Outline

Logistics
Logic in Writing
Pitch Peer Review
Logistics

http://www.ics.uci.edu/~dramanan/teaching/ics139w_spring14/schedule.html

• Grades for statement, pitch presentations out
• I encourage folks to come to office-hours/discussion for additional feedback
• Please bring draft with TA comments
• You may submit a revised statement to “statement_revision” on EEE dropbox by next Tuesday (5/27/14)
Logic in writing

In the pitch assignment, you are trying to convince someone to implement your change.

We convince people by making logical arguments.
Formal logic

Studied in linguistics, artificial intelligence, philosophy

Note: the following discussion is likely overkill for your assignments, but it's interesting nonetheless....
Formal logic

Propositional logic

$P =$ proposition that “it is raining outside”

$P =$ true (T) or false (F), depending upon if its actually raining outside
Formal logic

Propositional logic

P = proposition that “it is raining outside”

P = true (T) or false (F), depending upon if its actually raining outside

Given a bunch of propositions (P,Q,R,...) we want to know what can be logically deduced

Q = proposition that “it rained yesterday”

...
Propositional calculus

A set of mathematical rules for computing deductions

\[
\begin{align*}
P \\
\neg P \\
P \land Q \\
P \lor Q \\
P \rightarrow Q
\end{align*}
\]
Truth tables

\[
\begin{array}{ccc}
 p & q & p \rightarrow q \\
 T & T & T \\
 T & F & F \\
 F & T & T \\
 F & F & F \\
\end{array}
\]

\[p = \text{"it rained yesterday"}\]
\[q = \text{"its raining outside"}\]

\[p \rightarrow q \text{ "if it rained yesterday, its raining outside"}\]
### Truth tables

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>$p$</td>
<td>$q$</td>
<td>$p \rightarrow q$</td>
</tr>
<tr>
<td>T</td>
<td>T</td>
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<tr>
<td>F</td>
<td>F</td>
<td>T</td>
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</tbody>
</table>
Example

Premise: If I am clever then I will pass,
If I will pass then I am clever,
Either I am clever or I will pass

Conclusion: i am clever and i will pass

Does conclusion follow from the premise?

[On board]
Truth table

\[
\begin{align*}
A & = \{ p \Rightarrow q, \\
& \quad q \Rightarrow p, \\
& \quad p \lor q \}\ \\
C & = p \land q
\end{align*}
\]

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>p =&gt; q</th>
<th>q =&gt; p</th>
<th>p</th>
<th>q</th>
<th>A</th>
<th>p &amp; q</th>
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<tbody>
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</table>

Conclusions follow from premise
Example 2

Premise: If I am clever then I will pass, Either I am clever or I will pass

Conclusion: i am clever and i will pass

What about now?
Truth table

\[ A = \{ p \rightarrow q, \quad p \land q \} \]
\[ C = p \land q \]

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>( p \rightarrow q )</th>
<th>( p \land q )</th>
<th>A</th>
<th>( p \land q )</th>
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<tbody>
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<td>T</td>
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</tbody>
</table>

Conclusion does not follow from premise
## Logics in general

<table>
<thead>
<tr>
<th>Language</th>
<th>Ontological commitment* (what it talks about)</th>
<th>Epistemological commitment* (what it says about truth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prop. logic</td>
<td>facts</td>
<td>true/false/unknown</td>
</tr>
<tr>
<td>First-order logic</td>
<td>facts, objects, relations</td>
<td>true/false/unknown</td>
</tr>
<tr>
<td>Temporal logic</td>
<td>facts, objects, relations, times</td>
<td>true/false/unknown</td>
</tr>
<tr>
<td>Probability theory</td>
<td>facts</td>
<td>degree of belief</td>
</tr>
<tr>
<td>Fuzzy logic</td>
<td>facts + degree of truth</td>
<td>known interval value</td>
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</tbody>
</table>

*To philosophers, these mean roughly the following:

ontological commitment ≈ our assumptions about what things exist

epistemological commitment ≈ what we can know about those things
First-order logic

Augment propositional statements with quantifiers
Add relational statements

Premise:
- all fruits can_be_eaten
- is_kind_of(apple,fruit)

Conclusion:
- apples can_be_eaten
Quantifiers

\( \forall x \in D. \ P(x) \)

“For all \( x \) in \( D \), \( P(x) \) is true”

\( \exists x \in D. \ P(x) \)

“There exists an \( x \) in \( D \) such that \( P(x) \) is true”

