Logical Reasoning

Brief Intro

The Basic Laws

- Non-contradiction
  - ‘A’ cannot be ‘Not-A’ at the same time and in the same sense
- Identity
  - ‘A’ is ‘A’ (or A = A)
- Excluded Middle
  - Either ‘A’ or ‘Not A’

A Propositional Argument

- Is always composed of at least one premise and exactly one conclusion
- The premises provide (or claim to to provide) support, evidence, justification, etc., for the conclusion
- It is the logician's business to determine just how good that support is

Evaluating a Propositional Argument

- Typically done in terms of 1) validity (form of an argument) and 2) soundness (truth value of the premises)
- Now to assessing the validity or form of an argument

Modus Ponens *(A Valid Form)*

- If *p* then *q*
- *p*
- Therefore *q*
- *E.G.:* If John passes the driving test, he'll qualify to drive his car
- John passes the driving test
- John qualifies to drive his car

Modus Tolens *(A Valid Form)*

- If *p* then *q*
- Not *q*
- Therefore not *p*
- *E.g.:* If John passes the driving test, then he'll qualify to drive his car
- John fails to qualify to drive his car
- John fails or fails to take the driving test (or John passed but hasn't gotten his driver's license just yet)

Affirming the consequent (An Invalid Form)

- If *p* then *q*
- *q*
- Therefore *p*
- *E.g.:* If Jim discovered $E = MC^2$, then Jim is a great scientist.
- Jim is a great scientist
- Therefore Jim discovered $E = MC^2$

Hypothetical Syllogism

- P→Q
- Q→R
- _____

P→R

Read: if P implies Q and Q implies R, then P implies R.

Conjunction

- P
- Q
- _____
- P & Q
- Read, if P is true, and Q is true, then the conjunction “P and Q” is also true

Simplification

- P & Q
- _____
- P
- Or
- P & Q
- _____
- Q

Validity and Soundness

- Assessing the validity or form of an argument (by way of review)
- Now to assessing the soundness of an argument
  - We're asking are the premises true?

Evaluating a Propositional Argument

- If John passes the driving test, he'll qualify to drive his car
- John passes the driving test
- John qualifies to drive his car
- Did John really pass the driving test?
  - Is this a contradiction in terms?
  - Is it improbable that he passed the test?
- Does passing the driving test really qualify one to drive his car?