

What to do with logic and inference?



General concepts

The truth of *contingent statements* depends on what exists or occurs in the world. (Look the word 'contingent' up in your dictionary).

The truths of reason, *necessary truths*, are true in this world and in all possible worlds.

Logic is the study of valid reasoning.

Valid/invalid are judgements about the form of an argument.

True/false are judgements made about the content/language of an argument.

A *sound* argument is both valid and true.

Deductive arguments reason from the general to the specific, while *inductive* arguments reason from a collection of particulars to a generalization.

Deductive arguments forms are called *syllogisms*: *categorical*, *hypothetical*, *disjunctive*.

5. If she goes on a diet, then she will lose weight.
And she went on a diet .
So, she lost weight.
6. If I take the poison, then I will die.
But I didn't die .
So, didn't take the poison.
7. If he likes me, then he will call me.
And he called me .
So, he likes me.
8. If he does not like me, then he will not call me.
He called me .
So, he likes me.
9. If she loves me, then she will marry me.
She doesn't love me .
She won't marry me.
10. If it snows, then my car won't start.
My car started .
Thus, it didn't snow.
11. If it snows, then school will be closed.
It didn't snow .
So, the school will not be closed.
12. It didn't snow or the school will be closed.
It did snow .
The school will be closed.
13. She will cook or I will starve.
She didn't cook .
I starved.
14. She will cook or I will starve.
She cooked .
So, I didn't starve.

Exercise 2

Which of these hypothetical types of syllogisms are valid (V) and which are invalid (inV)?
Which type (a,b,c,d,e,f) are each of the examples in exercise 1?

- | | | | | | |
|----------------------|----------------------|----------------------|----------------------|----------------|----------------|
| a. $p \Rightarrow q$ | b. $p \Rightarrow q$ | c. $p \Rightarrow q$ | d. $p \Rightarrow q$ | e. $p \vee q$ | f. $p \vee q$ |
| $\frac{p}{q}$ | $\frac{q}{p}$ | $\frac{-p}{-q}$ | $\frac{-q}{-p}$ | $\frac{-p}{q}$ | $\frac{p}{-q}$ |

Symbolic logic

Truth tables for the fundamental compound propositions:

Negation, 'not p', $\sim p$

p	$\sim p$
T	F
F	T

Conjunktion, 'p and q', $p \wedge q$

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

Disjunktion, 'p or q', $p \vee q$

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

Exclusive disjunktion, 'either p or q', $p \oplus q$

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

Implication, 'if p then q', $p \Rightarrow q$

p	q	$p \Rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

Bimplication, 'p if and only if q', $p \Leftrightarrow q$

p	q	$p \Leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

Logical equivalence

If two (compound) propositions have the same truth values in every possible case, the propositions are called *logically equivalent*.

Exercise 3

Complete these truth tables and conclude which composed propositions are logically equivalent.

p	q	$\sim p$	$\sim q$	$\sim(p \wedge q)$	$\sim p \vee \sim q$	$p \Rightarrow q$	$\sim q \Rightarrow \sim p$	$\sim p \vee q$	$q \Rightarrow p$	$\sim p \Rightarrow \sim q$
T	T	F								
T	F	F								
F	T	T								
F	F	T								

When $p \Rightarrow q$, p is called a *sufficient condition* for q, and q is called a *necessary condition* for p. p is sufficient for q, because 'if p then q'. q is necessary for p, because 'if not q then not p'.

Logic and ordinary language - argument recognition

Exercise 4

1. If the guard was not paying attention at the time, the car was not noticed when it came in.
2. If the witness's account is correct, the guard was not paying attention at the time.
3. Either the car was noticed or Jones is hiding something.
4. Jones is not hiding anything.
5. Therefore: The witness's account is not correct.

From John Hospers:

"An Introduction to Philosophical Analysis, Routledge, London, 1990 (3.ed) p. 106.

Name the single propositions with letters (p, q, r ...). Transform the compound propositions to symbolic statements. Use the rules of inference or truth tables to check if the conclusion is correct.

Exercise 5 (from TOK Teachers guide 1989)

In everyday speech, it would be a bit queer to spell everything out, although in a formal demonstration of evidence of an assertion, this is a requirement.

In these everyday statements identify premises and conclusion (or invent them if they are missing). (Common premise indicators are: 'since', 'because', 'for', 'given that', 'in view of'; common conclusion indicators are: 'thus', 'it follows that', 'hence', 'so', 'therefore'.)

1. The defendant is insane, so he is not guilty.
2. That is not a good dictionary, because it does not give the origin of the word.
3. All philosophers are eccentric and Karl is a philosopher.
4. Coffee must contain a stimulant, because it keeps people awake.
5. He is either on this flight or the next one, and he was not on this one.

