

# Topic 4:

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## 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 "Spreaders"



## Definition: Argument

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# Inductive and Deductive Reasoning (1 / 3)

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## Definition: Inductive Argument

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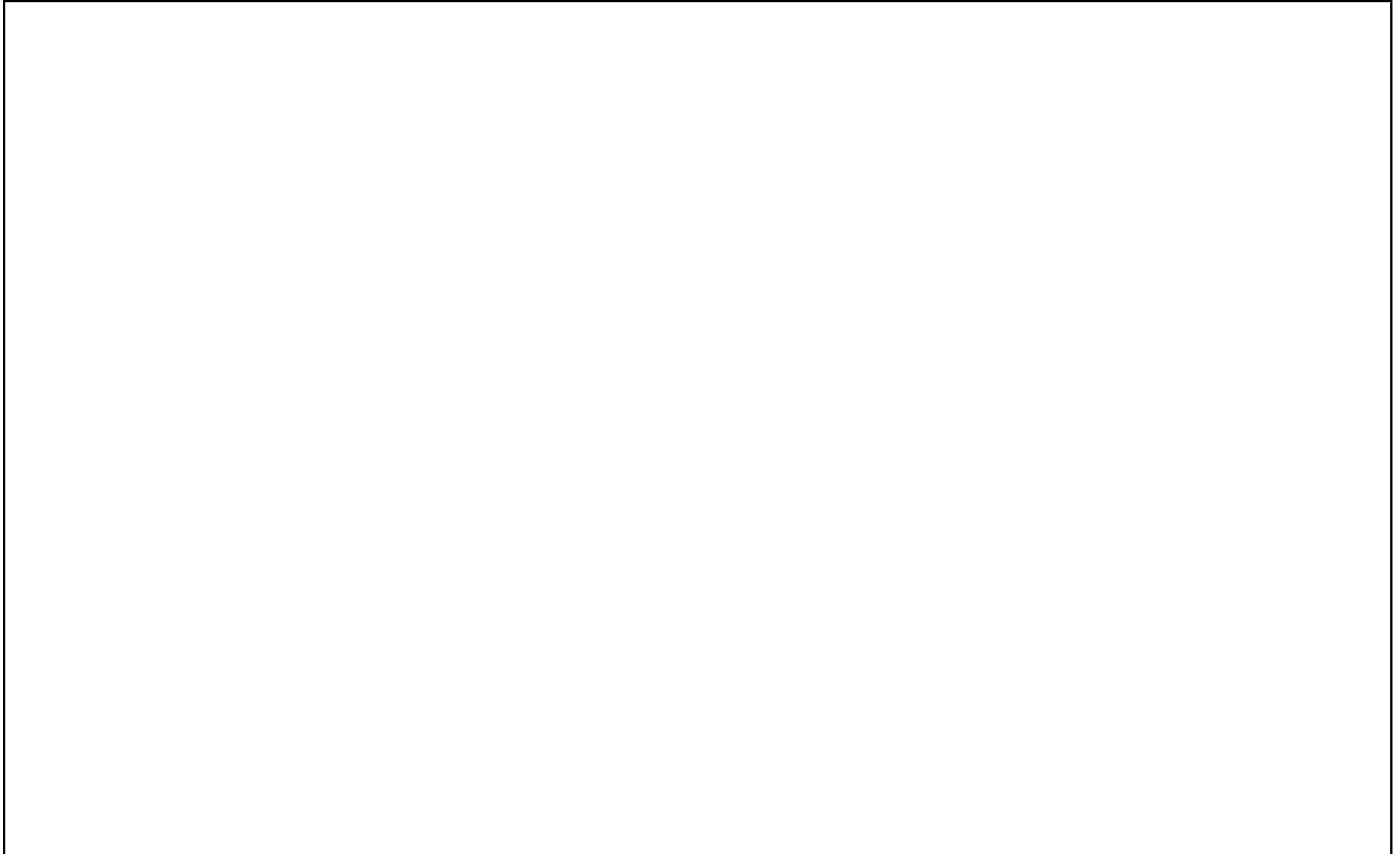
## Definition: Deductive Argument

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# Inductive and Deductive Reasoning (2 / 3)

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**Example(s):**



# Inductive and Deductive Reasoning (3 / 3)

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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

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$$(p_1 \wedge p_2 \wedge \dots \wedge p_n) \rightarrow q$$

# Valid and Sound Arguments (1 / 2)

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## Definition: Valid Argument

