Problem Set 1 Elementary Logic Due: 18 February 2009

Name	
Student ID Number	
email	

Mark _____%

Due 18 February 2009 by 4:00PM.

Submit your problem set to Ms. Loletta Li in Main Building 312. Make sure your problem set is timestamped. Do not submit assignments by email. Late penalty: 10% for each day late. This problem set will not be accepted after 20 February.

Answer the questions on the problem set itself. Write neatly. If the grader cannot read your handwriting, you will not receive credit.

Be sure that all pages of the assignment are securely stapled together.

Check the course bulletin board for announcements about the assignment.

Do your own work. If you copy your problem set, or permit others to copy, you may fail the course.

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 φ is a WFF of SL.

- T F The main connective of " $\sim (A\& \sim B)$ " is not "&".
- T F Whenever " $(A \rightarrow B)$ " is true, " $(A \leftrightarrow B)$ " is also true.
- T F "The red wheelbarrow" is a statement.
- T F Some WFF of SL contains exactly 16845 symbols.
- T F Some valid arguments are not good arguments.
- T F If φ contains the symbol "(" then φ contains a two-place connective.
- T F The conclusion of a valid argument cannot be false.
- T F If the premises of an argument are all true, then the argument is valid.
- T F No argument with a false conclusion contains a hidden assumption.
- T F Logic is a science which explains how people actually reason.

$2.~(15~\mathrm{marks})$

Make a correct truth table for each of the following WFFs of SL. a. $((A \leftrightarrow C)\&B)$

b.
$$((A \leftrightarrow \sim B) \rightarrow \sim A)$$

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

d.
$$((B \to C) \lor \sim \sim A)$$

e.
$$((A \lor \sim C) \lor \sim \sim A)$$

3. (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.		
M	0	
Т	Т	F
Т	F	F
F	Т	Т
F	F	F

b.

В	D	
Т	Т	Т
Т	F	F
F	Т	Т
F	F	Т
Т	Т	Т
Т	F	Т
F	Т	Т
F	F	Т
	B T F F T T F F F F F F F F F	B D T T T F F T F F T T T F T T T T T F F T F F F T F T

c.

A	В	C	
Т	Т	Т	F
Т	Т	F	Т
Т	F	Т	F
Т	F	F	F
F	Т	Т	F
F	Т	F	Т
F	F	Т	F
F	F	F	Т

d.

A	
Т	F
F	F

4. (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	No mammals can fly.
		So, no mammals can both fly and swim.
Yes	No	You are unhappy. Go away, if you are unhappy. So, go away.
Yes	No	Either his shirt is red or it is not red.
Yes	No	If I was late then he was angry. He was not angry. Therefore, either I was not late or he was late.
Yes	No	June follows May. June does not follow May. Therefore, there is melamine in that egg.

5. (5 marks) Which of the following five expressions is a WFF of SL? $(A \leftarrow B)$ $((A\&B)\& \sim A)$ $\sim \sim B$ $(((A \leftrightarrow A) \leftrightarrow ((\sim B \lor A) \lor \sim (B \rightarrow C))))$ $\sim \sim ((C \leftrightarrow A)\&A)$

/5

6. (12 marks)

Translate the following statements into SL. Preserve as much structure as possible. Use the following translation scheme:

A: Plato is sleeping.

- B: Mencius is reading.
- C: Socrates is smiling.
- D: Confucius is reading.

(a) Plato is not sleeping only if neither Mencius nor Confucius is reading.

(b) Whether or not Socrates is smiling, Plato is sleeping.

(c) Mencius is reading, although Confucius is not.

(d) If Socrates is smiling, then either both Mencius and Confucius are reading or neither one is.

/12

7. (5 marks)

Assume that each of the following two statements are false:

Either love does not conquer all, or truth is beauty. If the poet is right, then love conquers all.

Translate each of the two statements into SL, preserving as much structure as possible. Be sure to write down your translation scheme.

Is truth beauty?

8. (10 marks)

For each of the following: Circle "tautology" if it is a WFF of SL that is a tautology. Circle "contingent" if it is a contingent WFF of SL. Circle "inconsistent" if it is an inconsistent WFF of SL. Otherwise, don't circle anything.

tautology	$\begin{array}{c} ((A \lor \sim B) \to \sim A) \\ \text{contingent} \end{array}$	inconsistent
tautology	$((\sim A\&(B\&C)) \to (A \lor C))$ contingent	inconsistent
tautology	$(A \leftrightarrow (C \leftrightarrow A))\&B)$ contingent	inconsistent
tautology	$\begin{array}{c} ((\sim\!\!A \to \sim\!\!B)\&((\sim\!\!B \leftrightarrow A)\&(C \to C)))\\ \text{contingent} \end{array}$	inconsistent
tautology	$((\sim A \to (B \to C)) \lor ((B \to C) \to A))$ contingent	inconsistent
tautology	$\begin{array}{c} ((A \leftrightarrow B) \leftrightarrow ((A \lor C) \leftrightarrow (A\&C))) \\ \text{contingent} \end{array}$	inconsistent
tautology	$\begin{array}{c} ((A \rightarrow {\sim}B)\&(({\sim}B \rightarrow A) \lor (A \rightarrow B))) \\ \text{contingent} \end{array}$	inconsistent
tautology	$(\sim C \rightarrow ((A\&B) \rightarrow (C \lor A)))$ contingent	inconsistent
tautology	$(\sim A \to (B \to A))\&C)$ contingent	inconsistent
tautology	$\begin{array}{c} ((A \to A) \lor (B \to \sim B)) \\ \text{contingent} \end{array}$	inconsistent

9. (12 marks)

Assume that each of the following four statements is **true**:

If Bela was not rude that day, then Bela and Caspar are both cool.

Ambrose is agile only if Caspar is not cool.

Either Bela was rude that day and Bela is not cool, or Bela was not rude that day and Caspar is not cool.

Ambrose is agile.

1. Translate each of the four statements into SL, preserving as much structure as possible. Be sure to write down your translation scheme.

2. Is Bella cool?