Philosophy 220A
Symbolic Logic I

Instructor: Richard Johns

Answers to Problem Set 3

Total: 42 marks

3.21 [1 mark each]

1. Small(a) $\vee$ (Large(c) $\wedge$ Large(d))
2. BackOf(d, b) $\wedge$ BackOf(e, b)
3. BackOf(d, b) $\wedge$ BackOf(e, b) $\wedge$ Larger(d, b) $\wedge$ Larger(e, b)
4. Cube(d) $\wedge$ Cube(c) $\wedge$ $\neg$Small(d) $\wedge$ $\neg$Small(c)
5. $\neg$(RightOf(e, c) $\wedge$ LeftOf(e, b)) $\wedge$ $\neg$(RightOf(a, c) $\wedge$ LeftOf(a, b))
6. $\neg$Large(e) $\vee$ BackOf(e, a)
7. $\neg$Between(c, a, b) $\wedge$ $\neg$FrontOf(c, a) $\wedge$ $\neg$FrontOf(c, b)
8. (Tet(a) $\wedge$ Tet(e)) $\vee$ (Tet(a) $\wedge$ Tet(f))
9. $\neg$FrontOf(d, c) $\wedge$ $\neg$FrontOf(d, b) $\wedge$ $\neg$FrontOf(c, c) $\wedge$ $\neg$FrontOf(c, b)
10. Between(c, d, f) $\vee$ (Smaller(c, d) $\wedge$ Smaller(c, f))
11. $\neg$SameRow(b, c)
12. SameCol(b, e) $\wedge$ SameRow(e, d) $\wedge$ SameCol(d, a)

1. (i) Tautology, *need whole table*. [2 marks for table, 2 for the verdict]

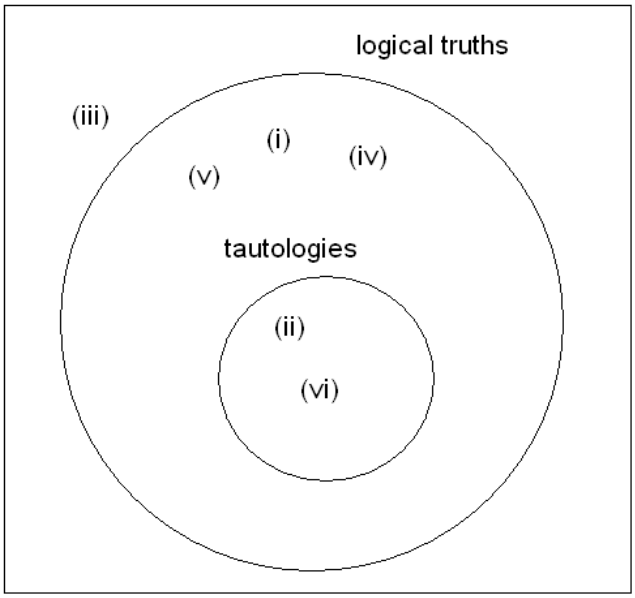
A	B	¬(A ∧ (¬A ∨ B)) ∨ B
T	T	F T F T T
T	F	T F F F T
F	T	T F T T T
F	F	T F T T T

(ii) Not a tautology. *Row 1 is sufficient*. [2 marks for table, 2 for the verdict]

C	A	B	¬C ∨ ¬(A ∧ B ∧ C)	
T	T	T	F F F T T	*
T	T	F	F T T F F	
T	F	T	F T T F F	
T	F	F	F T T F F	
F	T	T	T T T T F	
F	T	F	T T T F F	
F	F	T	T T T F F	
F	F	F	T T T F F	

N.B. (A ∧ B ∧ C) is understood to represent the FOL sentence ((A ∧ B) ∧ C), according to the convention on p. 101 of the textbook. But if you took it to mean (A ∧ (B ∧ C)) then that will also be fine.

