Logic, First Course, Winter 2020. Week 5, Lecture 1. Back to course website

Week 5, Review for exam

These lecture is a review session for the midterm exam, which takes the form of a practice exam. Hence, the problems fall into groups corresponding to the first four weeks:

- Week 1 problems
- Week 2 problems
- Week 3 problems
- Week 4 problems

Before you begin the homework, you might consider printing a copy either to work out by hand as you go along, or to work with on a tablet. A nice pdf of this page is INSERT.

Week 1 problems:

For the first two problems, draw the tree diagram associated to the formulas, by successively finding the main connectives of the formulas, starting with the big formulas and breaking them into smaller parts. On paper, simply draw the tree diagram. On the computer, successively find the main connectives (pressing 'return' to move to next connective), until the tree diagram has been drawn (ignore the "You may now submit your solution" remark after you finish, since this is just practice).

Problem 1

$(\neg p \vee (\neg q \wedge \neg r))$

Problem 2

$(\neg p \rightarrow (\neg q \rightarrow \neg r))$

For these next three problems, complete the truth-table. On the computer, you can check your truth-table for correctness.

Problem 3

$(\neg p \lor (\neg q \land \neg r))$

p	q	r	(¬	p	∨	(¬	q	∧	¬	r))
T	T	T		T			T			T
T	T	F		T			T			F
T	F	T		T			F			T
T	F	F		T			F			F
F	T	T		F			T			T
F	T	F		F			T			F
F	F	T		F			F			T
F	F	F		F			F			F

Check

Problem 4

(¬p → (¬q → ¬r))

p	q	r	(	¬	p	→	(	¬	q	→	¬	r	))
T	T	T			T				T			T	
T	T	F			T				T			F	
T	F	T			T				F			T	
T	F	F			T				F			F	
F	T	T			F				T			T	
F	T	F			F				T			F	
F	F	T			F				F			T	
F	F	F			F				F			F	

Check

Problem 5

(¬¬p ∧ ¬¬q)

p	q	(	¬	¬	p	∧	¬	¬	q	)
T	T				T				T	
T	F				T				F	
F	T				F				T	
F	F				F				F	

Check

Week 2 problems:

The next two problems concern translations into *propositional logic*.

Problem 6

l = the planning zone was *l*arger

d = the planning zone that the company *d*ealt with was the fifteen (15) kilometre planning zone that was laid out

k = I would *k*now about it

m = I would take *m*easures

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If the planning zone was larger and if the |
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If the planning zone was larger and if the planning zone that the company dealt with was the fifteen (15) kilometre planning zone that was laid out, I would know about it and I would take measures.

Problem 7

t = there are *t*wo articles in the literature

o = *o*ne reaches a conclusion about the efficacy of the instrument.

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There being two articles in the literature wa
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There being two articles in the literature was not sufficient for one reaching a conclusion about the efficacy of the instrument.

In the next two problems, determine whether the formula is a tautology or not. If it is a tautology simply fill out the entire table and indicate that it is a tautology in the subsequent yes/no question. If it is not a tautology, indicate a row where it is false-- on the computer just enter the row, while on paper circle the row-- and then explicitly indicate that it is not a tautology in the subsequent yes/no question.

Problem 8

(((p ∧ q) ∧ (q → p)) → (q → p))

p	q	(((p	∧	q)	∧	(q	→	p))	→	(q	→	p))
T	T	T		T		T		T		T		T
T	F	T		F		F		T		F		T
F	T	F		T		T		F		T		F
F	F	F		F		F		F		F		F

Non-Tautology | Check

It the formula a tautology?

- Yes.
- No.

Check

Problem 9

((q → p) → ((p ∧ q) ∧ (q → p)))

p	q	((q	→	p)	→	((p	∧	q)	∧	(q	→	p)))
T	T	T		T		T		T		T		T
T	F	F		T		T		F		F		T
F	T	T		F		F		T		T		F
F	F	F		F		F		F		F		F

Non-Tautology | Check

It the formula a tautology?

- ◯ Yes.
- ◯ No.

Check

Problem 10.

Consider the tautology $\neg(\neg a \vee \neg b) \leftrightarrow (\neg\neg a \wedge \neg\neg b)$. Which of the following is this a substitution instance of?

Which one?

- ◯ Law of excluded middle.
- ◯ Distribution.
- ◯ The law of double-negation.
- ◯ DeMorgan.

