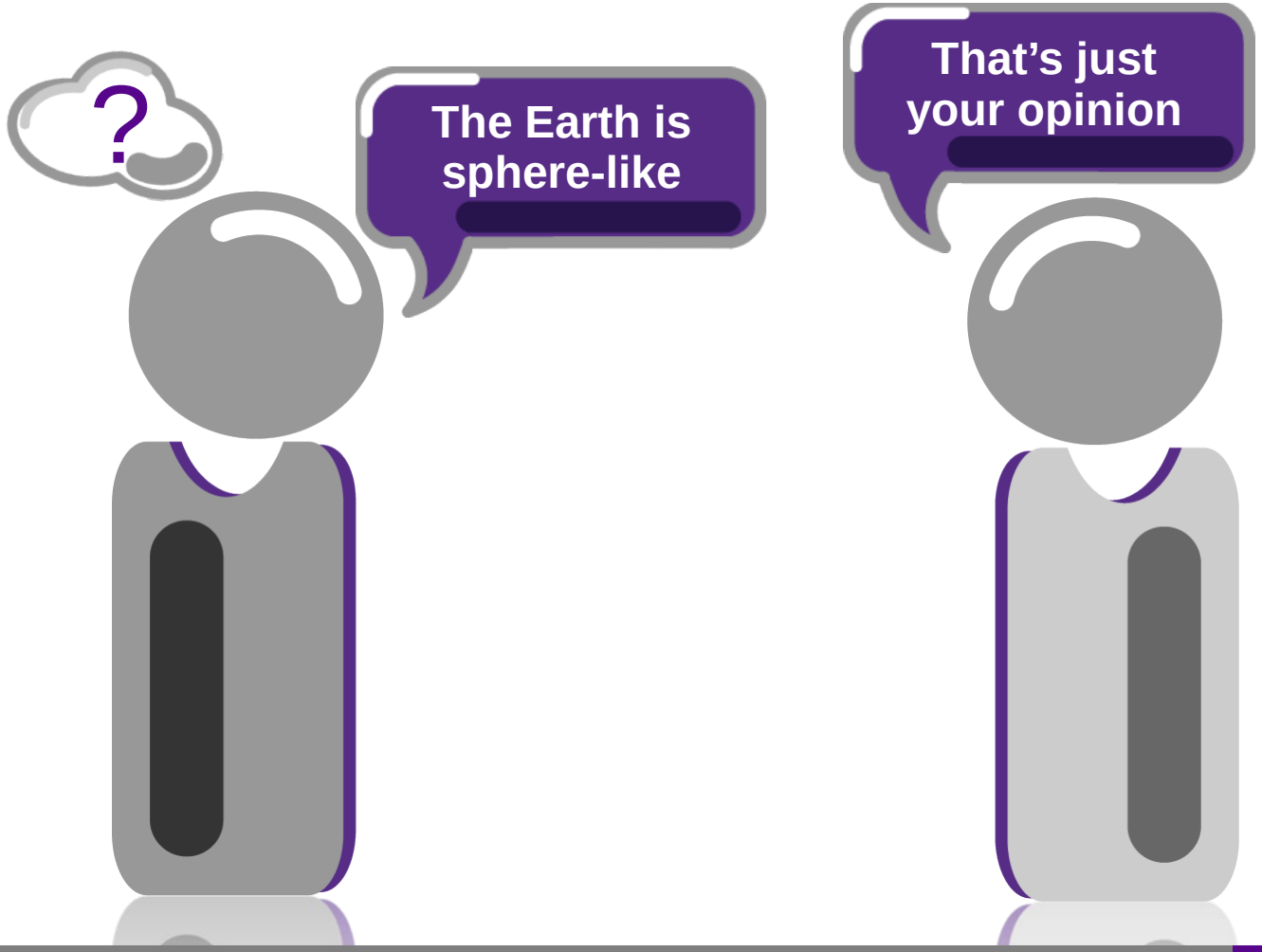
PD 20
Engineering Workplace Skills: Developing Reasoned Conclusions

Unit 04
Understanding Arguments

WATERLOO ENGINEERING

engineering.uwaterloo.ca

“That's just your opinion”



WATERLOO ENGINEERING

engineering.uwaterloo.ca

Aren’t all opinions equally good?

Politically, maybe...

