Philosophy 240
Symbolic Logic

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Class 2: Translation and Wffs
(§1.3-§1.4)

Today

- A little “review” (what we didn’t do on Friday)
  - An intuitive discussion of validity
  - The goal of Chapter 1 is a formal definition of validity
- Today’s work
  - Translation
  - Five connectives

The Most Important Sentence of This Course

- In deductive logic, if the form of an argument is valid and the premises are all true, then the conclusion must be true.



Validity and Soundness

- The validity of an argument depends on its form.
- An argument is valid if the conclusion follows logically from the premises.
  - Certain forms are valid.
  - Certain forms are invalid.
- The soundness of a valid argument depends on truth of its premises.
- A valid argument is sound if its premises are true.
- Only valid arguments can be sound.
- Validity is independent of truth.
- Validity is related to possibility, while soundness is related to truth.

Are these arguments good?

- Argument 1
  P1. All philosophers are thinkers.
  P2. Socrates is a philosopher.
  C. Socrates is a thinker.
- Argument 2
  P1. All persons are fish.
  P2. Barack Obama is a person.
  C. Barack Obama is a fish.
- Argument 3
  P1. All mathematicians are platonists.
  P2. Jerrold Katz is a platonist.
  C. Jerrold Katz is a mathematician.

Questions Remaining on the HW?

Compositionality

Gabriel García Márquez
from “The Last Voyage of the Ghost Ship”

Now they’re going to see who I am, he said to himself in his strong new man’s voice, many years after had seen the huge ocean liner without lights **and** without any sound which passed by the village one night like a great uninhabitated palace**,** longer than the whole village and much taller than the steeple of the church, **and** it sailed by in the darkness toward the colonial city on the the other side of the bay that had been fortified against buccaneers**,** with its old slave port and the rotating light, whose gloomy beams transfigured the village into a lunar encampment of glowing houses **and** streets of volcanic deserts every fifteen seconds…

Five Connectives

Identified by syntax (shape)

- Tilde ~
- Dot •
- Wedge ∨
- Hook ⊃
- Triple-bar ≡

Five Connectives

By logical operations

- Negation ~
- Conjunction •
- Disjunction ∨
- Material Implication ⊃
- Material Biconditional ≡

Negation

a unary operator

- Some negation indicators
  - Not
  - It is not the case that
  - It is not true that
  - It is false that
- John will take the train
  - John won't take the train.
  - It's not the case that John will take the train.
  - John takes the train...not!
- Sample Negations
  - $\sim R$
  - $\sim(P \bullet Q)$
  - $\sim\{[(A \vee B) \supset C] \bullet \sim D\}$

Denial and Affirmation

- Kant affirms that arithmetic is synthetic *a priori*.
  - K
- Kant does not affirm that arithmetic is synthetic *a priori*.
  - ~K
- Kant denies that arithmetic is synthetic *a priori*.
  - It's not: ~K
  - One can fail to affirm without denying, by remaining silent.
- Moral: keep simple sentences positive, but not all negative-feeling sentences are simply negations of positive ones.

Conjunction

- Some conjunction indicators
  - and
  - but
  - also
  - however
  - yet
  - still
  - moreover
  - although
  - nevertheless
  - both
- Some English sentences which we can represent as conjunctions.
  - Angelina walks the dog and Brad cleans the floors.
  - Although Angelina walks the dog, Brad cleans the floors.
  - Bob and Ray are comedians.
    - Not: Bob and Ray are brothers.
  - Carolyn is nice, but Emily is really nice.
- Sample Conjunctions
  - $P \bullet {\sim}Q$
  - $(A \supset B) \bullet (B \supset A)$
  - $(P \vee {\sim}Q) \bullet {\sim}[P \equiv (Q \bullet R)]$