2. [1 mark each, total 6]



(i) $2 = 2$

(ii) $\text{Tet}(d) \vee \neg\text{Tet}(d)$

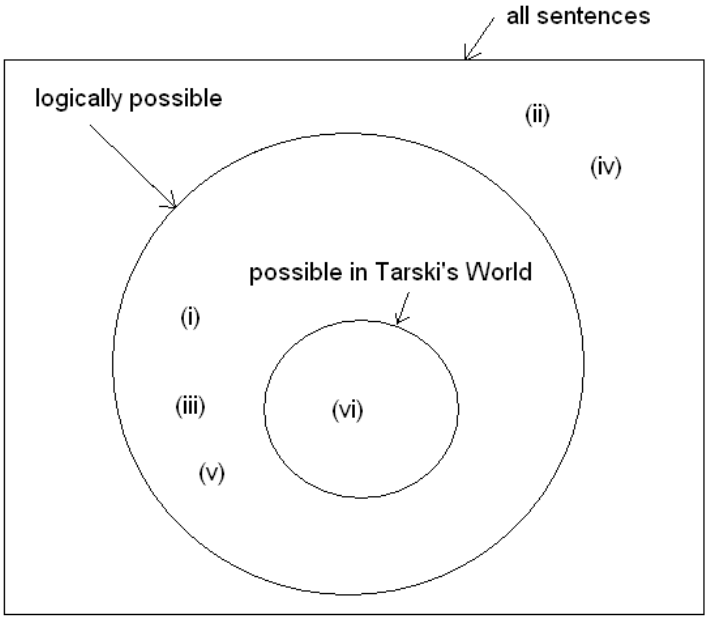
(iii) $\text{Cube}(a) \vee \text{Small}(a)$

(iv) $\neg\text{Small}(a) \vee \neg\text{Large}(a)$

(v) $\neg(\text{Tet}(a) \wedge \text{Cube}(b) \wedge a = b)$

(vi) $\neg(\text{Smaller}(a, b) \wedge \neg\text{Smaller}(a, b))$

3. [1 mark each, total 6]



(i) $\text{Small}(a) \wedge \text{Smaller}(b, a)$

(ii) $\text{SameSize}(a, b) \wedge \text{Small}(a) \wedge \text{Large}(b)$

(iii) $\text{Large}(a) \wedge \text{Large}(b) \wedge \text{Adjoins}(a, b)$

(iv) $a = b \wedge \neg\text{SameRow}(a, b)$

(v) $\neg(\text{Cube}(a) \vee \text{Tet}(a) \vee \text{Dodec}(a))$

(vi) $\text{Tet}(a) \wedge \text{Cube}(b) \wedge \text{Larger}(a, b)$

4. (i)

(a) is a logical consequence, and a TT con as well. [2 marks]

(b) is a logical consequence, but isn't TT con. [2 marks]

(a)

$\neg(\text{Larger}(a, b) \wedge \text{Tet}(c))$
$\text{Larger}(a, b)$
———
$\neg\text{Tet}(c)$

(b)

$\text{Larger}(a, b) \vee \text{Cube}(c)$
$a = b$
———
$\neg\text{Tet}(c)$

(ii) Show that one of the arguments above is not TT con by means of *one row* of a truth table.

Larger(a,b)	Cube(c)	a=b	Tet(c)	Larger(a,b) ∨ Cube(c)	a=b	¬Tet(c)
T	T	T	T	T	T	F
T	F	T	T	T	T	F
F	T	T	T	T	T	F

(***Any one*** of these 3 rows will suffice.) [2 marks for one suitable row]

4.12 TT equivalent. (N.B. need whole table.) [2 marks for the table]

(1) A	(2) B	(1) ¬(A ∨ B)		(2) ¬A ∧ ¬B		
T	T	F	T	F	F	F
T	F	F	T	F	F	T
F	T	F	T	T	F	F
F	F	T	F	T	T	T
		(1)		(2)		

4.17 TT equivalent. (N.B. need whole table.) [2 marks for the table]

(1) A	(2) B	(3) C	(1) A ∧ (B ∨ C)		(2) (A ∧ B) ∨ (A ∧ C)		
T	T	T	T	T	T	T	T
T	T	F	T	T	T	T	F
T	F	T	T	T	F	T	T
T	F	F	F	F	F	F	F
F	T	T	F	T	F	F	F
F	T	F	F	T	F	F	F
F	F	T	F	T	F	F	F
F	F	F	F	F	F	F	F
			(1)			(2)	