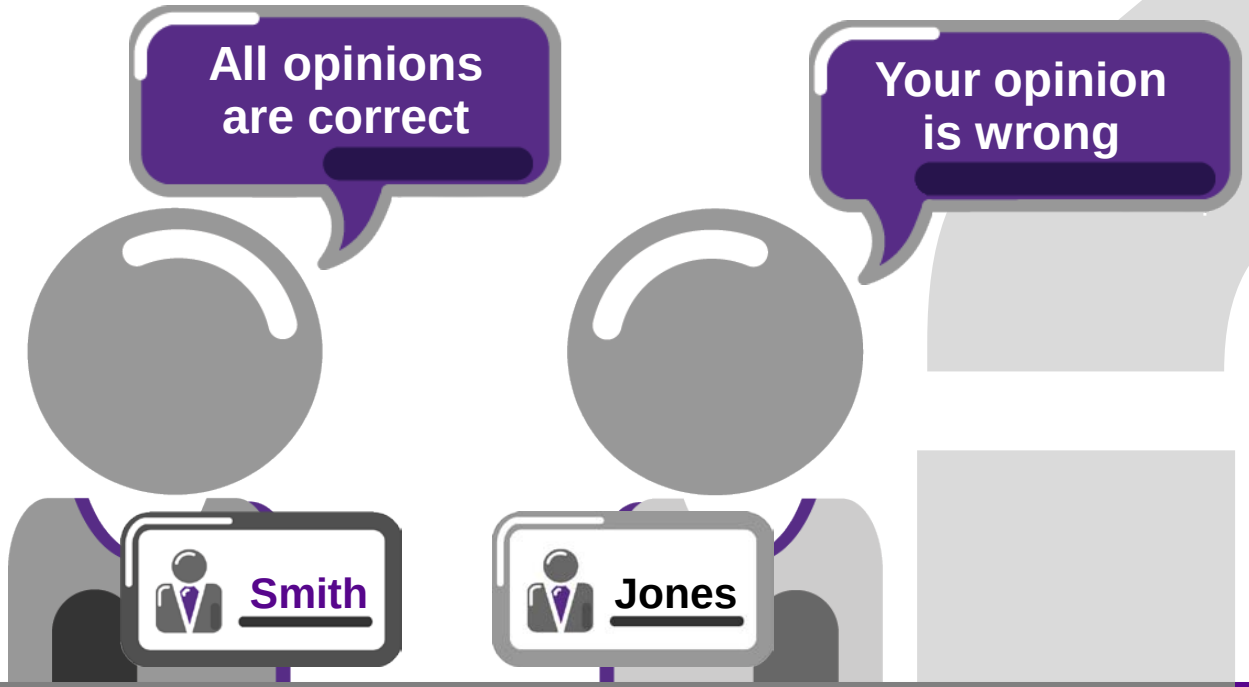
...but not from a logical point of view

WATERLOO ENGINEERING

engineering.uwaterloo.ca

Aren’t all opinions equally good?

Assume that nobody’s opinion is wrong in a debate.



WATERLOO ENGINEERING

engineering.uwaterloo.ca

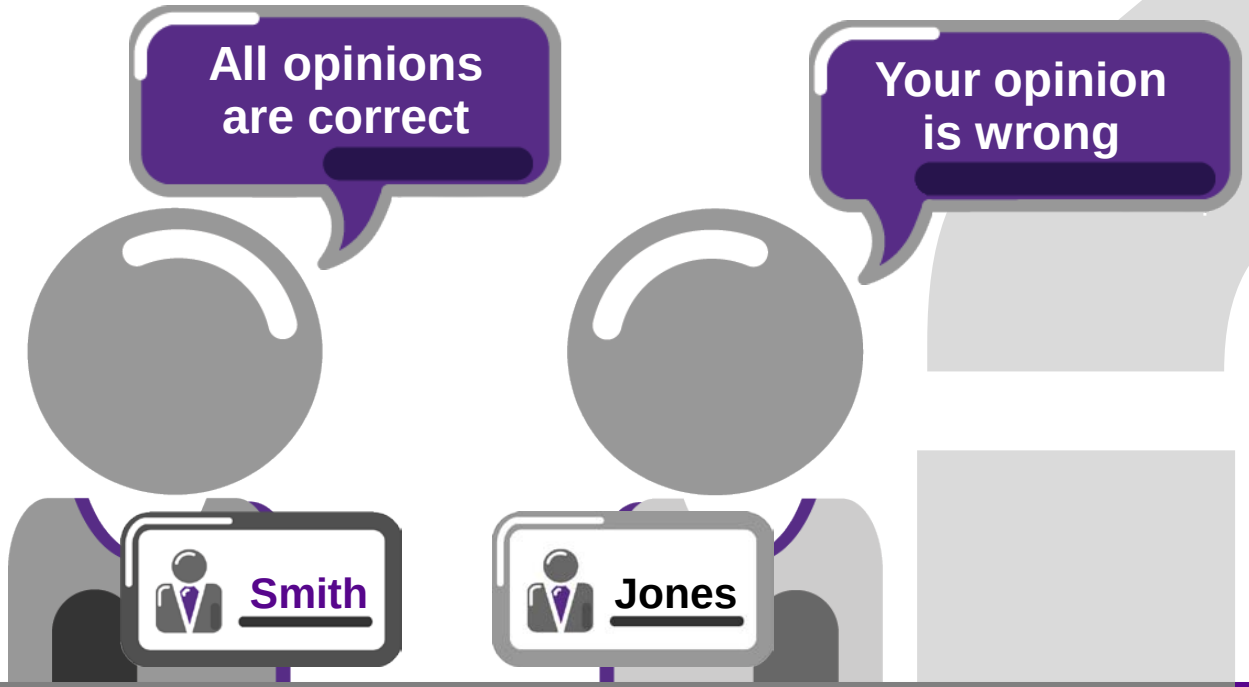
Aren't all opinions equally good?