We usually drop the “in \( D \)” part
Examples

loves(x,y) corresponds to the “x loves y” relation

“Everyone in the world is loved by at least one person”
Examples

loves(x,y) corresponds to the “x loves y” relation

“Everyone in the world is loved by at least one person”

∀y ∃x Loves(x, y)
Examples

loves(x, y) corresponds to the “x loves y” relation

“Everyone in the world is loved by at least one person”

\[ \forall y \ \exists x \ Loves(x, y) \]

“There is a person who loves everyone in the world”
Examples

loves(x, y) corresponds to the “x loves y” relation

“Everyone in the world is loved by at least one person”
\[ \forall y \exists x \ \text{Loves}(x, y) \]

“There is a person who loves everyone in the world”
\[ \exists x \ \forall y \ \text{Loves}(x, y) \]

Order of quantifiers matters
Examples

\[
\begin{align*}
&\text{at}(x,\text{UCI}) \\
&\text{smart}(x) \\
\end{align*}
\]

“Everyone at UCI is smart”

“Someone at UCI is smart”
Examples

\[ \text{at}(x, \text{UCI}) \]
\[ \text{smart}(x) \]

“Everyone at UCI is smart”
\[ \forall x, \quad \text{At}(x, \text{UCI}) \rightarrow \text{Smart}(x) \]

“Someone at UCI is smart”
\[ \exists x, \quad \text{At}(x, \text{UCI}) \land \text{Smart}(x) \]

what about?
\[ \exists x, \quad \text{At}(x, \text{UCI}) \rightarrow \text{Smart}(x) \]

“There exists a person, such that if they went to UCI, they would be smart”: True if there exists a person who didn’t go to UCI!
Using logic in writing

• lay out each premise clearly
• provide evidence for each premise
• draw a clear connection to the conclusion.

Say a writer was crafting an editorial to argue against using taxpayer dollars for the construction of a new stadium in the town of Mill Creek. The author's logic may look like this:

Premise 1: Projects funded by taxpayer dollars should benefit a majority of the public.
Premise 2: The proposed stadium construction benefits very few members of the public.
Conclusion: Therefore, the stadium construction should not be funded by taxpayer dollars.
Logic in writing

**Premise:** Proposition used as evidence in an argument.

**Conclusion:** Logical result of the relationship between the premises. Conclusions serve as the thesis of the argument.

**Syllogism:** The simplest sequence of logical premises and conclusions, devised by Aristotle.

Premise 1: Non-renewable resources do not exist in infinite supply.
Premise 2: Coal is a non-renewable resource.

Conclusion: Coal does not exist in infinite supply.
Using logic in writing

Premise 1: Projects funded by taxpayer dollars should benefit a majority of the public.
Premise 2: The proposed stadium construction benefits very few members of the public.
Conclusion: Therefore, the stadium construction should not be funded by taxpayer dollars.

Historically, Mill Creek has only funded public projects that benefit the population as a whole. Recent initiatives to build a light rail system and a new courthouse were approved because of their importance to the city. Last election, Mayor West reaffirmed this commitment in his inauguration speech by promising "I am determined to return public funds to the public." This is a sound commitment and a worthy pledge.

However, the new initiative to construct a stadium for the local baseball team, the Bears, does not follow this commitment. While baseball is an enjoyable pastime, it does not receive enough public support to justify spending $210 million in public funds for an improved stadium. Attendance in the past five years has been declining, and last year only an average of 400 people attended each home game, meaning that less than 1% of the population attends the stadium. The Bears have a dismal record at 0-43 which generates little public interest in the team.

The population of Mill Creek is plagued by many problems that affect the majority of the public, including its decrepit high school and decaying water filtration system. Based on declining attendance and interest, a new Bears stadium is not one of those needs, so the project should not be publicly funded. Funding this project would violate the mayor's commitment to use public money for the public.
Syllogisms

Premise 1: Some quadrilaterals are squares.

Premise 2: Figure 1 is a quadrilateral.

Conclusion: Figure 1 is a square.

Are these correct? Why or why not?

Premise 1: All birds lay eggs.

Premise 2: Platypuses lay eggs.

Conclusion: Platypuses are birds.

Are these correct? Why or why not?
Syllogisms

Premise 1: Some quadrilaterals are squares.

Premise 2: Figure 1 is a quadrilateral.

Conclusion: Figure 1 is a square.

\[ \forall x, \quad \text{Square}(x) \rightarrow \text{Quad}(x) \]

\[ \text{Quad}(fig1) \]

Cannot derive conclusion
Syllogisms

Premise 1: All birds lay eggs.

Premise 2: Platypuses lay eggs.

