Solutions to First-Term Test for *Introduction to Logic*

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1

A sentence *type* is an abstract object, one which can be thought of as being 'arrived at' by abstraction from sentence *tokens*. If I write 'Anna is a philosopher' and then, again, 'Anna is a philosopher', then I have written two *tokens* of the same type. The tokens are not abstract objects: they have physical location, and each is constituted by written marks. That they are of the same sentence-type is indicated by the fact that they have the same written marks in the same order. The sentence tokens are said to *instantiate* the types.

(One might question here whether 'She dove in the spring' (it wasn't winter) and 'She dove in the spring' (the water was so cool), with two different senses of 'spring', should be considered to be sentences of the same type for our purposes. Not just *shape* is relevant to type-individuation.)

2

a. 'Rome' refers to Rome. (Meaningful and true.)

   ''Rome'' refers to 'Rome'. (Meaningful and true.)

   'Rome' refers to 'Rome'. (Meaningful and false.)

   (Many other possibilities for the meaningfully true and meaningfully false.)

b. ''Rome'' refers to the linguistic expression 'Rome'. (Meaningful and true.)

   '''Rome''' refers to the linguistic expression ''Rome''. (Meaningful and true.)

   'Rome' refers to the linguistic expression 'Rome'. (Meaningful and false.)

   (Many more possibilities.)

c. Rome is the capital of Italy.

d. His friends called Django 'Django'.

e. ''Django'' is being used in ''Django' contains six letters'. (Meaningful and true.)

   '''Django''' is being used in '''Django'' contains six letters' letters'. (Meaningful and false.)

   (There are many other possibilities for the meaningfully false.)

f. '''Django''' designates the linguistic expression that designates the linguistic expression that designates Django. (Meaningful and true.)

   ''''Django'''' designates the linguistic expression that designates the linguistic expression that designates 'Django'. (Meaningful and true: and for any similar member of the series.)

   'Django' designates the linguistic expression 'that designates the linguistic expression that designates Django'. (Meaningful and false.)

   (Many other possibilities for the meaningfully false.)

3

a. A *declarative sentence* is a linguistic expression that is true or false. For example, 'Frege wrote *Grundlagen*', 'Russell liked Church', etc., but not 'Sit down, you oaf!' or 'Is this is a dagger which I see before me?'.

(Given that we have agreed that 'sentences' are for us sentence *types*, then a declarative sentence is a sentence type which is true or false. This further promotes the reflections at the end of the answer for (1), above. Note that there need be no implication that truth or falsity attaches to sentences primarily: they could be a property of thoughts or propositions, say, and apply to sentences derivatively.)

b. A *simple declarative sentence* is a declarative sentence which has the logical form $P(t_1, \ldots, t_n)$, where P is an n-ary predicate and $t_1, \ldots, t_n$ are n singular terms. For example: 'Wittgenstein is angry', 'Afla is to the left of Ateb'.

c. A *complex, sententially decomposable declarative sentence* is a declarative sentence which has a logical form of a conjunction $(A \wedge B)$, negation $(\neg A)$, disjunction $(A \vee B)$, material implication $(A \rightarrow B)$ or biconditional $(A \leftrightarrow B)$, or other formula whose main connective is a sentential operator. For example: 'Wyatt and Sydney were sonneteers', 'Trump is not electable', etc.

4

a. Declarative and simple (so, not decomposable).
b. Declarative, not simple, not sententially decomposable.
c. Non-declarative.
d. Declarative, not simple, sententially decomposable.
e. Declarative, not simple, sententially decomposable.
f. Declarative (depending on the truth of some philosophical views), not simple, not sententially decomposable.
g. Declarative, simple, not sententially decomposable.
h. Non-declarative.
i. Declarative, not simple, sententially decomposable (I'd say).
j. Declarative, not simple, not sententially decomposable.

