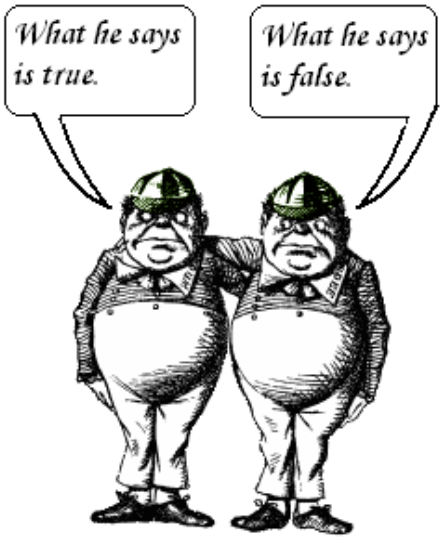
# UNIT 1
# REASON AND ARGUMENT

## 1.1 WHAT IS MODERN SYMBOLIC LOGIC?




## Logic.

### The Study & Evaluation of Reasoning & Argument

An argument probably seems ***logical*** if it look likes the conclusion must be true, based on what you are told is the case and what you already know to be true.

This is because logical deductive arguments are *truth-preserving*: if the premises are true, then the conclusions must be true. Studying logic can help you recognize which arguments are good ones, and thus improve your ability to distinguish truths or probable claims from ones that are poorly supported by the evidence.

## Symbolic.

### Use Tidy Symbols instead of Messy Words!

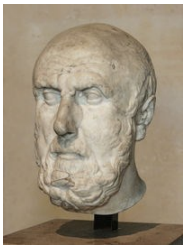
Using symbols instead of words lets you to focus on the logical form of the argument, so you can evaluate the reasoning of the argument without being distracted by other considerations, e.g. whether you agree with it, whether it's interesting or has true premises, etc.

Symbolization also can clear up ambiguities in meaning. Sometimes sentences, phrases and words can be interpreted different ways. Symbolization can force you to be more precise and consider exactly what is meant.

## Modern.

### After such people as ...

- **Aristotle** (384-322 BC). Aristotelian or *syllogistic* logic is the earliest system intended to classify and evaluate a wide range of arguments.

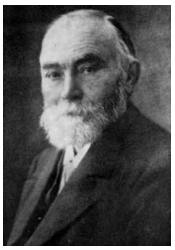


- **Chrysippus** (c.280-c.205 BC) developed a system of propositional logic that anticipates modern logic.

- **Gottfried Wilhelm Leibniz** (1646-1716), perhaps the father of symbolic logic, developed some of the first logical calculi.

George Boole (1815-1864) Boolean Logic

- **Gottlob Frege** (1848-1925) laid foundations for mathematical logic, further developed by Alfred North Whitehead (1861-1947) and Bertrand Russell (1872-1970) in their *Principia Mathematica*.



## 1.2 WHAT IS AN ARGUMENT?

In philosophy, logic, essays and many other contexts, arguments are bits of reasoning which present justifications for certain statements – a conclusion (a statement, opinion, thesis, etc.) supported by a justification or evidence.

An argument is a discourse in which some statements (the premises) are presented in support of another statement (the conclusion). In a valid deductive argument, the logical structure of that discourse is such that if the premises are true, then the conclusion must also be true. It is ***truth-preserving***! *


**Philosophy in Action:**
**A family engaged in a dialectical discourse for the purpose of determining truth and avoiding error.**

### Two parts of an Argument

**Premises or assumptions:** reasons or justification for the conclusion.

**Conclusion:** the statement, thesis or opinion being argued for.

Premises and conclusions are sentences, statements or propositions that can be true or false – they have *truth-value*. Arguments are generally composed of statements and usually don't include questions, commands and other sentences without truth-value.

'Premise' and 'conclusion' are relative terms. The same sentence can serve as a premise in one argument and as the conclusion in another.

### STRUCTURE OF AN ARGUMENT

This argument (center) is in standard form. The premises are stated above a horizontal line, and the conclusion is stated below. The argument is presented on the right in symbolic form.

| | | |
|---|---|---|
| Premise | If you will study then you will pass. | $S \rightarrow P$ |
| Premise | You will study. | S |
| Conclusion | Therefore, you will pass. | $\therefore P$ |

* This and other illustrations are the property of Gerald Grow, Professor of Journalism, Florida A&M University, and are here by his permission. http://www.longleaf.net/ggrow/CartoonPhil.html

## 1.3 IDENTIFYING THE ARGUMENT

### What to look for ... Signs of Reasoning or Inference Indicators

Some words or phrases at the beginning of sentences or clauses tell us that the sentence or clause is part of an argument. Some introduce premises (premise indicators) and others introduce conclusions (conclusion indicators).

