Logic, First Course, Winter 2020. Week 3, Practice Problems.

Week 3, Practice problems

The practice problems in this set fall into two groups:

- Assessing validity
- Assessing soundness

For the **solutions**, click here.

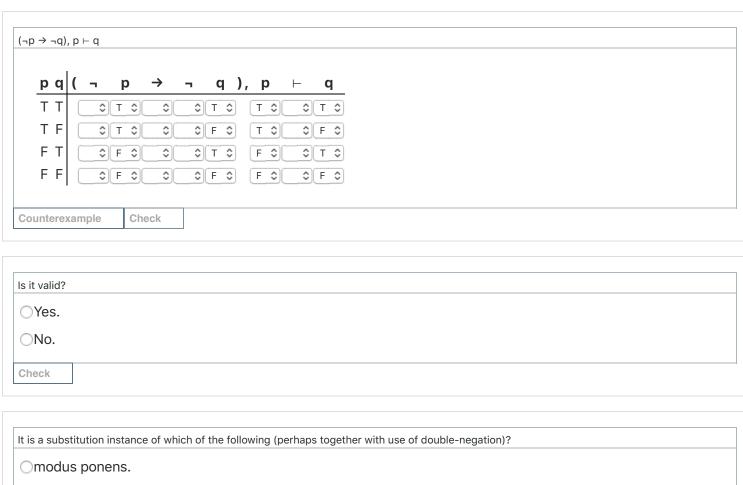
Assessing validity

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Is it valid?			
○Yes.			
○No.			
Check			

It is a substitution instance of which of the following (perhaps together with use of double-negation)?
Omodus ponens.
Omodus tollens.
Oaffirming the consequent.
Odenying the antecedent.
Check
Problem 2
$(\neg p \rightarrow \neg q), \neg q \vdash \neg p$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
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FF OFO OFO OFO
Counterexample Check
Is it valid?
○Yes.
○No.
Check
It is a substitution instance of which of the following (northers together with use of double negation)?

It is a substitution instance of which of the following (perhaps together with use of double-negation)?	
Omodus ponens.	
Omodus tollens.	
Oaffirming the consequent.	
Odenying the antecedent.	
Check	



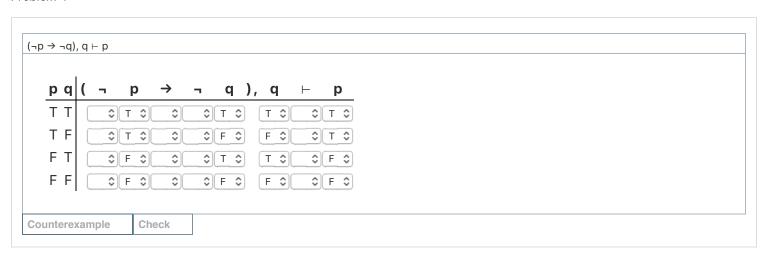
It is a substitution instance of which of the following (perhaps together with use of double-negation)?

Omodus ponens.

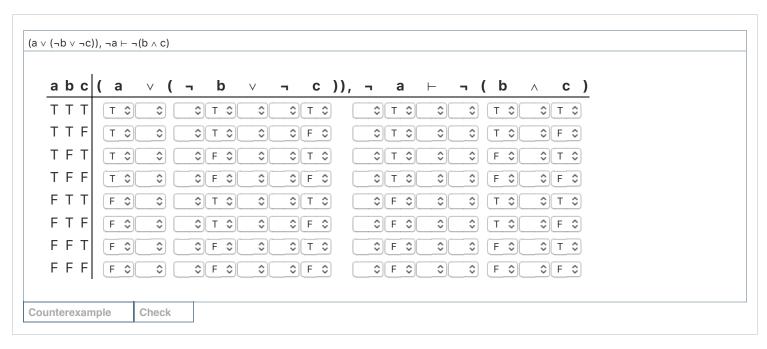
Omodus tollens.

Oaffirming the consequent.

Odenying the antecedent.

