

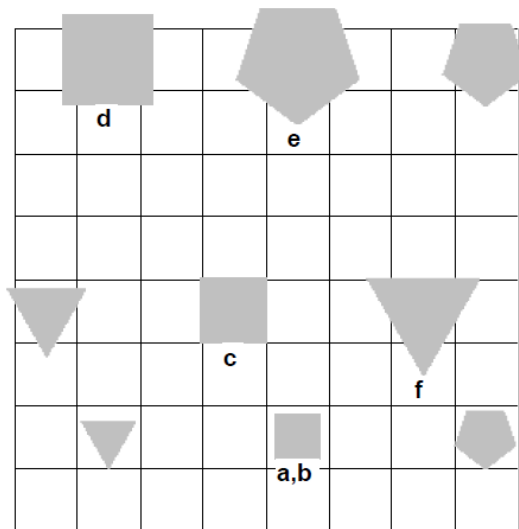
Answers to Problem Set 3

[Total: 50 marks]

By the way, please lay out your answers like mine, in the correct sequence.

1. [2 marks each, 16 total]

1. $\text{SameSize}(d, f) \wedge \text{SameSize}(e, f)$
2. $\neg \text{SameRow}(b, c)$
3. $\text{BackOf}(d, a) \wedge \text{Larger}(d, a)$
4. $\neg \text{Tet}(d) \wedge \neg \text{Tet}(b)$
5. $\neg (\text{LeftOf}(c, b) \wedge \text{LeftOf}(f, b))$
6. $(\text{LeftOf}(a, d) \wedge \text{LeftOf}(a, f)) \vee (\text{Smaller}(a, d) \wedge \text{Smaller}(a, f))$
7. $\neg \text{Smaller}(e, c) \wedge \neg \text{Smaller}(f, c) \wedge \neg \text{Smaller}(e, b) \wedge \neg \text{Smaller}(f, b)$
8. $\neg (\text{SameShape}(d, c) \wedge \text{SameRow}(d, c)) \wedge \neg (\text{SameShape}(f, c) \wedge \text{SameRow}(f, c))$



2. (i) Tautology, from whole table. (no F row.) [2 marks for table, 2 for the verdict]

A	B	$(\neg A \vee B) \vee (A \wedge \neg B)$		
T	T	T	T	F
T	F	F	T	T
F	T	T	T	F
F	F	T	T	F

- (ii) Not a tautology, from counter-example rows (*). [2 marks for table, 2 for the verdict]

A	B	$(A \wedge \neg B) \vee (\neg A \wedge B)$		
*T	T	F	F	F
T	F	T	T	F
F	T	F	T	T
*F	F	F	T	F

3. [1 mark each, 5 total]

		logical truth?	tautology?
(i)	$\text{Dodec}(b) \vee \neg \text{Dodec}(b)$	Yes	Yes
(ii)	$\neg (\text{Cube}(a) \vee \text{Larger}(a, b))$	No	No
(iii)	$\neg \text{Larger}(a, b) \vee \neg \text{SameSize}(b, a)$	Yes	No
(iv)	$\neg (\text{LeftOf}(a, b) \wedge a = b)$	Yes	No
(v)	$\neg (\text{Smaller}(a, b) \wedge \neg \text{Smaller}(a, b))$	Yes	Yes

4. [1 mark each, 5 total]

		Logically possible?	TW possible?
(i)	$\text{Larger}(b, a) \wedge \text{Smaller}(b, a)$	No	No
(ii)	$\text{SameSize}(a, b) \wedge \text{Small}(a) \wedge \text{Large}(b)$	No	No
(iii)	$\text{Tet}(a) \wedge \text{BackOf}(a, b)$	Yes	Yes
(iv)	$\text{Medium}(c) \wedge \text{Larger}(a, c) \wedge \neg \text{Large}(a)$	Yes	No
(v)	$\neg \text{Cube}(a) \wedge \neg \text{Tet}(a) \wedge \neg \text{Dodec}(a)$	Yes	No

5. (i) [1 mark each]

(a)

$\neg(A \wedge B)$
A
—
$\neg B$

(b)

A \vee B
C
—
$\neg D$

(ii) (a) is a logical consequence, and a TT con as well. [1 mark]

(b) is a logical consequence, but isn't TT con. [1 mark]

(iii) (Any **one** of these 3 rows will suffice. Only the reference columns need to be shown.)
[2 marks for one suitable row]

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

6.

(i) TT equivalent, from whole table. [3 marks for table, 2 for the verdict]

A	B	C	$A \wedge (B \vee C)$		$(A \wedge B) \vee (A \wedge C)$		
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

(ii) Not TT-equivalent, from a counter-example row. [3 marks for table, 2 for the verdict]

D	E	G	$(D \wedge E) \vee G$		$D \wedge (E \vee G)$	
T	T	T	T	T	T	T
T	T	F	T	T	T	T
T	F	T	F	T	T	T
T	F	F	F	F	F	F
*	F	T	F	T	F	T
	F	F	F	F	F	T
*	F	T	F	T	F	T
	F	F	F	F	F	F