***Premise Indicators*:** words or phrases showing that the sentence or clause is being given in support of a conclusion, as reason or justification.

| | | |
|---|---|---|
| because | as indicated by | being that |
| since | in the first place | inasmuch as |
| as | you can see from | may be inferred from |
| for | seeing that | can be deduced from |
| as shown by | for the reasons that | whereas |
| follows from | assuming that | on account of |

***Conclusion Indicators*:** words or phrases showing that the sentence or clause is the conclusion for which reasons or justification will be given.

| | | |
|---|---|---|
| therefore | accordingly | we can conclude that |
| thus | consequently | we can deduce that |
| so | as a result | proves that |
| hence | it follows that | shows that |
| then | for this reason we see that | indicates that |
| in conclusion | it can be inferred that | this makes it clear that |

**BE CAREFUL – THINK ABOUT HOW WORDS ARE BEING USED!**

Inference indicators are just words and words perform different functions in different contexts. In arguments, words like "because," "for," "thus," and "then" are often inference indicators. But, in explanations, descriptions, or even in arguments, they perform many other functions.

Consider the different ways that 'since' can be used:

> I realize that I haven't seen my cousin *since* we were kids.
>
> *Since* I was sick, I have to turn my essay in late.
>
> Clearly Sam will win *since* he has the support of the party.

In the third sentence 'since' acts as a premise indicator, introducing a reason for accepting the conclusion (that Sam will win). In the other sentences, 'since' is not a premise indicator. In the first, it introduces a clause that provides information; in the second sentence, it introduces an explanation.

## 1.4 PUTTING ARGUMENTS IN STANDARD FORM

When you are analyzing a piece of writing think about what the piece as a whole is trying to do. If you think that there is an argument, start by picking out the main conclusion (the conclusion indicators may help with that). Then, try to use the premise indicators to pick out the premises from other bits of writing (elaborations, illustrations, explanations, filler...) Think it through!

When you present it in standard form, only state the premises and conclusion (leave out inference indicators and other filler). State the premises first, putting them in logical order and starting each one on a new line. Then draw a line. After the line, state the conclusion. You may want to put a therefore sign (∴) before the conclusion.

**Three Easy Steps!**

State the premises.

Draw a line.

Then state the conclusion.

Premise 1
Premise 2
. . .
∴ Conclusion

**EXAMPLE**

**Extract the argument and rewrite it in standard form:**

> Either Professor Plum or the butler committed the murder. But, as everybody knows, no sane person would commit murder without some sort of a motive. So it has to be the Professor. After all, not only is the butler sane but he couldn't possibly have had a motive to kill him.

This argument has a clearly indicated conclusion, introduced by 'so'. "…it has to be the Professor." After that, it is just a matter of identifying the premises. The first and second sentences are both premises. The last sentence has a premise indicator, 'after all,' introducing "not only is the butler sane." And the last premise is that the butler did not have a motive to kill the victim.

Either Professor Plum committed the murder or the butler committed the murder.
No sane person commits murder without a motive.
The butler is sane.
The butler had no motive to commit the murder.
———————————————

∴ Professor Plum committed the murder.

## A few more to try:

In each of the following, extract the argument and rewrite it in standard form:

1.4 E 1

Some students will undoubtedly pass this course. Hence it is clear that some students in this class will do the exercises, since nobody passes who doesn't do at least some of the exercises.

1.4 E 2

Anybody who smokes is irrational. Any rational person knows that smoking can kill you, and engaging in an activity that can kill you is suicide! No rational person commits suicide.

1.4 E 3

If I study, I won't have much free time in which to party. On the other hand, if I don't study, my parents will cut off my funds. Without parental funds I'm not going to be going out much at all. So it looks like there won't be any partying for me.

1.4 E 4

At some point in the far distant past, the universe came into existence. But nothing can come from nothing; nothing can come into existence unless there is something to create it. Accordingly, there must be a God – a first creator, outside time. This follows from the fact that there must exist, outside the universe, some being that caused the universe to exist. Such a being must not have been created at all, unless there was some greater being that caused it that creator to exist, and hence this being would be the first creator.

