

Midterm Test  
Elementary Logic  
4 March 2008

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Please write clearly.  
You have 60 minutes to complete this test.

Mark \_\_\_\_\_%

1. (20 marks)

True or false?

Circle 'T' if the statement is true.

Circle 'F' if the statement is false.

Assume that  $\varphi$  is a WFF of SL.

- T  F No WFF of SL contains exactly 17 symbols.
- T  F No argument with a false conclusion contains a hidden assumption.
- T  F If  $\varphi$  contains exactly 5 symbols then  $\varphi$  contains a two-place connective.
- T F The main connective of " $\sim(A \vee B)$ " is " $\sim$ ".
- T F Whenever " $(A \& B)$ " is true, " $(A \leftrightarrow B)$ " is also true.
- T F The consequent of " $(A \rightarrow C)$ " is " $C$ ".
- T  F Sentential logic is not an example of an informal system of logic.
- T F All arguments are either valid or unsound.
- T F Some good arguments are not sound arguments.
- T  F  $\varphi$  is either contingent or a tautology.

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2. (5 marks)

Circle each expression of SL below:

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

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3. Make a truth table for each of the following WFFs of SL. (20 marks)

a.  $(B \leftrightarrow (B \vee A))$

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

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

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

c.  $((A \vee B) \leftrightarrow (A \vee C))$

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

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

T
F
T
F
T
F
T
F

e.  $((\sim \sim A \rightarrow \sim B) \& \sim C)$

F
F
F
T
F
T
F
T

4. (16 marks)

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

Each WFF you write must be a disjunction.

a.

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

b.

A	B	C	$(\neg(B \leftrightarrow C) \vee \neg A)$
T	T	T	F
T	T	F	T
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.

D	$((D \leftrightarrow \neg D) \vee (D \leftrightarrow \neg \neg D))$
T	F
F	F

d.

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

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4. (12 marks) Suppose that “#” is a new connective added to SL.

You are told that “ $(A \rightarrow B) \# A$ ” is a tautology, but “ $A \# B$ ” is not a tautology.

If possible, complete the following truth table for “ $A \# B$ ”.

If it is not possible to complete the truth table, explain why.

A	B	$(A \# B)$
T	T	T
T	F	T
F	T	T
F	F	F

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6. (10 marks)

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

(a) Dora will not arrive, unless you buy her ticket.

$D$  : Dora will arrive.  
 $B$  : You buy Dora Ticket.

$(B \vee \neg D)$  or  $(\neg B \rightarrow \neg D)$  or  $(D \rightarrow B)$

(b) If Dora heard you she is angry, but otherwise she does not know.

$D$  : Dora heard you.       $K$  : Dora knows.  
 $A$  : Dora is angry.

$((D \rightarrow A) \wedge (\neg D \rightarrow \neg K))$

(c) Provided that Dora comes, I will not go and I will not let you go.

$C$  : Dora comes.       $G$  : I will go.       $L$  : I will let you go.

$(C \rightarrow (\neg G \wedge \neg L))$

(d) If you keep wasting your time, then you will succeed only if you are lucky.

$W$  : You keep wasting your time.  
 $S$  : You will succeed.  
 $L$  : You are lucky.

$(W \rightarrow (L \rightarrow S))$

(e) Either Dora or Lee knows how to do that.

$D$  : Dora knows how to do it.  
 $L$  : Lee knows how to do it.

$(D \vee L)$

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7. (5 marks)

1. Write down a valid, unsound argument with exactly one premise, and where the conclusion is different from the premise.

*The sun is smaller than the earth*

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$$1 + 1 = 2$$

2. Explain why your argument is both valid and unsound.

*It's valid because the conclusion is a tautology.  
It's unsound because its premise is false.*

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8. (12 marks)

Assume that each of the following four statements is false:

Alice is agile only if Caspar is not kind.

If Bela was not sick that day, then Bela and Caspar are both kind.

Alice is not agile.

Either Bela was sick that day and Bela is kind, or Bela was not sick that day and Caspar is not kind.

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

$A$  = Alice is agile

$B$  = Caspar is kind

$C$  = Bela was sick that day.

$D$  = Bela is kind.

$(A \rightarrow \neg B)$

$(\neg C \rightarrow (D \wedge B))$

$\neg A$

$((C \wedge D) \vee (\neg C \wedge \neg B))$

2. Was Bela sick that day?

No.

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