Disjunction

- Some disjunction indicators
  - or
  - either
  - unless
- Some English sentences which we can represent as disjunctions.
  - Either Paco makes the website, or Matt does.
  - Jared or Rene will go to the party.
  - Justin doesn’t feed the kids unless Carolyn asks him to.
- Sample Disjunctions
  - $\sim P \vee Q$
  - $(A \supset B) \vee (B \supset A)$
  - $(P \vee \sim Q) \vee \sim[P \equiv (Q \bullet R)]$

Material Implication (The Conditional)

- Some material implication indicators
  - if
  - only if
  - only when
  - is a necessary condition for
  - is a sufficient condition for
  - implies
  - entails
  - means
  - provided that
  - given that
  - on the condition that
  - in case

Translating Conditionals

A: Marina dances; B: Izzy plays baseball

1. If Marina dances, then Izzy plays baseball.
2. Marina dances if Izzy plays baseball.
3. Marina dances only if (only when) Izzy plays baseball.
4. Marina dancing is a necessary condition for Izzy playing baseball.
5. Marina dancing is a sufficient condition for Izzy playing baseball.
6. A necessary condition of Marina dancing is Izzy playing baseball.
7. A sufficient condition for Marina dancing is Izzy playing baseball.
8. Marina dancing me entails (implies, means) that Izzy plays baseball.
9. Marina dances given (provided, on the condition) that Izzy plays baseball.

1. If A then B
2. If B then A
3. A only if (only when) B
4. A is necessary for B
5. A is sufficient for B
6. B is necessary for A
7. B is sufficient for A
8. A entails (implies) B
9. A given B

Necessary and Sufficient Conditions

- Sufficient conditions are antecedents
- Necessary conditions are consequents
- SUN
- Playing basketball is sufficient for my happiness: $P \supset H$
- Playing basketball is necessary for my happiness: $H \supset P$
- "Playing ball is sufficient for my happiness, but if I couldn't play basketball, I'd find other ways to enjoy myself."
  - $P \supset H$
- "I can't imagine life without basketball, but it's not enough for me. It's necessary for my happiness, but not sufficient.
  - $H \supset P$

Sample Conditionals

- $\sim P \supset Q$
- $(A \supset B) \supset (B \supset A)$
- $(P \vee \sim Q) \supset \sim[P \equiv (Q \bullet R)]$

The Material Biconditional

- Some biconditional indicators
  - if and only if
  - is a necessary and sufficient condition for
  - just in case.
- ‘A ≡ B’ is short for ‘(A ⊃ B) • (B ⊃ A)’
- An English sentence we can represent as a biconditional
  - You’ll be successful just in case you work hard and are lucky.
- Sample biconditionals
  - ~P ≡ Q
  - (A ⊃ B) ≡ (B ⊃ A)
  - (P ∨ ~Q) ≡ ~[P ≡ (Q • R)]

Ambiguous Cases

You may have salad or potatoes and carrots.

- $(S \vee P) \bullet C$
- $S \vee (P \bullet C)$
- You may have salad or potatoes, and carrots.
  - $(S \vee P) \bullet C$
- You may have salad, or potatoes and carrots.
  - $S \vee (P \bullet C)$

Syntax of PL

- Capital English letters, used as propositional variables
  - A ... Z
- Five connectives
  - ~, •, ∨, ⊃, ≡
- Punctuation
  - (,), [,], {, }

Wffs

- baker and aebkr
- Some wffs
  - P • Q
  - (~P ∨ Q) ⊃ ~R
- Not wffs
  - • P Q
  - Pq ∨ R~

Formation Rules for Wffs

1. A single capital English letter is a wff.
2. If α is a wff, so is ~α.
3. If α and β are wffs, then so are:

   (α · β)
   (α ∨ β)
   (α ⊃ β)
   (α ≡ β)

- By convention, you may drop the outermost brackets.

4. These are the only ways to make wffs.

Analyzing Wffs

- $\sim P \supset [\sim(A \bullet B) \vee (Z \bullet Y)]$
- $(A \vee X) \supset (Y \bullet B) \equiv \sim Q$

HW for Wednesday

- Translation from English to PL and back
- wffs