1.4 E 5

Some people think that Ms. Peacock murdered Mr. Green, but that is wrong! It's evident that Ms. Peacock could not have murdered Mr. Green unless the murder occurred in the library. Yet, there were signs of struggle and drops of blood in the dining room, indicating that the murder occurred there and not in the library where the body was found.

1.4 E 6

I realized, as I lay in bed thinking, that we are not responsible for what we do. This is because either determinism or indeterminism must be true. If determinism is true, we cannot do other than we do. If so, we are but puppets on strings – our actions are not free. If indeterminism is true, then human actions are random, and hence not free. If our actions are not free, it must be conceded that we are not responsible for what we do.

1.4 E 7

author argues against this

From the way that people act, it would seem that some people desire power. It is true that all people desire what is good, and that nobody desires what is evil. So if people do desire power then it must be good. Yet, power leads to corruption and nobody can deny that corruption is evil. So power cannot be desired for it's own sake. Those who think they want power are mistaken, and rarely attain what they truly desire when they act to obtain power.

It would seem that

not supported

Nobody desires what is evil / all people desire what is good
If people do desire power then it must be good
Power leads to corruption
Corruption is evil

Power cannot be desired for its own sake

Some people desire power

Those who think they want power are mistaken.

## 1.5 SENTENCES AND TRUTH-VALUE

Many sentences (i.e. statements or propositions) are either ***true*** or ***false*** at some particular time and place. Such sentences have a ***truth-value***.

Not all sentences have truth-value. Questions, commands, exclamations, proposals and requests are neither true nor false, and have no truth-value.

> **True** sentences have truth-value **T.**
>
> **False** sentences have truth-value **F**.

These sentences have truth-value **T** (they are true)

> Ottawa is the capital of Canada.
>
> The volume of fixed mass of gas is proportional to its temperature at a fixed pressure.
>
> The last living passenger pigeon was named Martha.

These sentences have truth-value **F** (they are false)

> Toronto is the capital of Canada.
>
> The volume of a gas is inversely proportional to its temperature.
>
> A foreign oil company official wants to transfer millions of dollars into your bank account.

These sentences have no truth-value:

> Take me to your leader! (An order or imperative sentence)
>
> What planet are you from? (A question or interrogatory sentence)
>
> Gee willikers! (An exclamation or exclamatory sentence)

In the arguments that we will be looking at, each sentence of the argument must have a truth-value – it must be a statement. In real life, arguments often have imperatives for conclusions.

> If you don't do the homework you'll fail the course.
>
> You don't want to fail the course.
>
> _____
>
> Therefore, do the homework!

## 1.6 IS IT A GOOD ARGUMENT? VALIDITY AND SOUNDNESS

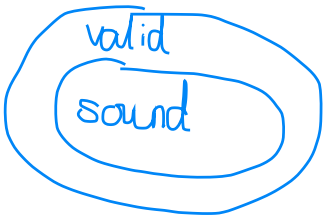
Different kinds of arguments can be 'good' in different ways. We will mainly deal with **deductive arguments** in which the conclusion can be conclusively deduced from the premises or evidence. The truth of the premises guarantees the truth of the conclusion.

> "I am the last and highest court of appeal in deduction."
> Sherlock Holmes in Sir Arthur Conan Doyle's *The Sign of Four*

**In evaluating DEDUCTIVE ARGUMENTS two things matter …**

**VALIDITY**: The conclusion must follow from the premises.

An argument is *deductively valid* if and only if the conclusion is true if all the premises are true. (Thus, it is valid if it is impossible for the premises to be true and the conclusion false.) An argument is *invalid* if and only if it is not valid.




**SOUNDNESS**: The premises are true *and* the argument is valid.

An argument is *sound* if and only if it is valid and all its premise are true.

Deductively sound

Since questions of soundness are relevant only to valid arguments, first consider whether the argument is valid (does the truth of the premises logically guarantee the truth of the conclusion?), then, if it is deductively valid, check out the truth of the premises (soundness).

When considering whether an argument is valid, try to imagine a state of affairs that makes all the premises true and the conclusion false. If you *can* do it, the argument is invalid. If you *can't* then it may be a valid argument. It's valid if it is impossible for the conclusion to be false when the premises are true.

