Basic Concepts and Skills
Critical Thinking tests rationales, i.e., reasons connected to conclusions by justifying or explaining principles

Why do CT?

**Answer:** Opinions without logical or evidential support are worthless.
Top 10 Critical Thinking Skills

1. How to define a good argument
2. How to recognize an argument
3. How to identify premises and conclusions
4. How to distinguish an argument from an explanation
5. How to distinguish deduction from induction
6. How to understand logical implication
7. How to tell whether an argument form is valid
8. How to show that a deductive argument is invalid
9. How to tell whether an argument is good
10. How to prove that any argument is bad
Section 1.1: Identify arguments, premises and conclusions
An argument is a collection of claims intended to establish the truth of a specific claim.
1. How to define a good argument

• “An argument is GOOD if and only if it is either SOUND or COGENT.”

• Thus, an argument is good if and only if it is either deductively valid plus all of its premises are true, i.e., SOUND, or, it is inductively strong plus all of its premises are true, i.e., COGENT.

• an argument is VALID if and only if it is impossible for the conclusion to be false when all of its assumptions are true

• an argument is STRONG if and only if is improbable that the conclusion is false when all of its assumptions are true

• Understand, memorize, apply this definition - it will help you every day …
How the text relates to the skills

Section 1.1: Identify arguments, premises and conclusions
Section 1.2: Recognizing arguments and explanations
Section 1.3: Discern deductive from inductive arguments
Section 1.4: Validity, soundness, strength and cogency
Section 1.5: Argument forms, proving invalidity

- You should complete all exercises assigned from each of these sections according to the syllabus schedule.
What undermines critical thinking?

PRE-EXISTING CONDITIONS

Stupid

Obnoxious

Devious

Weird

(Anonymous)
There are only two kinds of good argument:

- **Sound argument** = **Valid argument** + **All true premises**
- **Cogent argument** = **Strong argument** + **All true premises**
Overview

Statements
- True
- False

Groups of statements
- Arguments
  - Deductive
  - Inductive
  - Nonarguments

Deductive arguments
- Valid
- Invalid (all are unsound)

Inductive arguments
- Strong
- Weak (all are uncogent)

Sound
- Unsound

Cogent
- Uncogent
2. How to recognize an argument

- arguments present rational reasons for belief (rational = reasonable, non-emotional, non-personal, non-historical)

- argument ≠ disagreement

- argument = proof, some arguments are good and some are bad, but all arguments must cite evidence

- does the set of claims aim to justify/prove a conclusion about a specific issue (the main subject of controversy)? if not, it is a non-argument, e.g., these are not arguments: an exposition, a report, an illustration, an explanation, a conditional statement, or any statement of belief …

- the conclusion is the one precise claim which all other claims (premises) support – there can only be one conclusion

- premises (evidence) must present reasons which justify accepting the conclusion
3. How to identify premises and conclusions

- **look for indicator words** – *because, since, for, therefore, so, given that, we may infer that, it follows that* …

- **check support relations** – which claim needs the most support, which claims seem to be supporting another

- **eliminate alternatives** – when you can’t distinguish premises from the conclusion, just choose one claim at a time as the conclusion and decide whether the rest support it, if not, keep reconstructing these until you get the most charitable reconstruction

- **reconstruct using a charitable interpretation** – presume that other people, like yourself, are lovers of the good and believers of truths, so when more than one interpretation of an argument is possible, interpret the argument so that the premises provide the strongest support for the conclusion
3. How to identify premises and conclusions - Examples

- “Students should complete every online quiz in the course. Each student loses 10 points or five percent of the total points available in the course for every online quiz that they do not complete.”

- “Students cannot re-take or make-up any quiz, absolutely, no exceptions. There isn't time for this and there are plenty of points available so that one can miss a quiz and still do well in the course.”
3. How to identify premises and conclusions - Examples

- “Students should complete every online quiz in the course. Each student loses 10 points or five percent of the total points available in the course for every online quiz that they do not complete.”

