can facilitate the process.
* Allow time for ideas to "gel" or consolidate.  If time permits, give yourself time for solutions to develop.  Distance from a problem can allow you to clear your mind and get a new perspective.
* Talk about the problem – describing the problem to someone else and talking about it can often make a problem become more clear and defined so that a new solution will surface.

Decision Making Strategies

Decision making is a process of identifying and evaluating choices.  We make numerous decisions every day and our decisions may range from routine, every-day types of decisions to those decisions which will have far reaching impacts.  The types of decisions we make are routine, impulsive, and reasoned.  Deciding what to eat for breakfast is a routine decision; deciding to do or buy something at the last minute is considered an impulsive decision; and choosing your college major is, hopefully, a reasoned decision.  College coursework often requires you to make the latter, or reasoned decisions.

Decision making has much in common with problem solving.  In problem solving you identify and evaluate solution paths; in decision making you make a similar discovery and evaluation of alternatives.  The crux of decision making, then, is the careful identification and evaluation of alternatives.  As you weigh alternatives, use the following suggestions:

* Consider the outcome each is likely to produce, in both the short term and the long term.
* Compare alternatives based on how easily you can accomplish each.
* Evaluate possible negative side effects each may produce.
* Consider the risk involved in each.
* Be creative, original; don't eliminate alternatives because you have not heard or used them before.

An important part of decision making is to predict both short-term and long-term outcomes for each alternative.  You may find that while an alternative seems most desirable at the present, it may pose problems or complications over a longer time period.

**Why is logic and critical thinking important**

**Critical thinking**, then, enables us to form sound beliefs and judgments, and in doing so, provides us with a basis for a 'rational and reasonable' emotional life. ... Too many people are taken advantage of because of their lack of **critical thinking**, **logic** and deductive **reasoning**

**Logic and Critical Thinking**

Critical thinking underlies reading, writing, speaking, and listening. These are the 4 basic elements of communication. Critical thinking also plays an important part in social change. Consider that the institutions in any society - courts, governments, schools, businesses - are the products of a certain way of thinking.

Any organization draws its life from certain assumptions about the way things should be done. Before the institution can change, those assumptions need to be loosened up or reinvented.
Critical thinking also helps us uncover bias and prejudice. This is a first step toward communicating with people of other races and cultures.

Critical thinking is a path to freedom from half-truths and deception. You have the right to question what you see, hear, and read. Acquiring this ability is one of the major goals of a liberal education.

Skilled students are thorough thinkers. They distinguish between opinion and fact. They ask powerful questions. They make detailed observations. They uncover assumptions and define their terms. They make assertions carefully, basing them on sound logic and solid evidence. Almost everything that we call knowledge is a result of these activities. This means that critical thinking and learning are intimately linked.