Topic 4:

* The Logical Kind, Not The Talk Radio Kind.

Monty Python’s “The Argument Clinic”

Featuring:

- Michael Palin as “Man”
- Rita Davies as “Receptionist”
- Graham Chapman as “Mr. Barnard”
- John Cleese as “Mr. Vibrating”
- Eric Idle as “Complainer”
- Terry Jones as “Spreaders”

Definition: Argument
Inductive and Deductive Reasoning (1 / 3)

**Definition: Inductive Argument**


**Definition: Deductive Argument**


Inductive and Deductive Reasoning (2 / 3)

**Example(s):**
Inductive and Deductive Reasoning (3 / 3)

What type of argument is this?

3 is a prime number, 5 is a prime number, and 7 is a prime number. Therefore, all positive odd integers above 1 are prime numbers.

Structure of a Deductive Argument

\((p_1 \land p_2 \land \ldots \land p_n) \rightarrow q\)
Valid and Sound Arguments (1 / 2)

**Definition: Valid Argument**

... 

Example(s):

... 

Valid and Sound Arguments (2 / 2)

Example(s):

... 

**Definition: Sound Argument**

...
Some Rules of Inference (1 / 2)

Learn these!

1. Addition

2. Simplification

3. Conjunction

4. Modus Ponens

Some Rules of Inference (2 / 2)

Learn these, too!

5. Modus Tollens

6. Hypothetical Syllogism

7. Disjunctive Syllogism

8. Resolution
Examples of Valid Arguments (1 / 4)

#1: You accidently drop a pen. You know that the pen will fall if it is dropped. How do you know that the pen will fall?

Examples of Valid Arguments (2 / 4)

#2: If 191 is divisible by 7, then $191^2$ is divisible by 49.  
191 is divisible by 7, so $191^2$ is divisible by 49.  
Is this argument valid?
Examples of Valid Arguments (3 / 4)

#3: If you email me a love note, I’ll send you flowers. If you don’t, I’ll study Discrete Math. If I study Discrete Math, I’ll do well on the quiz. Can we conclude that, if I don’t send you flowers, I’ll do well on the quiz?

Examples of Valid Arguments (4 / 4)

#3: (cont.)

\[ p: \text{You email me a love note} \quad q: \text{I send you flowers} \]
\[ r: \text{I study Discrete Math} \quad s: \text{I do well on the quiz} \]

\[ p \rightarrow q \quad \overline{p} \rightarrow r \quad r \rightarrow s \]

\[ \frac{q}{\overline{q} \rightarrow s} \quad ??? \]
Rules of Inference for Predicates (1 / 2)

Four common rules:

1. **Universal Instantiation**
   \[ \forall x \ P(x), \ x \in D \ / \ : \ P(d) \text{ if } d \in D \]

2. **Universal Generalization**
   \[ P(d) \text{ for any } d \in D \ / \ : \ \forall x \ P(x), \ x \in D \]

3. **Existential Instantiation**
   \[ \exists x \ P(x), \ x \in D \ / \ : \ P(d) \text{ for some } d \in D \]

4. **Existential Generalization**
   \[ P(d) \text{ for some } d \in D \ / \ : \ \exists x \ P(x), \ x \in D \]

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Rules of Inference for Predicates (2 / 2)

**Example(s):**
Fallacies (1 / 2)

Definition: Fallacy

Three classic types:

1. Affirming the Conclusion (or . . . Consequent)

Fallacies (2 / 2)

2. Denying the Hypothesis (or . . . Antecedent)

3. Begging the Question (a.k.a. Circular Reasoning)
Fallacies for Fun

1. Fallacy of Interrogation

2. ‘No True Scotsman’ Fallacy

Extra Slides

The remaining slides in this topic are some that I no longer cover in class. I won’t ask about them on a quiz or an exam, but they could be referenced on a homework or in section.
Homer: Ah, not a bear in sight. The Bear Patrol must be working like a charm!

Lisa: That’s specious reasoning, Dad. [...] By your logic, I could claim that this rock keeps tigers away!

Homer: Oh . . . and how does it work?

Lisa: It doesn’t work. [...] It’s just a stupid rock. [...] But I don’t see any tigers around here, do you?

Homer: Lisa, I want to buy your rock.

From: The Simpsons, “Much Apu About Nothing”
(Season 7, Episode 151, Production Code 3F20)

Definition: Specious Reasoning
An unsupported or improperly constructed argument. (That is, an unsound or invalid argument.)

Question: Where is the error in Homer’s logic?

First issue: Which of these is Homer’s argument?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(\neg b) (Given)</td>
</tr>
<tr>
<td>(2)</td>
<td>(\therefore w) (???)</td>
</tr>
</tbody>
</table>

The first seems most reasonable in context.
Where is the error in Homer’s logic? (cont.)

Next, what is the missing piece of Homer’s argument?

(1) $\neg b$
(2) $\neg b \rightarrow w$ ← this is what we’re trying to show!

(3) $\therefore w$ (1, 2, Modus Ponens)

OK, then, how about …

(1) $\neg b$
(2) $w \rightarrow \neg b$ ← might sound good, but …

(3) $\therefore w$ (1, 2, um … Abracadabra?)

(The second form of Homer’s argument fails similarly.)