No! Not all opinions are equally good.

Assume that nobody's opinion is wrong in a debate.

If **Smith** is right, then **Smith** must concede that **Jones** is right…

Which is to say that Smith is wrong.

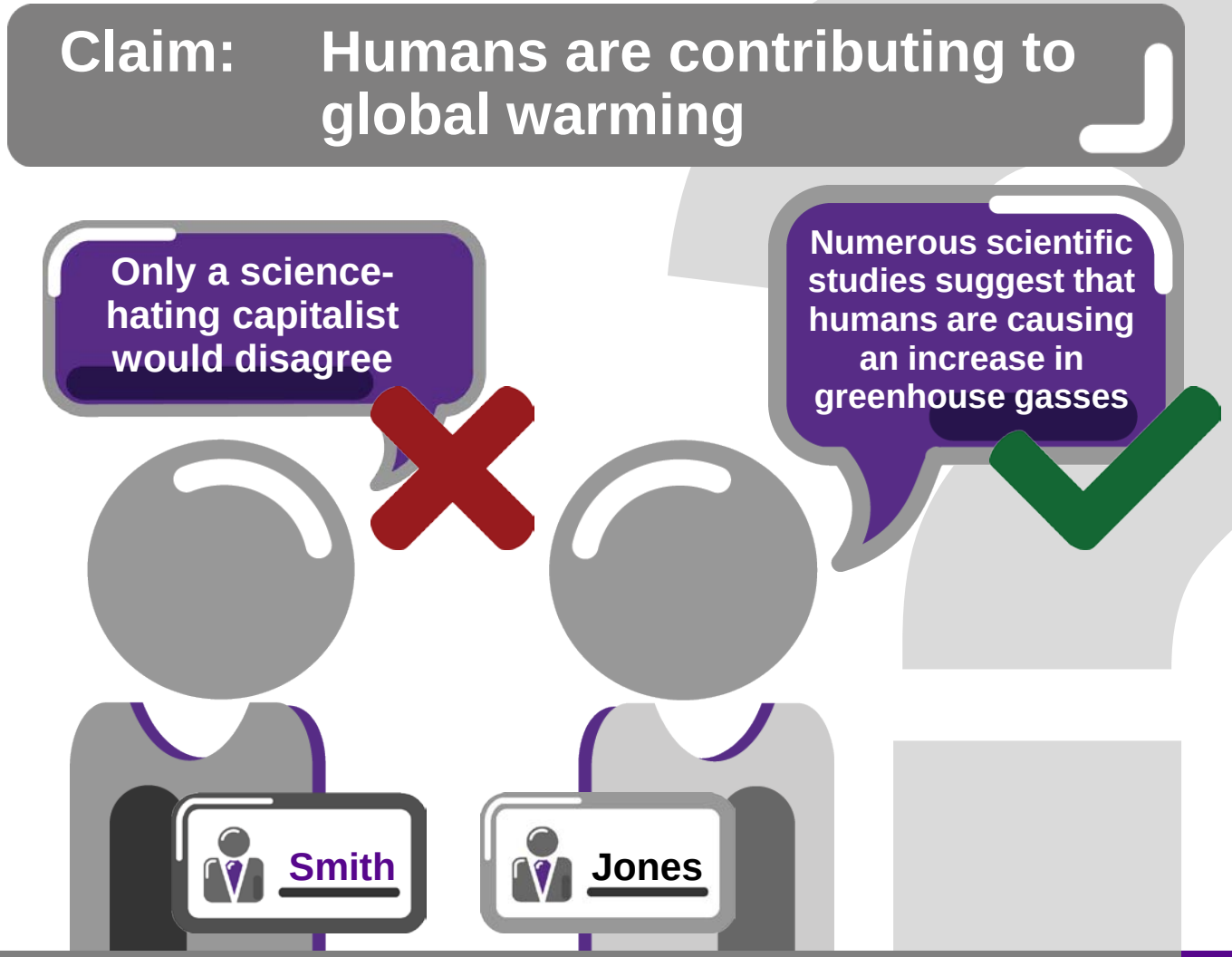


WATERLOO ENGINEERING

engineering.uwaterloo.ca

Aren't all opinions equally good?

