Problem Set 1

Elementary Logic

Due: 10 February 2010

Name _____

Student ID Number _____

email _____

Mark _____%

Due **10 February 2010** 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: 25% for each day late. This problem set will not be accepted after 12 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 Every good argument is a valid argument.
T F The conclusion of a valid argument must be true.
T F If the premises of an argument are all true, then the argument is valid.
T F If φ contains the symbol "(" then φ contains a two-place connective.
T F The main connective of "$(\sim\sim A \rightarrow \sim B)$" is "$\rightarrow$".
T F Whenever "$(A \vee B)$" is true, "$(A \leftrightarrow B)$" is also true.
T F "Leave me alone!" is a statement.
T F No WFF of SL contains exactly 37 symbols.
T F A lexically ambiguous word has more than one meaning in a language.
T F If an SL WFF contains the symbol "(" then that WFF contains a one-place connective.

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2. (16 marks)
Fill in the blanks with an SL WFF to make correct truth tables.
Each WFF must contain exactly two two-place connectives.

a.

C	B	A	
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

b.

A	B	C	
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	F
F	F	F	T

c.

A	B	
T	T	F
T	F	T
F	T	T
F	F	T

d.

A	
T	T
F	T

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3. (15 marks)
Make a correct truth table for each of the following WFFs of SL.

a. $((A \vee \sim D)\&B)$

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

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

d. $((B \rightarrow \sim\sim C) \vee \sim A)$

e. $((C \vee \sim D) \vee \sim\sim C)$

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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 Hong Kong is part of China.
Hong Kong is not part of China.
Therefore, Hong Kong is near Bolivia.

Yes No If you are late, don't blame me.
You are late.
So, don't blame me.

Yes No Either this is a vegetable or it is not a vegetable.

Yes No Organic food is expensive food.
If you buy expensive food you will be sorry.
Thus, if you buy organic food you will be sorry.

Yes No Every child who is in the class is bald.
Lee is a child who is not bald.
Thus, Lee is not in the class.

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5. (5 marks) *Which of the following is an expression of SL?*

   A

   $(((A \leftrightarrow A) \leftrightarrow ((\sim B \vee A) \vee \sim(B \rightarrow C)))$

   $\sim\sim$

   $(A \leftarrow B))$

   $(A\&B\& \sim A)$

   /5

6. (12 marks) *Translate the following statements into SL. Preserve as much structure as possible. Use the following translation scheme:*

   A: Aristotle is married.
   B: Socrates likes books.
   C: Socrates likes olives.
   D: Mencius understands.

   (a) Either Aristotle is married or Socrates does not like books.

   (b) Mencius understands only if Aristotle is not married and Socrates likes olives.

   (c) Whether or not Socrates likes olives, Aristotle is married.

   (d) If Mencius does not understand, then if Socrates likes books and olives then Socrates neither likes books nor olives.

   (e) Aristotle is married, but Mencius understands only if Socrates likes books.

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7. (5 marks) *Assume that statement (a) is* **true** *and statement (b) is* **false***:*

   (a) Either love conquers all, or truth is beauty, or freedom reigns.

   (b) If truth is not beauty, 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.

   Does freedom reign?

   /5

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.*

	$((B \rightarrow \sim A)\&((\sim B \leftrightarrow A) \vee (A \rightarrow B)))$	
tautology	contingent	inconsistent
	$(\sim\sim C \rightarrow ((A\&A) \rightarrow (C \vee B)))$	
tautology	contingent	inconsistent
	$(\sim B \rightarrow (A \rightarrow A))\&C)$	
tautology	contingent	inconsistent
	$((C \vee \sim B) \rightarrow C)$	
tautology	contingent	inconsistent
	$((\sim B\&(A\&C) \rightarrow (A \vee C))$	
tautology	contingent	inconsistent
	$((\sim B \rightarrow (A \rightarrow C)) \vee ((B \rightarrow C) \rightarrow A))$	
tautology	contingent	inconsistent
	$((A \leftrightarrow B) \leftrightarrow ((A \vee C) \leftrightarrow (B\&C)))$	
tautology	contingent	inconsistent
	$((A \rightarrow B) \vee (A \leftrightarrow \sim B))$	
tautology	contingent	inconsistent
	$(A \leftrightarrow (C \leftrightarrow B))\&A)$	
tautology	contingent	inconsistent
	$((\sim A \leftrightarrow \sim B)\&((\sim B \rightarrow C)\&(A \rightarrow C)))$	
tautology	contingent	inconsistent

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9. (12 marks) Suppose that a new one-place connective '@', and a new two-place connective '#' are added to SL. You are informed that: '@$(A\#B)$' does not entail '$(@A\#@B)$'; '$(@A\#@B)$' entails '@$(A\#B)$'; '@A' is consistent. Complete the truth tables:

A	@A
T	
F	

A	B	(A#B)
T	T	**T**
T	F	
F	T	
F	F	

True or false?

T F '$(@A\&B)$' is contingent.
T F '$(B\#A)$' is logically equivalent to '$(A\#B)$'.
T F '$(@A\#@B)$' does not entail '$(B \vee A)$'.
T F '$@A, (A \rightarrow B) \models B$' is a valid sequent.

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