

# Answer Keys

## Problem Set 1: PHIL 1068 Elementary Logic: Due 4:00PM 28 January 2011

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### 1. (15 marks)

True or false? Circle 'T' if the statement is true. Circle 'F' if the statement is false.  
For this question, you should assume that  $\varphi$  is a WFF of SL.

- T ☒ F "Be careful Yoda!" is a statement.
- T ☒ F The conclusion of a valid argument must be true.
- T ☒ F If an argument is not sound, then that argument is not valid.
- T ☒ F Some sound arguments have false conclusions.
- ☒ T F " $\sim$ " is the main connective of " $\sim \sim (D \leftrightarrow \sim A)$ ".
- ☒ T F Whenever " $(A \& B)$ " is true, " $(D \vee A)$ " is also true.
- ☒ T F If  $\varphi$  contains the symbol " $\rightarrow$ " then  $\varphi$  contains a two-place connective.
- T ☒ F Logic describes how people reason.
- ☒ T F Some WFF of SL contains exactly 46 symbols.
- ☒ T F The word "drawer" is lexically ambiguous.
- T ☒ F  $\varphi$  might not be an expression of SL.
- T ☒ F  $\varphi$  is either a disjunction or a conjunction.
- ☒ T F The scope of "&" in " $(\sim(\sim P \& Q) \rightarrow P)$ " is " $(\sim P \& Q)$ ".
- T ☒ F Every SL WFF contains at least one connective.
- T ☒ F The antecedent of " $(\sim P \rightarrow Q)$ " is " $P$ ".

1 mark  
each

/15

### 2. (10 marks) Which of the following is a valid argument?

Circle "Yes" if it is a valid argument. Circle "No" if it is not a valid argument.

- ☒ Yes No Some birds cannot fly.  
So, not all birds can both fly and swim.
- Yes ☒ No He wants to be rich.  
Every rich person is unhappy.  
So, he wants to be unhappy.
- ☒ Yes No English is not widely spoken in Jakarta.  
English is widely spoken in Jakarta.  
Therefore, English is widely spoken.
- Yes ☒ No If Plato knew Picasso then Socrates never smiled.  
Socrates never smiled.  
Therefore, either Plato knew Picasso or Plato.
- Yes ☒ No If red is a color, then red is a color.

2 marks  
each

/10

3. (4 marks) Which of the following five expressions is not a WFF of SL?

- $(A \rightarrow B)$   
 $((A \leftrightarrow A) \leftrightarrow ((\sim B \vee A) \vee \sim(B \leftarrow D)))$   
 $\sim \sim (((D \leftrightarrow A) \& A))$   
 $((A \& B) \& \sim A)$   
 $\sim(\sim B)$

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4. (16 marks)

Fill in the blanks with an SL WFF to make correct truth tables.

Each WFF must contain exactly three two-place connectives.

a.

Q	R	P	$(\sim(R \& P) \& (\sim Q \vee R))$
T	T	T	F
T	T	F	T
T	F	T	F
T	F	F	F
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	T

b.

P	Q	R	$((R \vee \sim P) \vee (R \vee \sim P))$
T	T	T	T
T	T	F	F
T	F	T	T
T	F	F	F
F	T	T	T
F	T	F	T
F	F	T	T
F	F	F	T

c.

P	Q	$((\sim P \& \sim Q) \& (\sim P \& \sim Q))$
T	T	F
T	F	F
F	T	F
F	F	T

d.

B	$((\sim B \& \sim B) \& (\sim B \& \sim B))$
T	F
F	T

/16

4 marks each

5. (15 marks) Make a correct truth table for each of the following WFFs of SL.

a.  $((A \& B) \leftrightarrow A_3)$

A	B	A <sub>3</sub>	$((A \& B) \leftrightarrow A_3)$
T	T	T	T
T	T	F	F
T	F	T	F
T	F	F	T
F	T	T	F
F	T	F	T <sup>2</sup>
F	F	T	F
F	F	F	T

b.  $(\sim\sim B \vee (A \rightarrow \sim D))$

B	A	D	$(\sim\sim B \vee (A \rightarrow \sim D))$
T	T	T	T
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	T

c.  $((B \vee A) \rightarrow (A \& \sim D))$

B	A	D	$((B \vee A) \rightarrow (A \& \sim D))$
T	T	T	F
T	T	F	T
T	F	T	F
T	F	F	F
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	T

d.  $((B \vee \sim A) \leftrightarrow \sim(\sim B \& A))$

B	A	$((B \vee \sim A) \leftrightarrow \sim(\sim B \& A))$
T	T	T
T	F	T
F	T	T
F	F	T

e.  $((B \leftrightarrow \sim B) \rightarrow \sim B)$

B	$((B \leftrightarrow \sim B) \rightarrow \sim B)$
T	T
F	T

3 marks  
each

/15