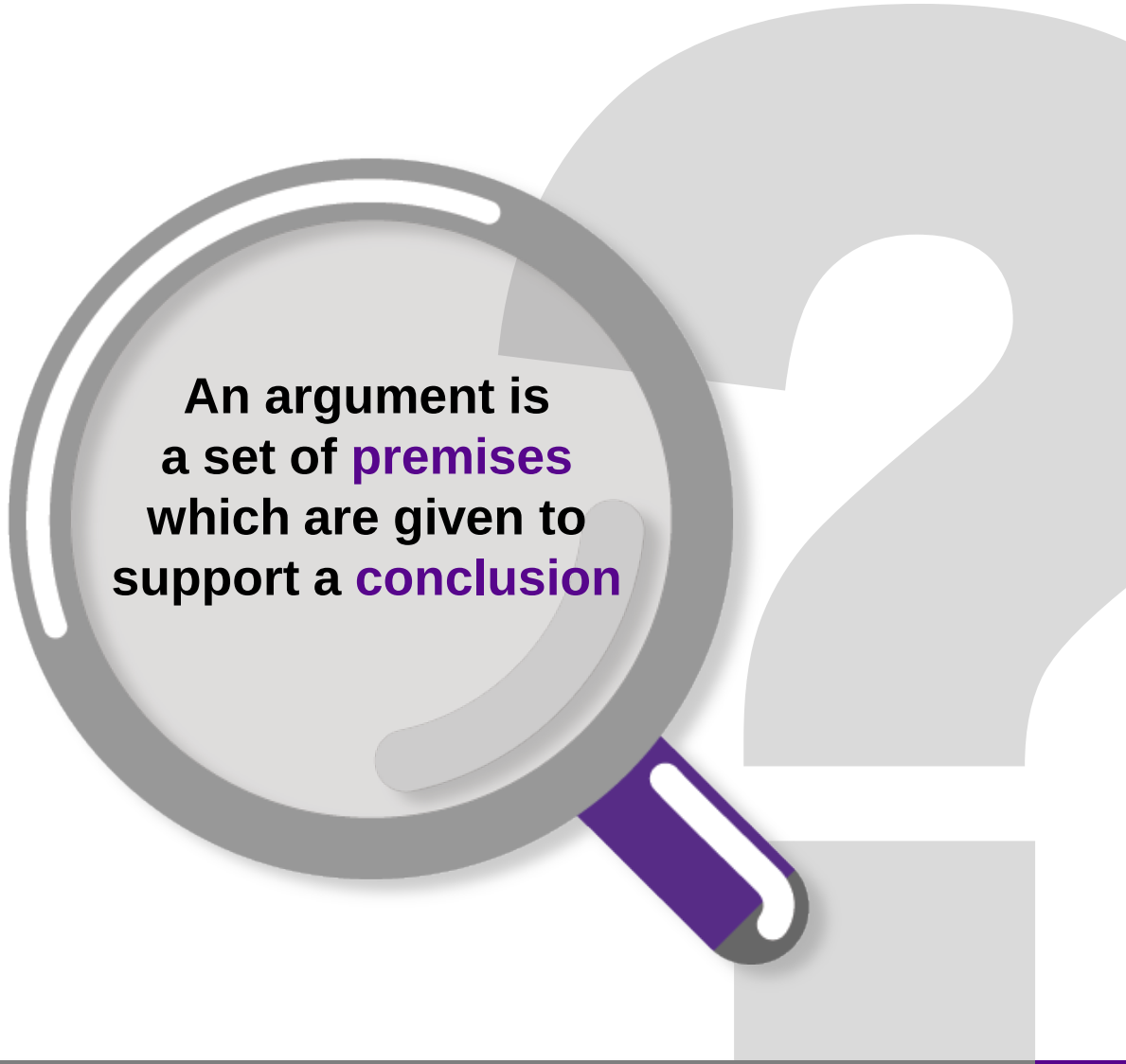
Global warming...



