
24.903
 Language & Structure III: Semantics and Pragmatics
 Spring 2003, 2-151, MW 1-2.30
 April 2, 2003
 Assignment 6, due in class on April 9

1. Provide truth tables for the following statements.

- i. $[[p \vee \neg q] \rightarrow [\neg p \leftrightarrow q]]$
- ii. $[[p \wedge [p \rightarrow q]] \rightarrow q]$
- iii. $[[[p \rightarrow q] \wedge [q \rightarrow r]] \wedge \neg[\neg p \vee r]]$
- iv. $[[\neg p \wedge q] \leftrightarrow [p \vee q]]$
- v. $[[[p \vee q] \wedge [r \vee \neg q]] \rightarrow [p \vee r]]$

2. There is a two place connective $|$ called the ‘Sheffer Stroke’ with the following truth table:

p	q	$p q$
1	1	0
1	0	1
0	1	1
0	0	1

- a. Define \neg , \vee , and \wedge in terms of $|$ only.
- b. Define $|$ in terms of \neg , \vee , and \wedge .
- c. There is one other two place connective Υ , called the Quine dagger, which is similar to $|$ in that it can be used to define both \neg , \vee , and \wedge . Find it, provide its truth table, and do (a) and (b) for it. If you have done (b) correctly, finding the relevant connective should be relatively easy.

3. Let ϕ be a tautology, ψ a contradiction, and χ a contingency. Which of the following sentences are (i) tautological, (ii) contradictory, (iii) contingent, (iv) logically equivalent to χ .

- a. $\phi \wedge \chi$
- b. $\phi \vee \chi$
- c. $\psi \wedge \chi$
- d. $\psi \vee \chi$
- e. $\phi \vee \psi$
- f. $\chi \rightarrow \psi$

**4. Refute the following general assertion by providing a formula to which it does not apply:
 If $\phi \vee \psi$ is a tautology, then ϕ is a tautology or ψ is a tautology.**

- 5. Construct a formal proof of validity for each of the following arguments using the suggested notation:**
- (a) If either Argentina or Brazil joins the alliance then if either Chile or Ecuador boycotts it then Peru will not boycott it but Venezuela will boycott it. If either Peru or Nicaragua does not boycott it then Uruguay will join the alliance. Therefore if Argentina joins the alliance then if Chile boycotts it then Uruguay will join the alliance. (A, B, C, E, P, V, N, U)¹
 - (b) If we go to Europe then we tour Scandinavia. If we go to Europe then if we tour Scandinavia then we tour Norway, If we tour Scandinavia then if we visit Norway then we will take a trip on a fjord. Therefore if we go to Europe then we will take a trip on a fjord. (E, S, N, F).

¹You should make the assumption that not boycotting the alliance is the same as joining it. It might be best if you first convert all instance of boycotting into instances of ‘not joining’ and then formalize the argument.