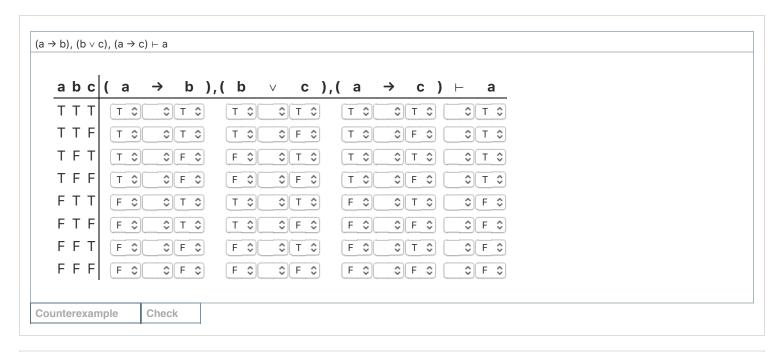


Is it valid?
○Yes.
○No.
Check
It is a substitution instance of which of the following (perhaps together with use of double-negation)?
Omodus ponens.
Omodus tollens.
Oaffirming the consequent.
Odenying the antecedent.
Check



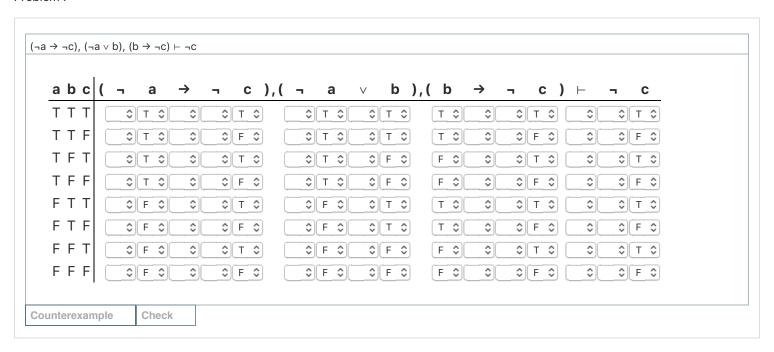
Is it valid?	
○Yes.	
○No.	
Check	_

What laws	and paradigm examples can you use to quickly assess for validity, in tandem with DeMorgan?
Ocomm	nutativity.
Odistrib	oution.
Odisjun	active syllogism.
Oreaso	ning by cases.
Check	



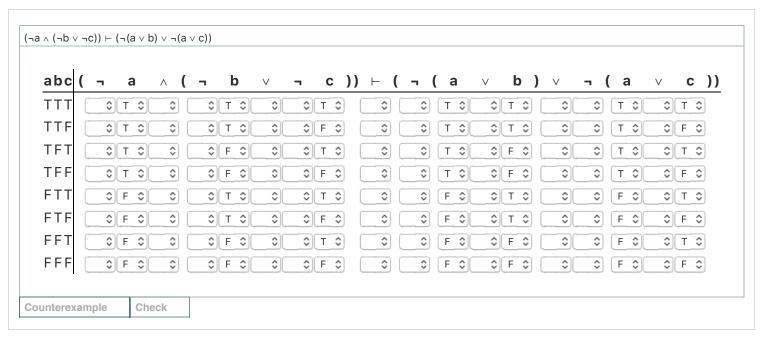
Is it valid?			
OYes.			
○No.			
Check			

onditionals wit	h false antecedents are true.
0	
conditionals with	true antecedents and false consequents are false (and this is the only circumstance in which
they are false).	
Oconditionals wit	h true consequents are true.



Is it valid?	
○Yes.	
○No.	
Check	

Which of t	the following is this a substitution instance of?
Ocomn	nutativity.
Odistril	bution.
Odisjur	nctive syllogism.
Oreaso	oning by cases.
Check	



	1
Is it valid?	
○Yes.	
○No.	
Check]

What laws and paradigm examples can you use to quickly assess for validity, in tandem with DeMorgan?
Ocommutativity.
Odistribution.
Odisjunctive syllogism.
Oreasoning by cases.
Check

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1													
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s it valid?													
○Yes.													
○No.													
Check													
What laws and p	oaradigm exar	nples can	you use to c	quickly asse	ess for val	idity, in ta	ndem	with DeM	lorgan?				
_commutat	tivity.												
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Odisjunctiv	e syllogism	١.											
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Check													

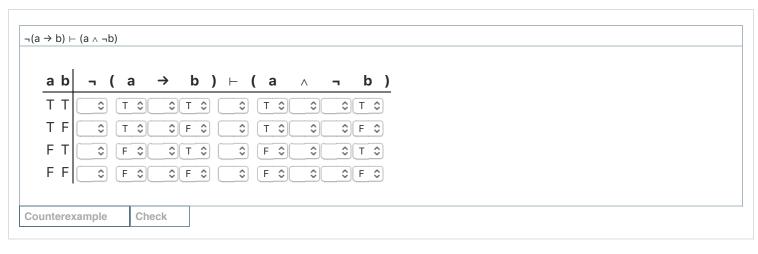
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FFT	
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Counterexan	mple Check
Is it valid?	
○Yes.	
○No.	
Check	
Officer	
What laws an	nd paradigm examples can you use to quickly assess for validity, in tandem with associativity?
○commut	tativity.
Odistribut	ition.
Odisjunct	tive syllogism.
Oreasonir	ng by cases.
Check	

