

Problem Set 1
Elementary Logic
Due: 10 October 2006

Name _____

Arthur Chin

Student ID Number _____

email _____

Mark _____%

Due 10 October 2006 by 4:00PM.

Submit your problem set to Ms. Loletta Li in Main Building 302. 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 14 October.

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. (20 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 valid argument is a good argument.

F Some sound arguments are not good arguments

T Logic is a science which tells us how people actually reason.

F The premises and conclusion of an invalid argument can all be true.

F The premises and conclusion of a valid argument can all be false.

F φ is an expression of SL.

T No argument with a true conclusion contains a hidden assumption

F There is an expression of SL containing exactly 2 symbols.

T The main connective of " $\sim(A \& B)$ " is "&"

T Whenever " $(A \vee B)$ " is true, " $(A \rightarrow B)$ " is also true.

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20 marks

Take correct truth table for each of the following WFFs of

$$((A \leftrightarrow B) \rightarrow A)$$

T	T	T	T
T	F	F	T
F	F	T	F
F	T	F	F

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

T	T	T	T
T	F	F	T
F	F	T	F
F	F	F	F

$$(A \vee B) \leftrightarrow (A \& B)$$

T	T	T	T
T	T	F	F
F	T	T	F
F	F	F	F

$$(\sim A) \vee (\sim B)$$

$$((A \sim C) \& \sim A)$$

T	T	F	F	T
T	T	F	F	T
F	F	F	F	T
F	T	F	T	F

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

T	F	F	T	T
T	T	F	F	T
F	T	F	F	T
F	F	F	F	T
T	F	F	T	F
T	T	T	F	F
F	T	F	T	F
F	F	T	F	F

(20 marks) ~ Any other WWF logically equivalent to the suggested one with do
 Fill the blanks with an SL WWF to make correct truth tables.

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

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

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

C	$(C \vee \sim C)$
T	T
F	T

4. (15 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 If Hong Kong is a city, then Hong Kong is a city.

Yes No If you are hungry, then eat something.
You are hungry.
So, eat something.

No If I was late, then she was angry.
If I was early, then she was angry.
If I was early, then I was not late.
Therefore, she was angry.

No London is in England.
London is not in England.
Nothing is both in England and not in England.
Therefore, London is in France.

No All mammals lay eggs.
So, all mammals lay eggs.

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5. (5 marks)

Circle each expression that is not a WFF of SL:

$(\sim \sim B)$

$((B \& B) \vee \sim B)$

$\sim \sim ((C \leftarrow A) \& A)$

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

$A \vee B$

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6. (12 marks)

Translate the following statements into SL.

Preserve as much structure as possible.

Use the following translation scheme:

A: Plato is hungry.

B: Mencius is shopping.

C: Socrates looks tired.

D: Confucius is hungry.

(a) If Plato is hungry, then Mencius is not shopping only if Socrates looks tired

$$(P \rightarrow (\neg B \rightarrow C))$$

(b) Although Mencius is shopping, Socrates looks tired

$$(B \& C)$$

(c) Whenever Confucius and Plato are hungry, Socrates looks tired

$$((P \& D) \rightarrow C)$$

(d) Whether or not Mencius is shopping, neither Plato nor Confucius is hungry.

$$((B \vee \neg B) \rightarrow (\neg A \& \neg D)) / ((B \vee \neg B) \rightarrow \neg(A \vee D))$$

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7. (8 marks)

a. How many WFFs of SL are there which contain less than 6 symbols and no sentence letter other than "A" or "B"?

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b. Write an expression of SL which is not a WFF of SL, contains exactly 7 symbols and does not contain any connectives.

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c. Write a WFF of SL which contains exactly 6 symbols and no sentence letter other than "B".

$\neg \neg \neg \neg B$

d. Write a WFF of SL which has " $(A \vee B)$ " as its antecedent and a conjunction as its consequent.

$$((A \vee B) \rightarrow (A \& B))$$

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