> Either Professor Plum committed the murder or the butler did.
> No sane person commits murder without a motive.
> The butler is sane.
> The butler had no motive the murder.
> _____
>
> Professor Plum committed the murder.

This argument is valid – if the premises are true the conclusion must follow. Since the butler had no motive and the butler was sane then the butler didn't do it; for no sane person commits murder without a motive. If the butler didn't do it, the professor did – since it was one or the other if the first premise is true.

More formal methods of determining validity that we will be learning in this course are methods of truth-value analysis and derivations.

Techniques of logic will allow us to evaluate validity; however, they will not let us evaluate soundness. For that, you need knowledge of matters of fact.

## IS IT VALID? IS IT SOUND?

Valid deductive arguments are truth preserving because the logical form of the argument is such that conclusion must follow from the premises. ***If*** the premises are true then it is impossible for the conclusion to be false. A valid argument is a good argument, but this does not mean that it has to have true premises – that it is sound!

Invalid deductive arguments are poor arguments since the logical form of the argument is not such that the conclusion follows from the premises. The premises could all be true and yet the conclusion could still be wrong. The premises don't support the conclusion.

It's useful to be able to identify valid arguments and we will be learning techniques to do this. All good deductive arguments are valid, but not all valid deductive arguments are good one.

valid but not good.

### Three VALID argument forms that don't usually produce good arguments:

1. If the conclusion is a tautology (can't be false), it's always true. No matter what the premises are, it is not possible for the premises to be true and the conclusion false … it's valid!

   Some students study hard.

   _____

   It will rain today or it won't.

2. When the premises form an inconsistent set or include a logical falsehood (which is inconsistent with itself), the premises cannot all be true. So it doesn't matter what the conclusion is, it is not possible for the premises to be true and the conclusion is false ... so it's valid!

   I like all vegetables, but I don't like parsnips.

   _____

   The moon is made of green cheese.

3. When the conclusion is also a premise then it is impossible for all the premises to be true and the conclusion false. This "fallacy of reasoning" is called "begging the question" or "circular reasoning". It's a lousy argument ... but it's valid!

   Snow is white.

   _____

   Snow is white.

REMEMBER… Even though these may not seem like good arguments to you, they are deductively valid! It is impossible for the premise(s) to be true and the conclusion false. The truth of the conclusion is logically guaranteed by the truth of the premises.

**EXAMPLE**

**Is the following argument valid? Can you determine if it is sound?**

Nobody passes this course who doesn't do some of the exercises.
Some students will pass this course.

---

∴ Some students in this course will do some of the exercises.

This argument is valid. Suppose that the conclusion is false – nobody in the class does the exercises. If the first premise is true (nobody passes who doesn't do the exercises), then nobody passes since nobody does the exercises. Thus the second premise is false. If the conclusion is false it is impossible for both of the premises to be true – the argument is valid!

Since the argument is valid, we can now determine whether or not it is sound by checking whether the premises are true.

In this case, we can't fully determine whether it is sound … since we don't *really* know truth-value of the premises; however, it is likely that they are both true. Thus the argument is (as far as we can tell) sound.

**A few more:** Are the following arguments valid or invalid? Can you determine if they are sound?

1.6 E 1

All students love learning
Everyone who loves learning is responsible.
Any student who misses a class is not responsible.

Valid but not sound

---

∴ No student will miss a class.

1.6 E 2

Hounds are dogs.
Snoopy is a dog.

Invalid

---

∴ Snoopy is a hound.

1.6 E 3

Toronto is either farther south than Seattle or farther north than Ottawa.
If Toronto is farther north than Ottawa then Ottawa is not the capital of Canada.
Ottawa is the capital of Canada.

---

Valid and sound

∴ Toronto is farther south than Seattle.

1.6 E 4

Dark chocolate contains antioxidants.
Everything containing antioxidants is good for you.

---

Valid not sound

∴ Dark chocolate is good for you.

1.6 E 5

If today is Tuesday then we do not have logic class.
Today is not Tuesday.
_____ Invalid
∴ Therefore we do have logic class.

1.6 E 6

Toronto is the capital of Ontario.
Ottawa is the capital of Canada. ~~Valid but unsound~~
_____
∴ At least two capital cities are in Ontario.

If common knowledge that Toronto and Ottawa are cities in Ontario is treated as implicit premise. VALID and SOUND.

