Philosophy of the Human Person
Lecture #3

Stoic Logic: Basic Forms

syllogism—"a discourse in which, certain things being stated, something other than what is stated follows of necessity from their being so"—Aristotle

- Stoic syllogisms
  - begin with [i.e., have as premises]
    - a compound proposition stating a logical relation between two propositions
    - the assertion or denial of one of the component propositions
  - end with [i.e., have as a conclusion]
    - the assertion or denial of the other of the component propositions
- the three logical relations on which Stoic syllogisms depend
  - if … then … symbolized: p □ q
  - … or … symbolized: p q
  - not both … and … symbolized: p ↑ q or ~(p □ q)

a. if-then

- distinguish
  - premise & conclusion
    - "You don't study hard.
    - So, you'll do badly on examinations."
  - conditional (or hypothetical) statement connecting antecedent & consequent
    - "If you don't study hard, you'll do badly on you examination"
    - these have, as essential constituents, antecedent & consequent
      - antecedent—you don't study hard
      - consequent—you'll do badly on you examination
      - but they do not *assert* the antecedent
      - they only state what else would be true if the antecedent were
    - conditionals are useful because we often want to state a consequence of a proposition before we know whether the proposition is true
      - e.g., in scientific work we may not know whether a theory is true
      - the best way to find out is to draw some predictions (consequences) from it and see whether the predictions correspond with experimental or observational results
  - conditionals can express …
    - sufficient conditions
      - S is the sufficient condition of Q
        - write: S □ Q
        - for example

- it is a sufficient condition of being elected President of the United States that one receive a majority of votes in the Electoral College
- E = George Bush received a majority of votes in the Electoral College
- P = George Bush is President
- If George Bush received a majority of votes in the Electoral College, then George Bush is President
- $E \supset P$

sometimes if-statements express absolute sufficiency, as above

sometimes, only relative sufficiency

- for example, "If this paper is combustible, then it will catch fire whe I put this match to it"
  - strictly, combustibility is not sufficient, since fire also requires the presence of oxygen, but sufficient relative to an ordinary situation (in which oxygen would be assumed to be present)

N is a necessary condition of Q

- write: $P \supset N$
- for example
  - it is a necessary condition of being President of the United States that one be at least 35 years of age
  - P = George Bush is President
  - T = George Bush is at least 35 years of age
  - If George Bush is President, then George Bush is at least 35 years of age
  - $P \supset T$

arguments grounded in if-then ("hypothetical syllogisms")

- two basic forms of hypothetical syllogism
  - examples
    - *Modus ponens*—"If John got an "A" on all of his examinations, he'll get an "A" for the course. John did get an "A" on all his examinations. So, he will get an "A" for the course.
    - *Modus tollens*—"If this is pure water, it will evaporate at 212° F. It does not evaporate at 212°. So, it is not pure water."
  - formally

Modus ponens	$P \supset Q$ P $\therefore Q$	affirming the antecedent leads to affirming consequent
Modus tollens	$P \supset Q$ $\sim Q$ $\therefore \sim P$	denying the consequent leads to denying antecedent

  - determination of truth of simple proposition is possible if (but only if) the right component is affirmed or denied one must be careful that one is affirming or denying the right component—affirming the consequent or denying the antecedent does not lead to any conclusion

example of fallacious reasoning (or fallacies)

“If the liquid in this flask is water, it is tasteless. It is tasteless. So, it is water.”

NB: it is possible to have compound antecedents (or consequents)

e.g., “If this is pure water and it is at standard temperature & pressure, then it will evaporate at 212° F. This is pure water and it is at standard temperature & pressure. So, it will evaporate at 212° F.”

formally,

(P□Q) □ R
(P□Q)
□ R

b. not-both

argument grounded in not-both

symbolically—either (p↑q) or ~(p□q)

example

“John can’t both have worked hard on his biology project and gone to the party last night. He did go to the party. So he can’t have worked hard on his project.”

form

Disjunctive Syllogism with “not both”	P↑Q P □ □Q	affirming one component requires denying the other

since “not-both” is commutative, it does not matter which component one affirms, but it matters that one affirms with “not-both”

denying one disjunct allows no conclusion about the other

c. or

argument grounded in “or” (disjunctive syllogism)

example

“[Since he’s Irish], either his father is Irish or his mother is. But his mother is not Irish. So, his father is.”

form

Disjunctive Syllogism (with “or”)	P Q ~P □ Q	denying one disjunct requires affirming the other

in effect—process of elimination

“or” is commutative—(p q) is equivalent to (q p)

so, it does not matter which component one denies, but it matters that the other premise *denies* one of the disjuncts

- since the disjunction is compatible with both disjuncts being true …
  - affirming one disjunct allows no conclusion about the other

two meanings of “or”
- the inclusive “or”—one or the other or both (i.e., at least one)
  - e.g., Speaking about someone who got into a very selective college: “Either he had very high test scores or he had very good letters of recommendation from his teachers.”
    - Such a person, the speaker says, must have had at least one, but there’s no reason to think that the student could not have had both
  - this is the sense symbolized by p q
- the exclusive “or”—one or the other but not both (i.e., exactly one)
  - e.g., Speaking about the presidential election: “Either Bush will be elected or Kerry will.”
    - obviously, not both will be elected
  - this could be symbolized as p_q
  - but can also be written as (p q) □ (p↑q)—one or the other, but not both
- why this is important
  - some arguments that are invalid on the inclusive sense are valid on the exclusive sense
  - e.g.,
    - Either Bush will be elected or Kerry will.
    - Bush will be elected.
    - So, Kerry will not be elected.
- how does one decide which “or” is meant?
  - and
    - which symbol to use
    - whether a particular argument is valid
  - first, note that both senses of “or” include the connection p q
    - so, *any time* one has two statements connected by an “or” one should write at least that
  - second, one should only add p↑q if there is a particular reason to do so
    - the most common particular reasons would be
      - an explicit statement of the speaker to the effect that “not both”
      - background knowledge that justifies this
        - as in the election example above
      - when charity requires it
        - if the validity of an argument requires that the speaker mean “not both,” one might note that rather than just say that the argument is invalid
        - but this does require writing (p q) □ (p↑q)
        - p q along with p does not lead to a conclusion
          - p q *is* the inclusive or

d. summary

Hypothetical Syllogisms		Disjunctive Syllogisms	
Modus Ponens	Modus Tollens	with ‘or’	with ‘not both’
P⊃ Q P ∴ Q	P⊃ Q ~Q ∴ ~P	P Q ~P ∴ Q	P↑Q P ∴ ~Q