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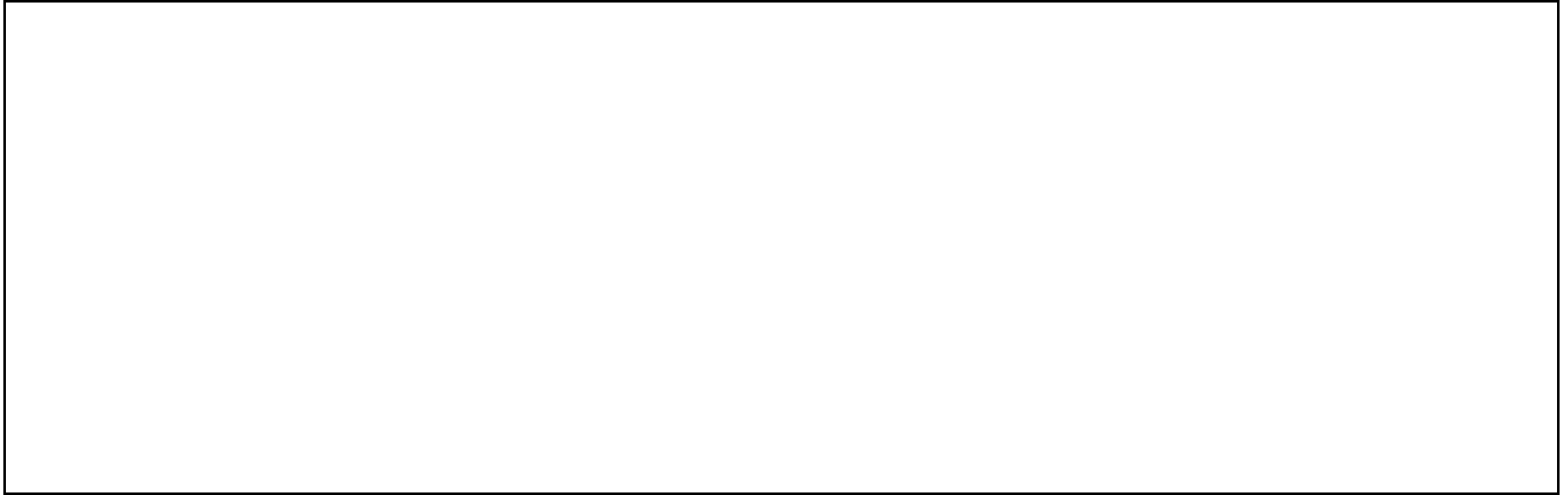
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## Example(s):

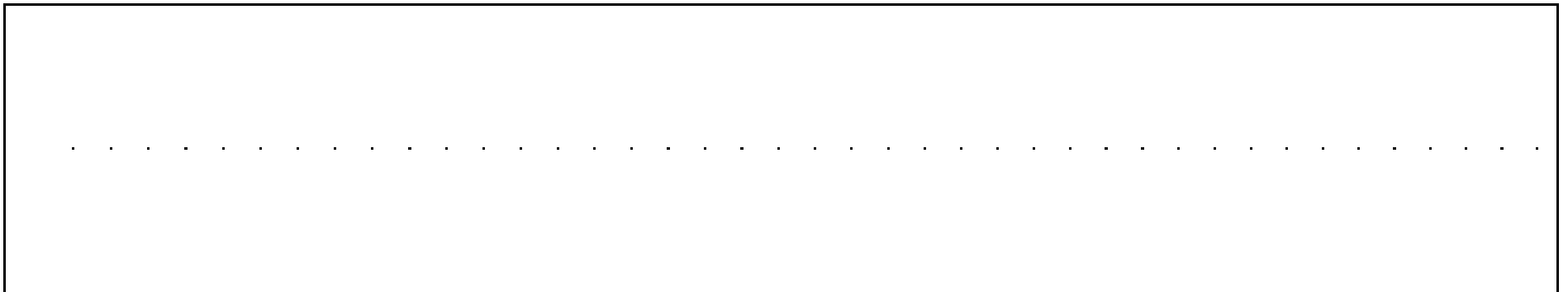
# Valid and Sound Arguments (2 / 2)

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**Example(s):**



**Definition: Sound Argument**





# Some Rules of Inference (1 / 2)

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Learn these!

1. Addition

2. Simplification

3. Conjunction

4. Modus Ponens

# Some Rules of Inference (2 / 2)

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Learn these, too!

5. Modus Tollens

6. Hypothetical Syllogism

7. Disjunctive Syllogism

8. Resolution

# Examples of Valid Arguments (1 / 4)

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#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)

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#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)

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#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)

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#3: (cont.)