WATERLOO ENGINEERING

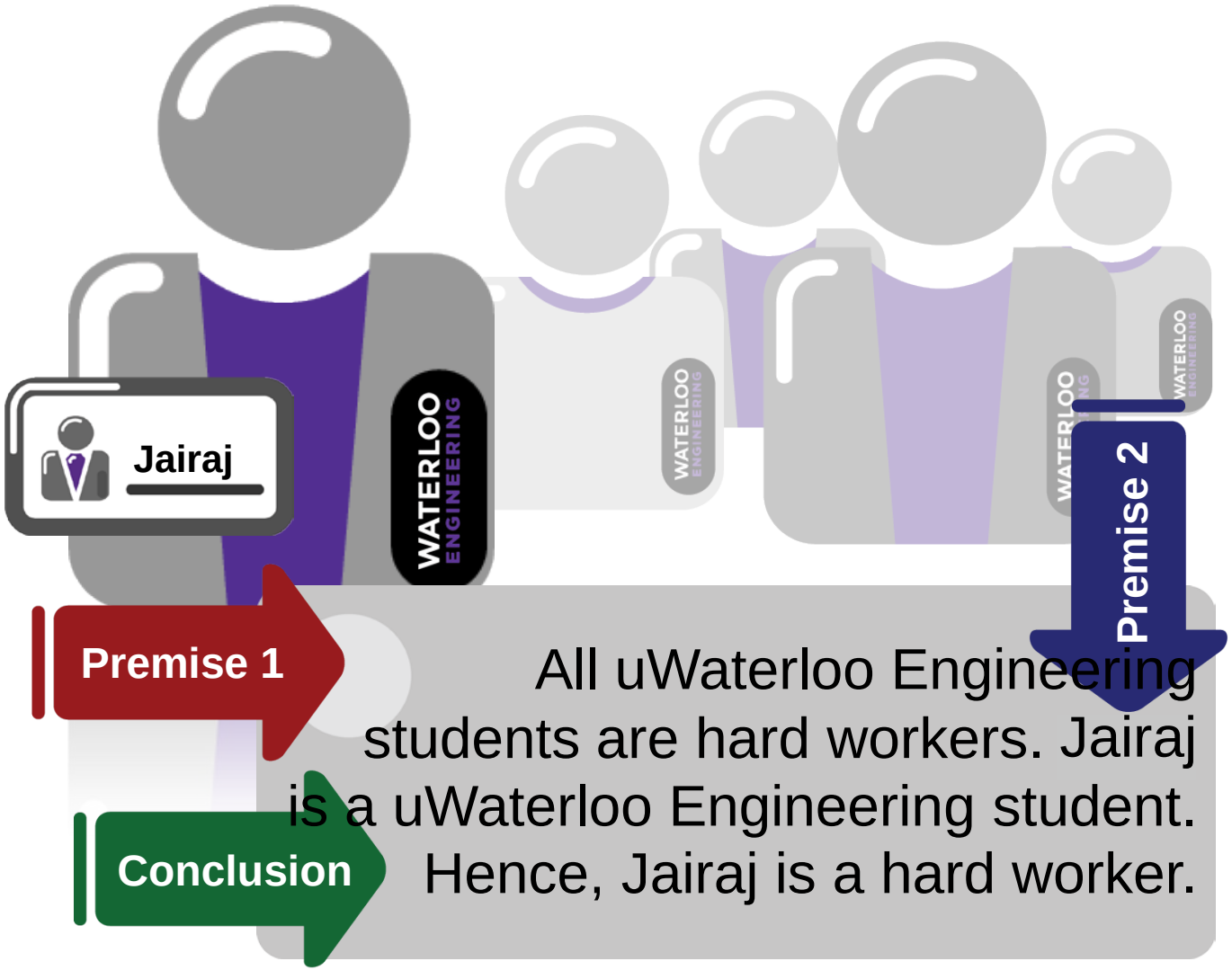
engineering.uwaterloo.ca

What is an Argument?



WATERLOO
ENGINEERING
engineering.uwaterloo.ca

Example



WATERLOO ENGINEERING
engineering.uwaterloo.ca

Example

Premise 1

All uWaterloo Engineering students are hard workers.