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Section 1.2: Recognizing arguments and explanations
4. How to distinguish an argument from an explanation

- what are the reasons doing? – use the diagram –
- notice arguments and explanations both have conclusions and reasons ... but only explanations describe what causes a conclusion to be true
- justifying ≠ explaining
- if reasons are justifying belief in the conclusion, then it's an argument
- if reasons are specifying cause(s) of truth of the conclusion, then it's an explanation
Arguments vs. Explanations

**Argument**
- Premises (Accepted facts)
- Claimed to prove
- Conclusion

**Explanation**
- Explanans
- Claimed to shed light on
- Explanandum (Accepted fact)
Examples of Explanations

The sky appears blue from the earth’s surface because light rays from the sun are scattered by particles in the atmosphere.

Golf balls have a dimpled surface because the dimples reduce air drag, causing the ball to travel farther.

Naval oranges are called by that name because they have a growth that resembles a human naval on the end opposite the stem.
An **argument** is a rationale designed to convince us of the truth of a conclusion by giving reasons which are evidence for accepting that conclusion.

An **explanation** is a rationale designed to help us understand a fact or event by giving reasons specifying its causes.

**Rationale**

[Diagram showing the flow of reasons to principle to conclusion]

**Argument**

[Diagram showing evidence to opinion by principle]

establishes knowledge by answering questions:
- "How do you know C?"
- "Why should one believe C?"

**Explanation**

[Diagram showing cause to fact by principle]

produces understanding by answering questions:
- "Why is C so?"
- "How did C come to be true?"
Section 1.3: Discern deductive from inductive arguments
5. How to distinguish deduction from induction

- **reconstruct using a charitable interpretation** - when more than one interpretation of an argument is possible, interpret the argument so that the premises provide the strongest support for the conclusion

- if the conclusion seems necessary, then it is deduction

- if the conclusion seems probable, then it is induction

- conclusions of inductive arguments assert more than what is contained in the premises, but conclusions of deductive arguments do not - the conclusion of a deductive argument is not supposed to contain more information than the premises

- if the conclusion of an argument could be false when all of the premises are true, then the argument is not deductive
Deductive vs. Inductive reasoning

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.
<table>
<thead>
<tr>
<th></th>
<th>Valid</th>
<th>Invalid</th>
</tr>
</thead>
<tbody>
<tr>
<td>True premises</td>
<td>All wines are beverages. Chardonnay is a wine. Therefore, chardonnay is a beverage. [sound]</td>
<td>All wines are beverages. Chardonnay is a beverage. Therefore, chardonnay is a wine. [unsound]</td>
</tr>
<tr>
<td>True conclusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>False premises</td>
<td>None exist.</td>
<td>All wines are beverages. Ginger ale is a beverage. Therefore, ginger ale is a wine. [unsound]</td>
</tr>
<tr>
<td>False conclusion</td>
<td>All wines are soft drinks. Ginger ale is a wine. Therefore, ginger ale is a soft drink. [unsound]</td>
<td>All wines are whiskeys. Chardonnay is a whiskey. Therefore, chardonnay is a wine. [unsound]</td>
</tr>
<tr>
<td>False premises</td>
<td>All wines are whiskeys. Ginger ale is a wine. Therefore, ginger ale is a whiskey. [unsound]</td>
<td>All wines are whiskeys. Ginger ale is a whiskey. Therefore, ginger ale is a wine. [unsound]</td>
</tr>
<tr>
<td>False conclusion</td>
<td></td>
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<tr>
<td>Strong</td>
<td>Weak</td>
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</tr>
<tr>
<td><strong>True premise</strong></td>
<td>A few U.S. presidents were lawyers.</td>
<td></td>
</tr>
<tr>
<td><strong>Probably true conclusion</strong></td>
<td>Therefore, probably the next U.S. president will be older than 40.</td>
<td></td>
</tr>
<tr>
<td>All previous U.S. presidents were older than 40.</td>
<td>[uncogent]</td>
<td></td>
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<tr>
<td></td>
<td>[cogent]</td>
<td></td>
</tr>
<tr>
<td><strong>True premise</strong></td>
<td>A few U.S. presidents were unmarried.</td>
<td></td>
</tr>
<tr>
<td><strong>Probably false conclusion</strong></td>
<td>Therefore, probably the next U.S. president will be unmarried.</td>
<td></td>
</tr>
<tr>
<td>None exist</td>
<td>[uncogent]</td>
<td></td>
</tr>
<tr>
<td><strong>False premise</strong></td>
<td>A few U.S. presidents were dentists.</td>
<td></td>
</tr>
<tr>
<td><strong>Probably true conclusion</strong></td>
<td>Therefore, probably the next U.S. president will be a TV debater.</td>
<td></td>
</tr>
<tr>
<td>All previous U.S. presidents were TV debaters.</td>
<td>[uncogent]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[cogent]</td>
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<td>A few U.S. presidents were dentists.</td>
<td></td>
</tr>
<tr>
<td><strong>Probably false conclusion</strong></td>
<td>Therefore, probably the next U.S. president will die in office.</td>
<td></td>
</tr>
<tr>
<td>All previous U.S. presidents died in office.</td>
<td>[uncogent]</td>
<td></td>
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</tbody>
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6. How to understand (and test) logical implication