Conclusion: Platypuses are birds.

\[ \forall x, \quad \text{Bird}(x) \rightarrow \text{LayEggs}(x) \]
\[ \forall x \quad \text{Platypus}(x) \rightarrow \text{LayEggs}(x) \]

Cannot derive conclusion
Syllogisms in text

# 4
Posted by Scott Anderson on March 18th, 2009 @ 4:51 pm
F.H. Kim Krenz criticizes wind energy for being “notoriously unreliable.” Electricity generated from wind is variable, not unreliable, and its variability can be estimated from historical weather patterns. If apologists for nuclear energy spent more time describing how new Ontario nuclear plants would be more reliable than the province’s existing unreliable ones, and less time taking a swipe at alternative energy technology, they would be doing us all a great service.

Mark Bell
BSc 1979
Toronto

Suggestions for syllogism?
F.H. Kim Krenz criticizes wind energy for being “notoriously unreliable.” Electricity generated from wind is variable, not unreliable, and its variability can be estimated from historical weather patterns. If apologists for nuclear energy spent more time describing how new Ontario nuclear plants would be more reliable than the province’s existing unreliable ones, and less time taking a swipe at alternative energy technology, they would be doing us all a great service.

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BSc 1979  
Toronto

Suggestions for syllogism?

Wind is variable  
The amount of wind variability can be predicted from past history  
Predictable signals are reliable

Wind is reliable
Errors in logic
(logical fallacies)

If we ban assault rifles because they can penetrate police body armor, eventually the government will ban all weapons, so we should not ban assault rifles.
Errors in logic
(logical fallacies)

If we ban assault rifles because they can penetrate police body armor, eventually the government will ban all weapons, so we should not ban assault rifles.

**Slippery Slope:** This is a conclusion based on the premise that if A happens, then eventually through a series of small steps, through B, C, ..., X, Y, Z will happen, too, basically equating A and Z. So, if we don't want Z to occur, A must not be allowed to occur either.

The overall argument is valid if each implication can be proven to be true. But in everyday language, a “slippery slope” argument assumes intermediate implications to be true without explicit proof.
Logical fallacies

I drank bottled water and now I am sick, so the water must have made me sick.
Logical fallacies

I drank bottled water and now I am sick, so the water must have made me sick.

**Post hoc ergo propter hoc:** This is a conclusion that assumes that if 'A' occurred after 'B' then 'B' must have caused 'A.' In statistical terms, correlation does not imply causation (active research area!).

Everyone morning my alarm clock wakes me up, I see the sunrise. Therefore my alarm clock causes the sun to rise.
Logical fallacies

You can't believe John when he says the proposed policy would help the economy. He doesn't even have a job.

**Ad hominem:** This is an attack on the character of a person rather than her/his opinions or arguments.

Could this be fixed?
The level of mercury in seafood may be unsafe, but what will fishers do to support their families?

**Red Herring:** This is a diversionary tactic that avoids the key issues, often by avoiding opposing arguments rather than addressing them. In this example, the author switches the discussion away from the safety of the food and talks instead about an economic issue, the livelihood of those catching fish. We should really be debating safety issues (assuming that is the debate in question), not economic consequences.
Logical fallacies

List of fallacies

From Wikipedia, the free encyclopedia

For specific popular misconceptions, see List of common misconceptions.

A fallacy is incorrect argumentation in logic and rhetoric resulting in a lack of validity, or more generally, a lack of soundness.

List of fallacies

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1 Formal fallacies
   1.1 Propositional fallacies
   1.2 Quantification fallacies
   1.3 Formal syllogistic fallacies
2 Informal fallacies
   2.1 Faulty generalizations
   2.2 Red herring fallacies
3 Conditional or questionable fallacies
4 See also
5 References
6 Further reading
7 External links

Formal fallacies

A formal fallacy is an error in logic that can be seen in the argument's form without an understanding of the argument's content.[1] All formal fallacies are specific types of non sequiturs.

- Appeal to probability – assumes that because something is likely to happen, it is inevitable that it will happen.[2][3]
- Argument from fallacy – assumes that if an argument for some conclusion is fallacious, then the conclusion itself is false.[4]
- Base rate fallacy – making a probability judgement based on conditional probabilities, without taking into account the effect of prior probabilities.[5]
- Conjunction fallacy – assumption that an outcome simultaneously satisfying multiple conditions is more probable than an outcome satisfying a single one of them.[6]
- Masked man fallacy (illicit substitution of identicals) – the substitution of identical designators in a true statement can lead to a false one.[7]

Propositional fallacies

[edit]