Check

Week 3 problems

In the next two problems, determine whether the argument is valid or not. If it is valid simply fill out the entire table and indicate that it is valid in the subsequent yes/no question. If it is not valid, indicate a row where the premises are all true and the conclusion is false-- on the computer just enter the row, while on paper circle the row-- and then explicitly indicate that it is valid in the subsequent yes/no question.

Problem 11.

(a ∨ b), (c → a), (c → b) ⊢ ¬c

a	b	c	(a	∨	b),	(c	→	a),	(c	→	b)	⊢	¬	c
T	T	T	T		T	T		T	T		T			T
T	T	F	T		T	F		T	F		T			F
T	F	T	T		F	T		T	T		F			T
T	F	F	T		F	F		T	F		F			F
F	T	T	F		T	T		F	T		T			T
F	T	F	F		T	F		F	F		T			F
F	F	T	F		F	T		F	T		F			T
F	F	F	F		F	F		F	F		F			F

Counterexample | Check

It the argument valid?

- Yes.
- No.

Check

Problem 12.

(a ∨ b), (a → ¬c), (b → ¬c) ⊢ ¬c

abc	(a	∨	b),	(a	→	¬	c),	(b	→	¬	c)	⊢	¬	c
TTT	T		T	T			T	T			T			T
TTF	T		T	T			F	T			F			F
TFT	T		F	T			T	F			T			T
TFF	T		F	T			F	F			F			F
FTT	F		T	F			T	T			T			T
FTF	F		T	F			F	T			F			F
FFT	F		F	F			T	F			T			T
FFF	F		F	F			F	F			F			F

Counterexample Check

It the argument valid?

- ◯ Yes.
- ◯ No.

Check

Problem 13.

The following is a valid argument:

$$(a \vee (b \vee c)), \neg b \wedge \neg c \vdash \neg a$$

It can be obtained from disjunctive syllogism $p \vee q, \neg q \vdash \neg p$ by doing a substitution, and then DeMorgan. Which substitution should you do in order to obtain it?

Which substitution?

- Substitute c for p, and substitute a\/b for q.
- Substitute a\/b for p, and substitute c for q.
- Substitute b\/c for p, and substitute a for q.
- Substitute a for p, and substitute b\/c for q.

Check

Problem 14

One and only one of the following is a valid argument. Which is it? *Hint: it can be obtained from distribution.*

Which one is valid?

- $a \vee (b \wedge c) \vdash a \vee c$
- $a \vee (b \wedge c) \vdash b \vee c$
- $a \vee (b \wedge c) \vdash a \wedge c$
- $a \vee (b \wedge c) \vdash b \wedge c$

Check

Problem 15

One and only one of the following statements is always true about valid arguments:

Which of the following is always true?

- If a valid argument has a false conclusion, then it has a true premise.
- If a valid argument has a false conclusion, then it has all false premises.
- If a valid argument has a false conclusion, then it has a false premise.
- If a valid argument has a false conclusion, then it has all true premises.

Check

Week 4 problems

In the following four problems we use the following key:

a = "Atlanta"
b = "Baltimore"
c = "Chicago"
F = "has a football team"
H = "has a hockey team"
I = "is inland"
M = "is in the midwest"
S = "has a soccer team"

Remember that on the translation problems, to check them on the computer you just press 'return.'

Problem 16

`If Baltimore has a soccer team and Baltimore i`

If Baltimore has a soccer team and Baltimore is in the midwest, then someplace has a soccer team and is in the Midwest.

Problem 17

`If all places having football teams do not hav`

If all places having football teams do not have hockey teams, then Atlanta does not have a hockey team.

Problem 18

Find an equivalent of "someplace is inland and

Find an equivalent of "someplace is inland and has a hockey team" in predicate logic without using a quantifier, under the hypothesis that there are only three places a,b,c.

Problem 19

m = it is in the *m*idwest

s = it has a *s*occer team

h = it has a *h*ockey team

Insert a propositional consequence of "All pla

Insert a propositional consequence of "All places in the midwest have soccer teams and not hockey teams".

Problem 20

Which of the following is ~Ex((~Fx/\~Gx)\/Hx) equivalent to?

- Ax((Fx\/Gx)/\~Hx)
- Ax((~Fx\/Gx)/\~Hx)
- Ax((~~Fx\/~~Gx)/\Hx)
- Ax((Fx/\Gx)\/~Hx)

Check

These are lecture notes written for this course.[1]

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1. It is run on the Carnap software, which is↩