- implication = conditional = hypothetical

- To say that "P implies Q" means that whenever P is true Q is also true.

- P implies Q = if P then Q = all P are Q = the only P are Q = P only if Q

- “P does not imply Q” when P is true and Q is not.

- “P only if Q” is the best way to read “if P then Q” or “P implies Q” statements. Why? “P only if Q” is logically equivalent to “P implies Q” and makes our brains see two things: (1) that P is only sufficient for Q – it is not necessary, and (2) that Q is necessary for P – P can’t be true without Q also being true.
Every conditional has two components – the antecedent condition implies the consequent condition.
How to test logical implications

- implication = conditional = hypothetical
- Conditionals are false only when their antecedents are true and their consequent is false. We test a conditional for truth by thinking of a counter-example to it which shows that it is false.
- The implication fails when P does not imply Q, i.e., when P is true and Q is not.

Suppose someone says:

- “If you love me, then you buy me a diamond ring.”

When is this clearly false?

- Answer: Whenever the antecedent is true and the consequent is false. That is, in any case where it is plausible that one both loves someone and one does not buy that someone a diamond ring.
Section 1.4: Validity, soundness, strength and cogency
7. How to tell whether an argument form is valid

• Ask: Can the conclusion be false when all assumptions true?

• an argument is VALID if and only if it is impossible for the conclusion to be false when all of its assumptions are true

• Is the form same as known valid forms? – examples –

• consider counter-examples to the form to test it …

• an argument is SOUND if and only if it is valid plus all assumptions are true

• valid ≠ true, valid ≠ good, only arguments can be valid
A syllogism, in general, is an argument consisting of exactly two premises and one conclusion. Categorical syllogisms will be treated in greater depth in Chapter 5, but for now we will say that a **categorical syllogism** is a syllogism in which each statement begins with one of the words “all,” “no,” or “some.” Example:

- All ancient forests are sources of wonder.
- Some ancient forests are targets of the timber industry.
- Therefore, some sources of wonder are targets of the timber industry.

Arguments such as these are nearly always best treated as deductive.

A **hypothetical syllogism** is a syllogism having a conditional (“if ... then”) statement for one or both of its premises. Examples:

- If estate taxes are abolished, then wealth will accumulate disproportionately.
- If wealth accumulates disproportionately, then democracy will be threatened.
- Therefore, if estate taxes are abolished, then democracy will be threatened.