Exercise 6 (from TOK Teachers guide, 1989)

Find the form (hypothetical or disjunctive) and the validity (valid or invalid) of the following arguments:

1. If inflation is allowed to continue, the unions will demand a steep rise in wages. And that is what is going to happen, because inflation is going to be allowed to continue.
2. The alternatives seem to be that the United States government weakens its NATO commitment by withdrawing troops from Europe or that it meets increasing criticism at home for the enormous funds spent in maintaining these troops abroad. The government will never weaken its NATO commitment: so we may expect that criticism to increase.
3. The food in the cafeteria will improve or there will be a student strike. And since there is a student strike scheduled for tomorrow, it follows that the food will improve.
4. The streets are no safer today than they were five years ago; yet if the Crime Control Act was effective, we would expect streets to be safer. Hence, the Act was not effective.

5. Granted that only if there were no problems on earth, man should explore the moon. But you admit that there are problems on earth, so man should not be spending money to explore the moon.
6. If people disagree about whether human beings descended from lower forms of animals or were specially created, then the textbooks in biology should state explicitly that this question has not been settled by science. They do disagree, and that is what the textbooks should say.
7. Maybe the Governor did accept bribes from the racing syndicate to fix the races, or maybe, on the other hand, these accusations are just vicious rumours spread by his political enemies. The latter I cannot believe, so I conclude that the Governor took the money.
8. By 1985, either we will institute far-reaching procedures to recycle our trash, or by 1985 we will have to find room to dispose of 440 million tons of waste paper, junk cars and plastics that will be produced each year by the affluent society. But we are assured that somehow such room will be found, so large scale recycling will not be necessary.
9. If the French tend to eat, drink, and smoke more than people in other European countries, then we may assume their life-expectancy to be lower than people in, for example, Great Britain, Denmark, Italy, Germany, and this is exactly true. The French men live an average of 67.1 years: women 74.6 years: a good deal lower than other European citizens. The conclusion? The French eat, drink, and smoke too much.

Exercise 7

Find a short text; it can be a fragment of an article from a newspaper or a magazine or from a novel, shortstory or poem. Make a logical analysis of the text, trying to identify examples of syllogisms, discussing type, validity, missing or hidden parts, symbolic representation etc.

As an example follows here on the next page a poem by Andrew Marvell: "To His Coy Mistress". (Published 1681).

Glossary (v. Bjarne Weidick):

coy = bly, undselig, knibsk. mistress = elskede, kæreste, elskerinde. but = kun. thou shouldst = you should.
 tide = tidevand, strøm. The Flood = Syndfloden. conversion = omvendelse.
 vegetable = grøntsag, plante, T (om person): kedeligt løg, hjælpeløst vrag. show = lægge for dagen, påvise.
 state = ære. rate = fart, pris. wing = bevinge. chariot = stridsvogn. yonder = (archaic) hist, derhenne, derovre.
 vault = gravhvælving. quaint = gammeldags; mærkelig, løjerlig. private = hemmelig, fortrolig. hue = lød (farve).
 transpire = (på Marvell's tid) ånde (ud). sport = more sig. devour = sluge, fortære.
 languish = sygne hen, blive mat. rough = rå, ublid, voldsom. strife = strid.

Exercise 8

Do the Cornell Condition-Reasoning Test, Form X, following. (From TOK Teachers Guide, 1989).

Andrew Marvell

To His Coy Mistress

Had we but world enough, and time,
This coyness, lady, were no crime.
We would sit down, and think which way
To walk, and pass our long love's day.
Thou by the Indian Ganges' side
Shouldst rubies find; I by the tide
Of Humber would complain. I would
Love you ten years before the flood,
And you should, if you please, refuse
Till the conversion of the Jews.
My vegetable love should grow
Vaster than empires and more slow;
An hundred years should go to praise
Thine eyes, and on thy forehead gaze;
Two hundred to adore each breast,
But thirty thousand to the rest;
An age at least to every part,
And the last age should show your heart.
For, lady, you deserve this state,
Nor would I love at lower rate.

But at my back I always hear
Time's winged chariot hurrying near;
And yonder all before us lie
Deserts of vast eternity.
Thy beauty shall no more be found,
Nor, in the marble vault, shall sound
My echoing song; then worms shall try
That long-preserved virginity,
And your quaint honor turn to dust,
And into ashes all my lust:
The grave's a fine and private place,
But none, I think; do there embrace.
Now therefore, while the youthful hue
Sits on thy skin like morning dew,
And while thy willing soul transpires
At every pore with instant fires,
Now let us sport us while we may,
And now, like amorous birds of prey,
Rather at once our time devour
Than languish in his slow-chapped power.
Let us roll all our strength and all
Our sweetness up into one ball,
And tear our pleasures with rough strife
Thorough the iron gates of life:
Thus, though we cannot make our sun
Stand still, yet we will make him run.

Humber: Compared to the gorgeous Oriental Ganges, the Humber (which flows through Marvell's home town of Hull) is a dull and unassuming little stream.
complain: implies songs of plaintive love.
conversion of the Jews: According to popular chronology, the Jews were to be converted just before the Last Judgement.
you deserve this state: of dignity.

morning dew: The text reads "glew" - an odious reading. "Lew" (meaning "warmth" has also been suggested, but it was obsolete long before Marvell wrote.
transpires: breathes forth.
instant fires: immediate, present enthusiasm.
slow-chapped: slow-jawed. Time is envisaged as slowly chewing up the world and the people in it.