1.6 E 7

If it is possible to know that God exists, then it is possible to know that angels exist.
It is not possible to know that angels exist.
_____ Valid (contrapositive)
∴ It is not possible to know that God exists. ~~Invalid~~

1.6 E 8

Tomatoes are fruits.
Tomatoes are vegetables. ~~Invalid~~
_____ Valid (conclusion is a tautology)
∴ Either a tomato is an animal or it isn't.

1.6 E 9

Only the good die young.
Kurt Cobain was good.
_____ The first premise = if one dies young, he is good. ! = if one is good, he dies young. INVALID
∴ Kurt Cobain died young. ~~Valid but unsound~~

1.6 E 10

Only the good die young. Invalid
Courtney Love is still alive.
_____ ~~Valid but unsound~~
∴ Courtney Love is not good.

1.6 E 11

All philosophers are professors.
All philosophers are logicians. Invalid
_____
∴ All logicians are professors.

1.6 E 12

Power corrupts.
Knowledge is power. ~~Valid but unsound~~
_____
∴ Knowledge corrupts.

The word power here is ambiguous with different meanings. If they have the same meaning then valid.

1.6 E 13

Nobody who received the H1N1 vaccine got the Swine Flu.
George didn't get the Swine Flu.

Invalid

∴ George got the H1N1 vaccine.

1.6 E 14

On the whole, students in PHL 245 work harder than students in PHL 102.

Invalid

∴ Samantha, in PHL 245, works harder than Max, in PHL 102.

1.6 E 15

Hotel key cards are encoded with your personal and credit card information.
Items with your personal and credit card information should be destroyed when you no longer need them in order to prevent identity fraud.

Valid but unsound

Therefore, hotel key cards should be destroyed when you no longer need them.

1.6 E 16

Every moment in time is followed by another moment in time.
Every moment in time is preceded by another moment in time.
An infinite series is one that has no beginning or end.

Valid but unsound

∴ Time is an infinite series of moments.

1.6 E 17

Atoms are colourless.
Air is made up of atoms.

Valid but unsound

Fallacy of composition: a property applies to parts of a thing != applies to whole

∴ Air is colourless.

1.6 E 18

If God does not exist then there is no right or wrong.
God exists.

Invalid

Valid but unsound

∴ There is right and wrong.

1.6 E 19

Everything that is actual is possible.
Human beings are actual.

Valid

∴ Human beings are possible.

1.6 E 20

Tom is a barber who shaves all and only those barbers who do not shave themselves.

∴ Tom has a pet dog.

Valid

## 1.7 INDUCTIVE ARGUMENTS

Although this text is about deductive arguments, not all arguments are deductive. Other main types of arguments include inductive arguments, abductive arguments (arguments to the best explanation) and arguments from analogy.

An inductive argument is an argument based on reasoning from observed cases to unobserved cases, on the assumption of some kind of continued uniformity or regularity. Inductive arguments often involve an empirical generalization, reasoning from a set of observed or experienced cases to a general statement about all relevantly similar cases, or to a further similar particular case.

The sun rose this morning.
The sun rose yesterday morning.
The sun rose the day before yesterday in the morning.
… The sun rose in the morning 14000 days ago.

_____
The sun will rise every morning.
Or… the sun will rise tomorrow morning.

This argument is strong, but not deductively valid!
The truth of the premises does not logically guarantee the truth of the conclusion.

**Is it invalid?**

That doesn't seem right. It is a very good argument. It is overwhelmingly probable that the sun will rise tomorrow morning. This is the kind of regularity we depend on in the world. It is why we believe that letting go of heavy objects results in their falling, that smoke indicates fire, smoking is bad for your health and that having too much to drink leaves us feeling lousy the next day.

**How do we evaluate such arguments?**

… on the basis of *inductive strength*. Based on the evidence or premises, how probable is the conclusion? The more probable or likely the conclusion, the higher the inductive strength. (It's statistics.)

**Is it necessarily truth-preserving?**

Not always. You can't get certainty from an inductive argument (although it's often certain enough to act on.) Indeed, most of what we take to be true is supported with this sort of empirical, inductive argument – it isn't certain, but we accept it as true at least until there is evidence to the contrary.

Some strong (or apparently strong) inductive arguments lead to false conclusions. As we have seen, over and over, many of the 'facts' supported by the statistical analyses of scientific studies and polls that we read about in the paper turn out to be false. (Is that a fact?)

> "There are three types of lies: lies, damn lies and statistics."
>
> Benjamin Disraeli