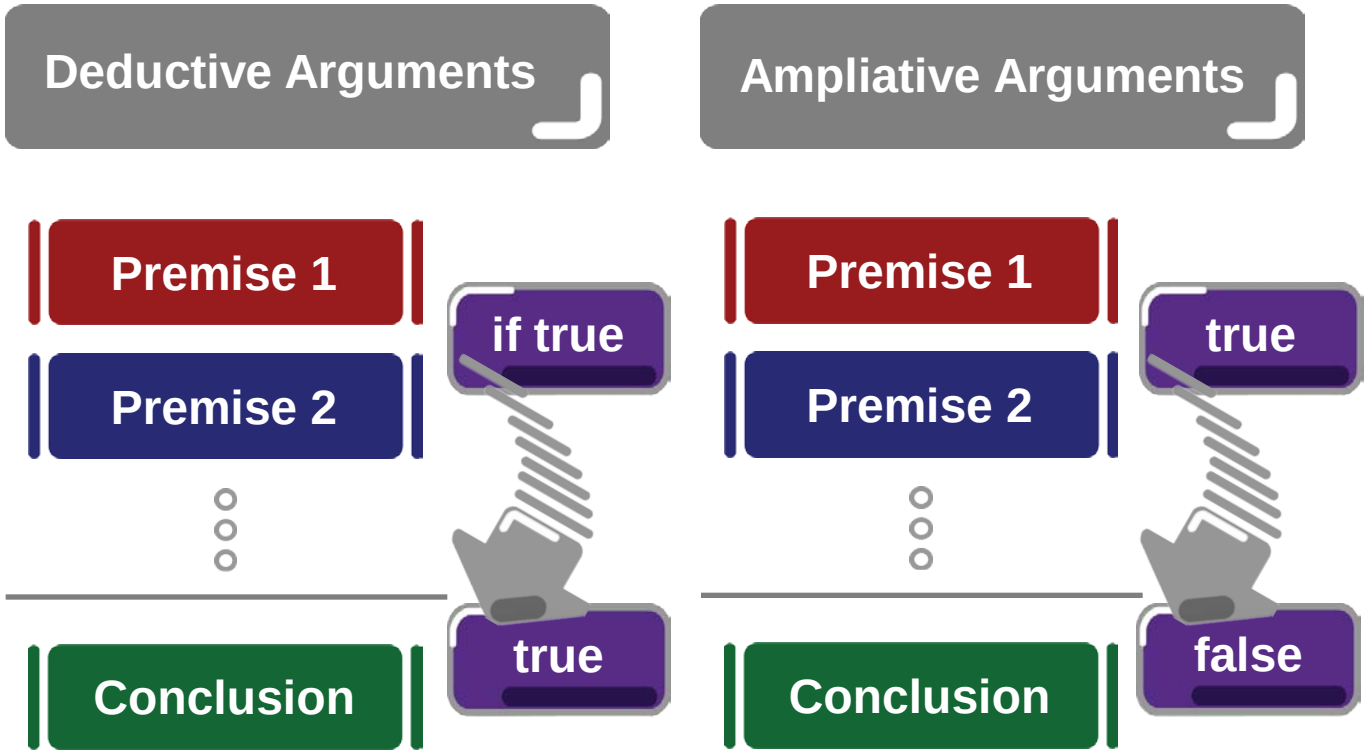
Premise 2

Jairaj is a uWaterloo Engineering student.

Conclusion

Hence, Jairaj is a hard worker.

Types of arguments



- Truth is guaranteed

- Defeasible

- Premises lend credence

Evaluating Deductive Arguments

Deductive Arguments

Premise 1

Premise 2

Conclusion

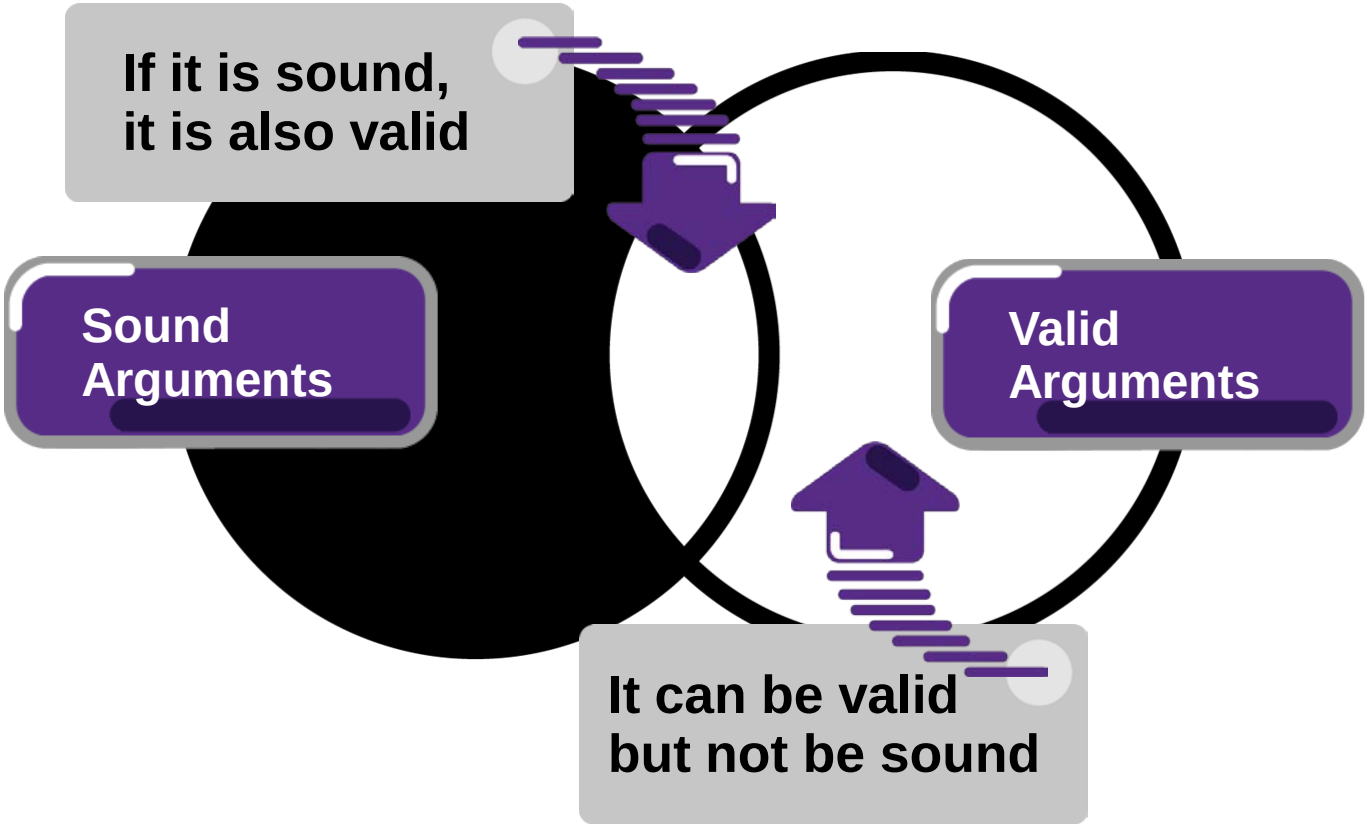
Validity:

