Topic 4:

Arguments

* 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 “Spreader”

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

**Definition: Inductive Argument**

[Blank]

**Definition: Deductive Argument**

[Blank]

Inductive and Deductive Reasoning (2 / 3)

**Example(s):**

[Blank]
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

Arguments – CSc 245 v1.1 (McCann) – p. 9

Some Rules of Inference (2 / 2)

Learn these, too!

5. Modus Tollens

6. Hypothetical Syllogism

7. Disjunctive Syllogism

8. Resolution

Arguments – CSc 245 v1.1 (McCann) – p. 10
#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?

#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?

#3: (cont.)

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

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

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

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

4. **Existential Generalization**
   \[ P(d) \text{ for some } d \in D \quad \therefore \exists x \ P(x), x \in D \]
**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.
Specious Reasoning: The Bear Patrol (1 / 3)

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)

Specious Reasoning: The Bear Patrol (2 / 3)

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?

b: There are bears in Springfield
w: The Bear Patrol is working

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

\[
\begin{align*}
(1) & \quad \neg b \quad \text{(Given)} \\
(2) & \quad \therefore w \quad \text{(???)}
\end{align*}
\]

\[
\begin{align*}
(1) & \quad w \quad \text{(Given)} \\
(2) & \quad \therefore \neg b \quad \text{(???)}
\end{align*}
\]

The first seems most reasonable in context.
Question: 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.)