$p$ : You email me a love note

$q$ : I send you flowers

$r$ : I study Discrete Math

$s$ : I do well on the quiz

$$p \rightarrow q$$

$$\bar{p} \rightarrow r$$

$$r \rightarrow s$$

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$$\therefore \bar{q} \rightarrow s \quad ???$$

# Rules of Inference for Predicates (1 / 2)

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Four common rules that you need to know:

1. **Universal Instantiation**

$$\forall x P(x), x \in D / \therefore P(d) \text{ if } d \in D$$

2. **Universal Generalization**

$$P(d) \text{ for any } d \in D / \therefore \forall x P(x), x \in D$$

3. **Existential Instantiation**

$$\exists x P(x), x \in D / \therefore P(d) \text{ for some } d \in D$$

4. **Existential Generalization**

$$P(d) \text{ for some } d \in D / \therefore \exists x P(x), x \in D$$

# Rules of Inference for Predicates (2 / 2)

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**Example(s):**

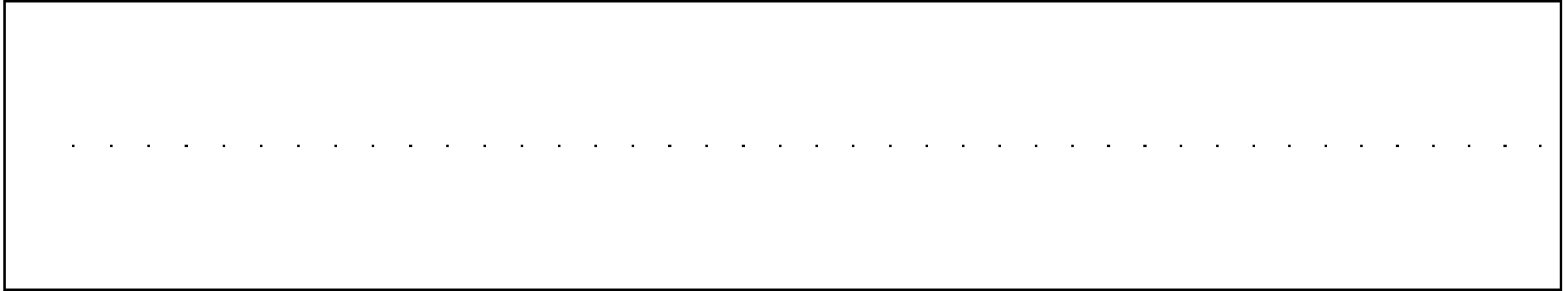




# Fallacies (1 / 2)

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## Definition: Fallacy



Three classic types:

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

# Fallacies (2 / 2)

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

3. Begging the Question (a.k.a. Circular Reasoning)

# Fallacies for Fun

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1. Fallacy of Interrogation

2. 'No True Scotsman' Fallacy

# Extra Slides

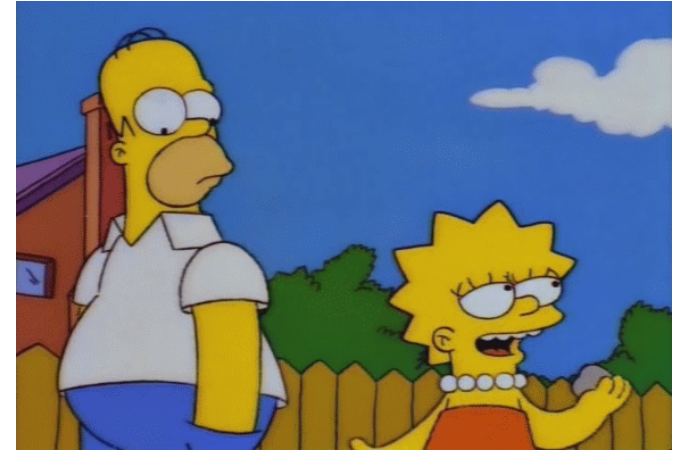
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The remaining slides in this topic are some that I no longer cover in class. I won't ask about them on a quiz or an exam, but they could be referenced on a homework or in SIs.

# 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?

(1)  $\neg b$  (Given)

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(2)  $\therefore w$  (???)

(1)  $w$  (Given)

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(2)  $\therefore \neg b$  (???)

The first seems most reasonable in context.

# Specious Reasoning: The Bear Patrol (3 / 3)

**Question:** Where is the error in Homer's logic? (cont.)

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

$$(1) \quad \neg b$$

$$(2) \quad \boxed{\neg b \rightarrow w} \quad \leftarrow \text{this is what we're trying to show!}$$

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$$(3) \quad \therefore w \quad (1, 2, \text{Modus Ponens})$$

OK, then, how about ...

$$(1) \quad \neg b$$

$$(2) \quad \boxed{w \rightarrow \neg b} \quad \leftarrow \text{might sound good, but ...}$$

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$$(3) \quad \therefore w \quad (1, 2, \text{um ... Abracadabra?})$$

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