- If Fox News is a propaganda machine, then it misleads its viewers.
- Fox News is a propaganda machine.
- Therefore, Fox News misleads its viewers.

Later in this book, the first of these arguments will be given the more specific name of pure hypothetical syllogism because it is composed exclusively of conditional (hypothetical) statements. The second argument is called a mixed hypothetical syllogism because only one of its component statements is a conditional. Later in this book, the second argument will be given the more specific Latin name *modus ponens*.

A **disjunctive syllogism** is a syllogism having a disjunctive (“either ... or ...”) statement. Example:

- Either global warming will be arrested, or hurricanes will become more intense.
- Global warming will not be arrested.
- Therefore, hurricanes will become more intense.
Section 1.5: Argument forms, proving invalidity
8. How to show that a deductive argument is invalid

- show it is NOT valid by showing how conclusion can be true when all assumptions false
- reveal the pattern, then consider counter-examples to the logical form itself …
- construct a substitution instance (using all true premises and a false conclusion) with the counter-example method to test whether a form is valid or invalid
- **How to do this**: (1) STATE the argument. (2) EXTRACT its logical form. (3) SUBSTITUTE terms. (4) EVALUATE - does your example show that the conclusion could be false when all of the premises are true? If yes, the argument is invalid. If no, try again, but at some point you have to consider that it might be valid, or you are unable to think of a counter-example but it really is invalid.
- every substitution instance of a valid form is a valid argument but it is not the case that every substitution instance of an invalid form is an invalid argument - this is rare
One way to show that an argument form is invalid
9. How to tell whether an argument is good

- “An argument is GOOD if and only if it is either SOUND or COGENT.”

- restate it using a charitable interpretation

- reconstruct/check its form (logic check)

- clarify/check its assumptions (fact check)

- the argument is good only if its reconstruction passes logic check and fact check

- only assumptions are true or false, arguments are not true or false

- When evaluating an argument with unstated premises, find a claim that would make the argument valid or strong and evaluate the argument as if this claim had been included.
10. How to prove that any argument is bad

- **Show that its form is illogical**, because it is either not truth-preserving (deductively valid) or not truth-generating (inductively strong). Call this the form test or the logic check.

- **Or, show that its content** - at least one of its assumptions - **is incredible**, because it is either demonstrably false or improbable.

- **Good arguments, by comparison, are less vulnerable to these problems than are bad arguments.** Call this the fact check or reality check. This is a test of soundness for deductive arguments, and a test of cogency for inductive arguments.

- **An argument is bad, i.e., fails to justify its conclusion, if and only if it fails either the logic check or the reality check.**

- **In other words, an argument is bad if it is neither sound nor cogent.** Such arguments fail either the logic check or the reality check.
There are only two kinds of good argument!

- **Sound argument** = **Valid argument** + **All true premises**

- **Cogent argument** = **Strong argument** + **All true premises**
So, a BAD argument is one which is not sound and not cogent.
BAD = not GOOD

“A lot of good arguments are spoiled by some fool who knows what he is talking about.”

- Miguel de Unamuno
Summary: Two ways arguments go bad

1. An argument is BAD if it fails the logic check, that is, if it is possible or probable that its conclusion is false when all of its premises are true.
   - “Jane got straight As in high-school, so Jane will probably get straight As in college.”

OR

2. An argument is BAD if if fails the reality check, that is, if at least one of its assumptions is false or dubious.
   - “Jack completed all of the quizzes, because Jack passed the course.”
Which are the BAD arguments?

- Statements
  - True
  - False

- Groups of statements
  - Arguments
    - Deductive
    - Inductive
    - Nonarguments
  - Nonarguments

- Deductive arguments
  - Valid
    - Sound
    - Unsound
    - Invalid (all are unsound)
  - Invalid (all are unsound)

- Inductive arguments
  - Strong
    - Cogent
    - Uncogent
  - Weak (all are uncogent)