If the premises are true, then the conclusion must also be true

Soundness:

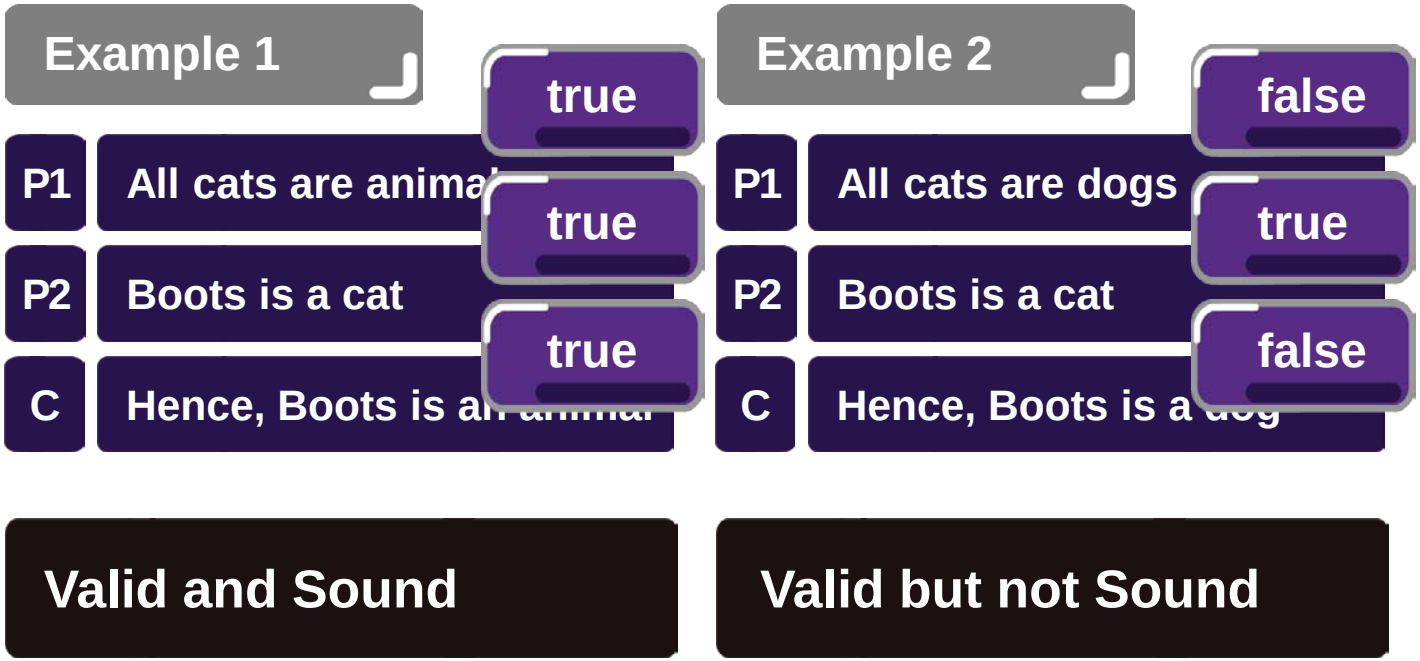
An argument is sound if
(1) It is a valid argument, and
(2) Its premises are true

All sound arguments are valid arguments



But not all valid arguments are sound arguments

Examples



Valid and Sound

Valid but not Sound

- Start with true premises
- Distinguish between form and content

Examples

Let S, P, and B be variables

Example 1

P1	All S are P
P2	B is a S
C	Hence, B is a P

Example 2

P1	All S are P
P2	B is a S
C	Hence, B is a P

How do we evaluate a deductive argument?

1) Analyze the argument form — Internal

2) Evaluate the truth of the premises and conclusion — External

Analyzing Argument Forms

Logical Vocabulary

The logical form of an argument depends on the logical vocabulary used in the premises and conclusion

Logical Vocabulary

Alice is in Toronto **and** Hamish is in Ottawa.
Either I got the job **or** Bob got the job.
If Anish is in Montreal **then** he is in Quebec.
It is **not** *the case* that chlorine is a garnish.