$(a \rightarrow (b \rightarrow c)), (a \rightarrow c)$	→ c) ⊢ b
abc ($a \rightarrow (b \rightarrow c)), (a \rightarrow c) \vdash b$
TTT	
TTF	
TFT	O O FOOTO TOOFO
TFF	$T \circlearrowleft \bigcirc F \circlearrowleft \bigcirc F \circlearrowleft \bigcirc F \circlearrowleft \bigcirc F \circlearrowleft$
FTT	
FTF	TO FO FO OTO
FFT	\circ \circ \circ \circ \circ \circ \circ \circ \circ
FFF	0 0 F 0 0 F 0 0 F 0 0 F 0
Counterexample	Check
Is it valid?	
OYes.	
○No.	
Check	
Each of the follow	ring is true. Which of these could you use to quickly assess for validity in this case?
Oconditional	s with false antecedents are true.
0	
	with true antecedents and false consequents are false (and this is the only circumstance in which
they are false	
	s with true consequents are true.
- Conditional	
Check	

$(a \land (b \land c)) \vdash (a \rightarrow (b \rightarrow c))$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	→ c))
TTT TOOTOOTO OTOOTO	○ T ○
TTF TOOTOFO O TOOTO	
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TFF TOOFOOFO TOOFO	○ F ○
FTT FOOTO OF O TO	≎ T ≎
FTF FOOTOFO OFOTO	≎ F ≎
FFT FOOFOOTO OFOOFO	○ T ○
FFF FOOFO OF OF	○ F ○
Counterexample Check	
Is it valid?	
OYes.	
ONo.	
Check	
Each of the following is true. Which of these sould you use to suitably serves for using	Nity in this cocc?
Each of the following is true. Which of these could you use to quickly assess for valid	arty in this case?
Oconditionals with false antecedents are true.	
0	
conditionals with true antecedents and false consequents are fal	se (and this is the only circumstance in which
they are false).	
Oconditionals with true consequents are true.	
Observ	
Check	

$(a \rightarrow b)$, a , $(b \rightarrow c) \vdash ((a \rightarrow b) \rightarrow (a \rightarrow c))$						
abc ($a \rightarrow b$), a ,($b \rightarrow c$) \vdash (($a \rightarrow b$) \rightarrow ($a \rightarrow c$))						
TTT TOOTO TO TOOTO O TOOTO						
TTF TO OTO TO OFO O TO OFO						
TFT TOOFO TO FOOTO TOOFO TOOTO						
TFF TOOFO TO FOOFO OF O TOOFO						
FTT FOOTO FO TO OTO OFO OTO						
FTF FOOTO FO TO FO TO FO						
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$						
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$						
Is it valid? Yes. No.						
Check						
Each of the following is true. Which of these could you use to quickly assess for validity in this case?						
Oconditionals with false antecedents are true.						
conditionals with true antecedents and false consequents are false (and this is the only circumstance in which they are false).						
Oconditionals with true consequents are true.						

Check



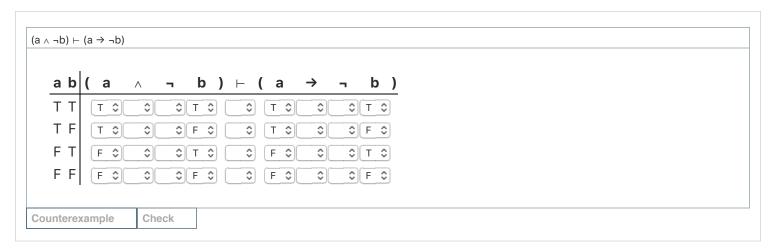
Is it valid?	
○Yes.	
ONo.	
Check	

Each of the following is true. Which of these could you use to quickly assess for validity in this case?

Conditionals with false antecedents are true.

Conditionals with true antecedents and false consequents are false (and this is the only circumstance in which they are false).

Conditionals with true consequents are true.



Is it valid?
○Yes.
○No.
Check
Each of the following is true. Which of these could you use to quickly assess for validity in this case?
Oconditionals with false antecedents are true.
conditionals with true antecedents and false consequents are false (and this is the only circumstance in which
they are false).
Oconditionals with true consequents are true.
Check

Assessing soundness

As we will discuss in Week 3 Lecture 2, an argument is **sound** if it is both valid and all the premises are true. Note that sound arguments automatically have true conclusions.