5

a. $p \vee q \rightarrow r$
b. $p \vee (q \rightarrow r)$
c. $(p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \wedge (p \rightarrow r))$
d. $(p \leftrightarrow q) \wedge (r \vee s)$
e. $p \wedge (q \vee r) \leftrightarrow (p \wedge q) \vee (p \wedge r)$

6

p	q	$p \vee q$
t	t	**t**
t	f	**t**
f	t	**t**
f	f	**f**

p	q	$p \rightarrow q$
t	t	**t**
t	f	**f**
f	t	**t**
f	f	**t**

p	q	$p \leftrightarrow q$
t	t	**t**
t	f	**f**
f	t	**f**
f	f	**t**

7

a. A *tautological* formula is one which is true no matter which truth-values are assigned to its sentential variables. Thus, the formula's main connective has a `t` beneath it in every row of its truth table.

   E.g.: $p \lor \neg p$.

b. A *contradictory* formula is one which is false no matter which truth-values are assigned to its sentential variables. Thus, the formula's main connective has a `f` beneath it in every row of its truth table.

   E.g.: $p \land \neg p$.

c. A formula is *contingent* just when it is neither tautological or contradictory. It has at least one `t` and one `f` beneath its main connective in the truth table.

   E.g.: p.

8

a. $p \land q$
b. $p \land q \to p \lor q$
c. p
d. $p \to (q \to r)$
e. p
f. $(p \land q) \to \neg(r \land s)$

   This might also be possible: $(\neg p \land \neg q) \to \neg(p \land q)$. Which you write might depend on your view about the logical relations between 'happpy' and 'unhappy'.

g. $p \leftrightarrow q$
h. $p \lor q$
i. $p \to q$
j. $(p \to q) \land (\neg p \to q)$

9

a.

p	q	$\neg$	$(p \lor q)$	$\lor$	$(p \land$	$\neg q)$
t	t	f	t	**f**	f	f
t	f	f	t	**t**	t	t
f	t	f	t	**f**	f	f
f	f	t	f	**t**	f	t

b.

p	q	$(p \to q)$	$\to$	$\neg p$	$\lor\ q$
t	t	t	**t**	f	t
t	f	f	**t**	f	f
f	t	t	**t**	t	t
f	f	t	**t**	t	t

c.

p	q	$p \to$	$q \land$	$\neg q$
t	t	**f**	f	f
t	f	**f**	f	t
f	t	**t**	f	f
f	f	**t**	f	t

d.

p	q	r	$p \wedge$	$(\neg q$	$\to r)$	$\to$	$\neg(q$	$\to p$	$\wedge r)$
t	t	t	t	f	t	**f**	f	t	t
t	t	f	t	f	t	**t**	t	f	f
t	f	t	t	t	t	**f**	f	t	t
t	f	f	f	t	f	**t**	f	t	f
f	t	t	f	f	t	**t**	t	f	f
f	t	f	f	f	t	**t**	t	f	f
f	f	t	f	t	t	**t**	f	t	f
f	f	f	f	t	f	**t**	f	t	f

e.

p	q	$\neg(($	$p \wedge$	$\neg q)$	$\to$	$\neg($	$\neg p$	$\vee q))$
t	t	**f**	f	f	t	f	f	t
t	f	**f**	t	t	t	t	f	f
f	t	**f**	f	f	t	f	t	t
f	f	**f**	f	t	t	f	t	t

10

a.

p	q	r	$p \to q$	$q \to r$	$p \to r$
t	t	t	**t**	**t**	**t**
t	t	f	**t**	**f**	**f**
t	f	t	**f**	**t**	**t**
t	f	f	**f**	**t**	**f**
f	t	t	**t**	**t**	**t**
f	t	f	**t**	**f**	**t**
f	f	t	**t**	**t**	**t**
f	f	f	**t**	**t**	**t**

Rows 1, 5, 7 and 8 (in grey) are those in which the premises are all true. For these rows, the conclusion is also true, so the argument is *valid.*

b.

p	q	$\neg p$	$\vee\ q$	q	$\neg p$
t	t	f	**t**	**t**	**f**
t	f	f	**f**	**f**	**f**
f	t	t	**t**	**t**	**t**
f	f	t	**t**	**f**	**t**

Rows 1 and 3 (in grey) make all premises true. However, row 1 also has the conclusion false. This means the argument is *invalid.*