In order to make an **argument**, you have to make a claim (the **conclusion**) and you have to give some evidence for the claim (the **premises**).

> "Bush tried to justify the war with Iraq by citing the danger of WMDs. But now we've found out that there were no WMDs. So, either Bush lied, or he got bad intelligence. If Bush got bad intelligence, then he made some really terrible appointments to top posts in the CIA. Therefore, either Bush is a liar, or he's incompetent."

Two components of an argument:

1. Conclusion
2. Premises

- The components of arguments are all **statements** — something that can be true or false. ("bivalence") Examples:
  - "The ten millionth digit in the decimal expansion of π is 2."
  - "The helium atom has a single electron."
- Not all sentences are statements. For example:
  - "Let's watch Hasselhoff's Berlin wall video again!"

Deductive Arguments

- In a **deductive** argument, the intention is to show that the conclusion follows from the premises with absolute certainty.

  - Conclusion **follows from** the premises.
  - Conclusion **is entailed by** the premises.
  - Conclusion is a **logical consequence** of the premises.
  - The premises **imply** the conclusion.
  - The premises **justify** the conclusion.

- Deductive arguments occur in the wild, and can be spotted in mathematics and computer science departments, and occasionally in some philosophy departments.

Non-deductive arguments

1. My friend Adam took PHI 201, and he got hired by Goldman-Sachs.

2. The best student in logic last year is now the international table-tennis champion.

3. It's rumored that Brooke Shields dated a student who was taking PHI 201.

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4. Students who take PHI 201 live happy and successful lives.

- **Inductive arguments:** (Occur frequently in the empirical sciences) The premises state that a certain fact holds in specific cases, and the conclusion states that the fact holds in general.

Aims of the Science of Logic

- Uncover the general principles that distinguish between **good** and **bad** deductive arguments.

- Uncover the basic **rules of thought** that any rational human being should follow.

- Critically examine the laws of logic.

- Most academic fields of study are **descriptive**: They tell us how nature and people do, in fact, behave. (e.g., chemistry, biology, psychology, anthropology, physics)

- Philosophy (and specifically logic) aspires to be **prescriptive**, or **normative**.

  - In ethics, we study how people **ought to** behave, not how they do in fact behave.

  - In logic, we study how people **ought** to think, not how they do in fact think.

Good and Bad Arguments

1. A majority of Americans believe that it is wrong to cheat on your taxes.

2. If the majority of Americans believe it, then it must be true.

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3. It is wrong to cheat on your taxes.

1. It is morally wrong to kill an innocent human being.

2. A fetus is an innocent human being.

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3. It is morally wrong to kill a fetus.

Good and Bad Arguments

1. If God does not exist, then life is meaningless.
2. God exists.

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3. Life is meaningful.

1. Only people born in the US are eligible to become President.
2. John Edwards was born in the US.

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3. John Edwards is eligible to become President.

We will replace the vague word "good" with a precisely defined word: **sound**. A sound argument has two features.

1. It uses good evidence — i.e., its premises are all true.

2. The conclusion follows logically from the premises.

Definition: An argument is **valid** if its conclusion follows logically from its premises — if it is impossible for the premises all to be true, but for the conclusion to be false.
Nota Bene: A valid argument need not have true premises, nor a true conclusion — validity requires only that **if** the premises were true **then** the conclusion would also be true.

Mini Quiz

1. If an argument has true premises and true conclusion is it sound?

2. If an argument has a false conclusion is it invalid?

Premises	Conclusion	Validity
True	True	?
True	False	Invalid
False	True	?
False	False	?

Demonstrating Invalidity

If God doesn't exist then there aren't any moral rules.

<u>God exists.</u>

There are moral rules.

If Princeton isn't in the US then it isn't in CA. **True**

<u>Princeton is in the US.</u> **True**

Princeton is in CA. **False**

Formal Logic

- **Starting Assumption of *Formal* Logic:** Whether or not an argument is valid depends only on its **form**; its **content** is irrelevant to validity. (Logic is "blind to the actual facts.")

  > "Logic contains no matter at all, only form of thought."
  > (Immanuel Kant)

- If two arguments have the same form, either they are both valid, or they are both invalid.

- But arguments don't wear their form on their sleeve.

1. Either God exists or everything is permitted.	1. Either G or E
2. God does not exist.	2. not-G
3. Everything is permitted.	3. E

1. If God doesn't exist then there aren't any moral rules.	1. If not-G then not-M
2. God exists.	2. G
3. There are moral rules.	3. M

1. If PU is not in the US then it isn't in CA.	1. If not-U then not-C
2. PU is in the US.	2. U
3. PU is in California.	3. C

Argument Forms

- An argument $\mathcal{A}$ is an **instance** of the form $\mathcal{F}$ just in case $\mathcal{A}$ results from a uniform replacement of words/sentences for blanks in $\mathcal{F}$.

- A **counterexample** to an argument $\mathcal{A}$ is a an argument $\mathcal{A}'$ that has the same form as $\mathcal{A}$, and where $\mathcal{A}'$ has (actually) true premises and a false conclusion.

- An argument $\mathcal{A}$ is **valid** just in case there is no counterexample to $\mathcal{A}$.

- For thought: Can we ever know for sure that an argument is valid? How can we be sure that someone won't find a counterexample?