To assess soundness we need to agree on what is true and what is false. While this is a hard thing to do in general, in the following five problems we simplify this by assuming that the following eight facts about collges and their location and acceptance rates are all true (these were obtained by searching "US colleges" on google, which strangely leads to a google page that does not have an obvious link):

- 1. Harvard, Massachusetts, acceptance rate 5%
- 2. Princeton, New Jersey, acceptance rate 7%
- 3. MIT, Massachusetts, acceptance rate 8%
- 4. Columbia, New York, acceptance rate 7%
- 5. Yale, Connecticut, acceptance rate 6%
- 6. Cal Tech, California, acceptance rate 8%
- 7. UC Berkeley, California, acceptance rate 17%
- 8. Cornell, New York, acceptance rate 14%

Problem 16

The following are four valid arguments which would be translated by substitution instances of modus ponens. But only one of the arguments is sound. Which one is it?

Which one is sound?
0
If Harvard is in Connecticut then Harvard is in the same state as MIT. Harvard is in Connecticut. Therefore
Harvard is in the same state as MIT.
If Yale is in Massachusetts then Yale is in the same state as MIT. Yale is in Massachusetts. Therefore Yale is in
the same state as MIT.
If Yale is in Connecticut then Yale is in the same state as MIT. Yale is in Connecticut. Therefore Yale is in the
same state as MIT.
If Harvard is in Massachusetts then Harvard is in the same state as MIT. Harvard is in Massachusetts. Therefore
Harvard is in the same state as MIT.
Check

The following are four valid arguments which would be translated by substitution instances of modus tollens (perhaps together with some replacement using double-negation). But only one of the arguments is sound. Which one is it?

Which one is sound?
If Columbia is in New York then Columbia is not in the same state as Princeton. Columbia is in the same state as
Princeton. Therefore Columbia is not in New York.
If Columbia is in New Jersey then Columbia is in the same state as Princeton. Columbia is not in the same state
as Princeton. Therefore Columbia is not in New Jersey.
If Cal Tech is not in New Jersey then Cal Tech is in the same state as Princeton. Cal Tech is not in the same state
as Princeton. Therefore Cal Tech is in New Jersey.
If Cal Tech is in California then Cal Tech is in the same state as Cornell. Cal Tech is not in the same state as
Cornell. Therefore Cal Tech is not in California.
Cornell. Therefore car real to the mi camornia.
Check

Problem 18

The following are four valid arguments which would be translated by substitution instances of disjunctive syllogism (perhaps together with some DeMorgan and double-negation). But only one of the arguments is sound. Which one is it? (In this problem, take "lowest acceptance rate in the state" to be shorthand for "lowest acceptance rate in the state of the colleges displayed in the list above." Also, in this problem, you'll probably have to actually look at the list of acceptance rates up above.)

/hich one is sound?
Not both Harvard and MIT have the lowest acceptance rate in Massachusetts. MIT has the lowest acceptance rate in Massachusetts. Therefore, Harvard does not have the lowest acceptance rate in Massachusetts.
Harvard or MIT has the lowest acceptance rate in Massachusetts. Harvard does not have the lowest acceptanc
ate in Massachusetts. Therefore, MIT has the lowest acceptance rate in Massachusetts.
MIT has the lowest acceptance rate in Massachusetts. Not both Harvard and MIT have the lowest acceptance
ate in Massachusetts. Therefore, Harvard does not have the lowest acceptance rate in Massachusetts.
Not both Harvard and MIT have the lowest acceptance rate in Massachusetts. Harvard has the lowest
acceptance rate in Massachusetts. Therefore, MIT does not have the lowest acceptance rate in Massachusetts
herk
heck

Consider the argument: "If Cal Tech has a lower acceptance rate than Cornell, then Cal Tech has a lower acceptance rate than UC Berkeley. Cal Tech has a lower acceptance rate than UC Berkeley. Therefore, Cal Tech has a lower acceptance rate than Cornell."

Which of the following describes this argument:

Which best describes the argument?	
OThe argument is sound	
OThe argument is unsound but valid.	
OThe argument is invalid but has all true premises and a true conclusion.	
OThe argument is invalid and has a false premise or a false conclusion.	
Check	

Problem 20

Consider the argument: "If Cornell does not have a lower acceptance rate than Columbia, then Cornell has a lower acceptance rate than Princeton. Cornell does not have a lower acceptance rate than Columbia. Therefore, Cornell has a lower acceptance rate than Princeton."

Which of the following describes this argument:

Which best describes the argument?	
OThe argument is sound	
OThe argument is unsound but valid.	
The argument is invalid but has all true premises and a true conclusion.	
The argument is invalid and has a false premise or a false conclusion.	
Check	

This is a practice problem set for this course. It is run on the Carnap software, which is an:

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