Analyzing Argument Forms

Once we understand the logical structure of the argument, we can look for counter examples

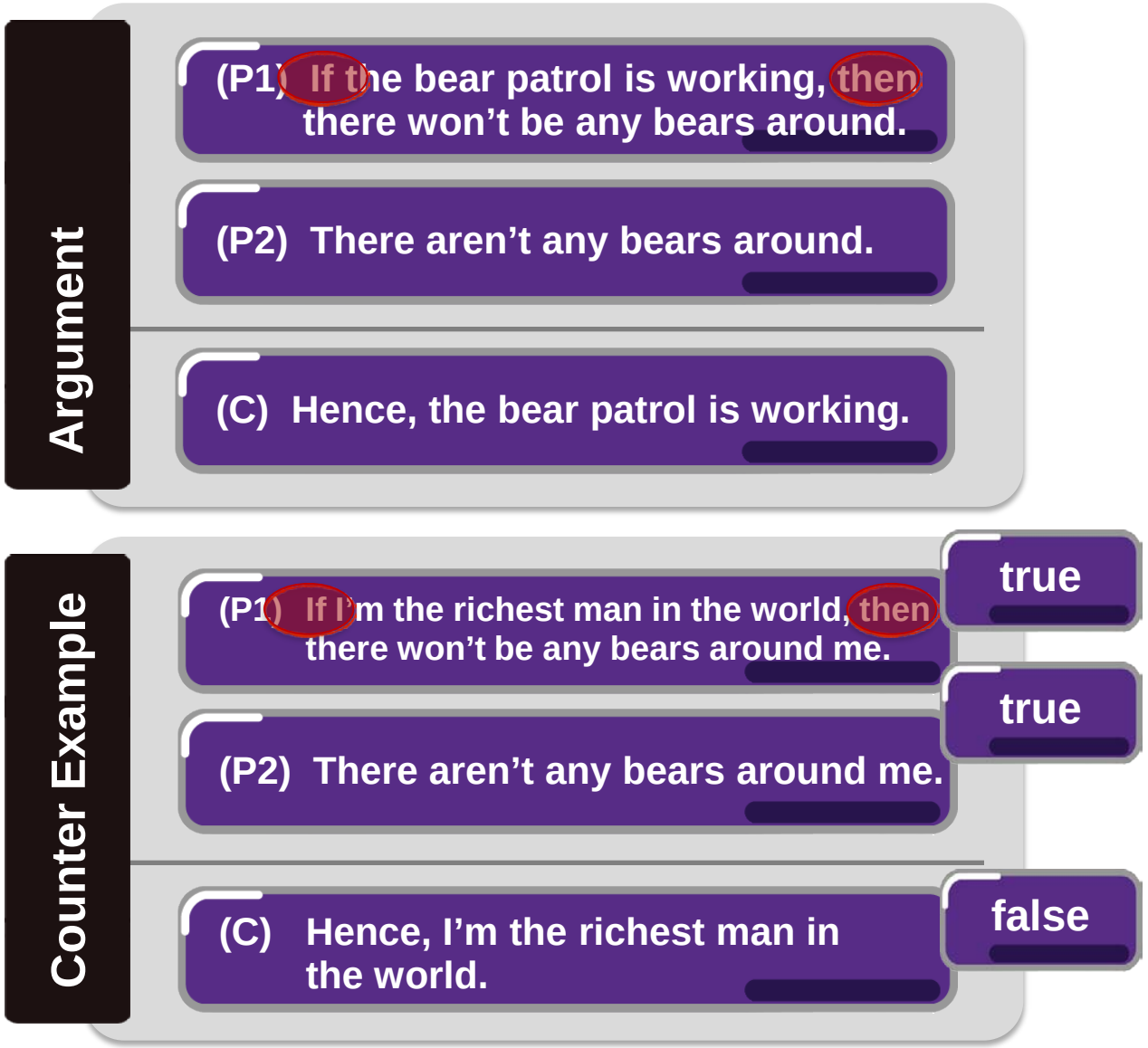
Counter Example
Try and come up with an argument where:

(1) The logical form is the same

(2) The premises are obviously true

(3) The conclusion is obviously false

Example of a Counter Example



Summary

- Not all opinions, beliefs, or claims are equal
- Claims need to be backed up with good arguments
- There are different types of arguments
- Evaluating deductive arguments is a two-part process:
  - 1. Analyze logical form
    - Check the logical vocabulary
    - A good deductive argument is truth-preserving
  - 2. Evaluate truth
    - Evaluating truth is an external process

Logic Courses at uWaterloo

- PHIL 240 Introduction to Formal Logic
- PHIL 342 Non-Classical Logics
- PMATH 330 Introduction to Mathematical Logic
- PMATH 432 First Order Logic and Computability

WATERLOO ENGINEERING
engineering.uwaterloo.ca