Logic, First Course, Winter 2020. Week 3, Homework (due Monday January 27 11:59pm).

Week 3, Homework

The homework problems in this set fall into three groups:

- Assessing validity via truth-tables
- Assessing validity via equivalences and substitution
- Assessing soundness

There are 20 problems total, each equally weighted. Submitted problems received on time receive 5 points each. Hence, there are 100 possible points. Late submissions receive 2 points each. The cutoff for submitting late homework is one week after the homework is due. At that point, the points recorded in carnap.io will be transferred to the ccle grading system and no further late work will be accepted.

Please remember to **press the "Submit" button** next to each problem after you are done. If you do not do this, you will **not** get credit for the problem. Once you have submitted your answer, your points are recorded. You can always check your points by going to the "user home" at the top right. You must be signed in in order to submit your answers.

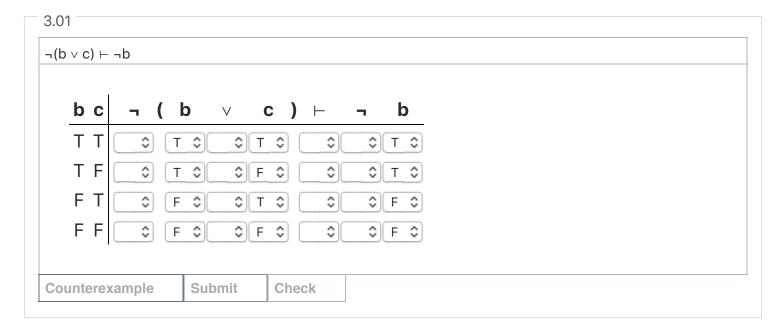
If you want to do some problems at one point in time and other problems at another point in time, you can do that by just coming back to this assignment page. Once submitted, your points are permanently recorded. If you return to this page later or refresh this page, it won't display your previously recorded answers, but again your points are permanently recorded. If you have forgotten which ones you still need to do, you can check your points by going to the "user home" at the top right.

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 at this link.

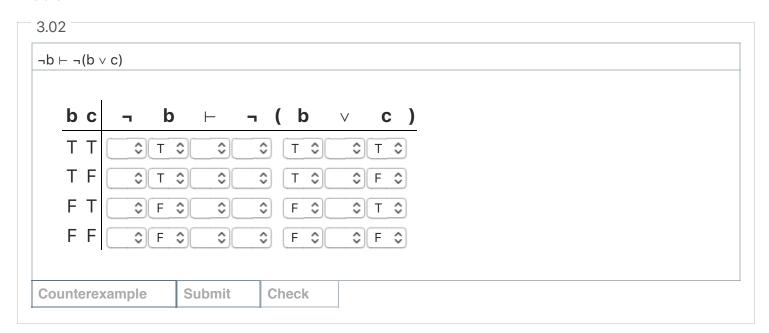
Assessing validity via truth-tables

On these problems, again please remember to press the "Submit" button next to each problem after you are done. This will usually be after you've pressed the 'check' or 'counterexample' button.

Use truth-tables to determine whether the following are valid or invalid:

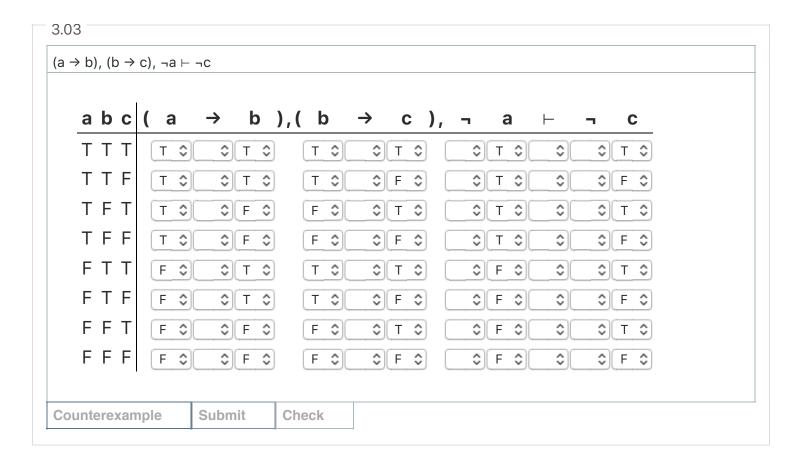


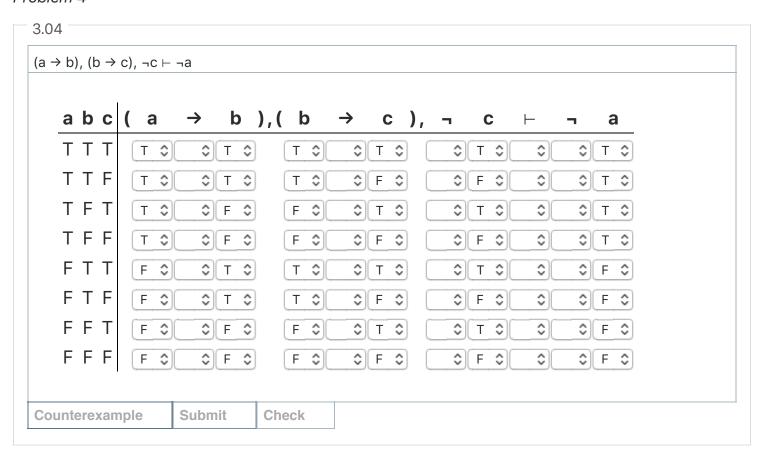
Problem 2

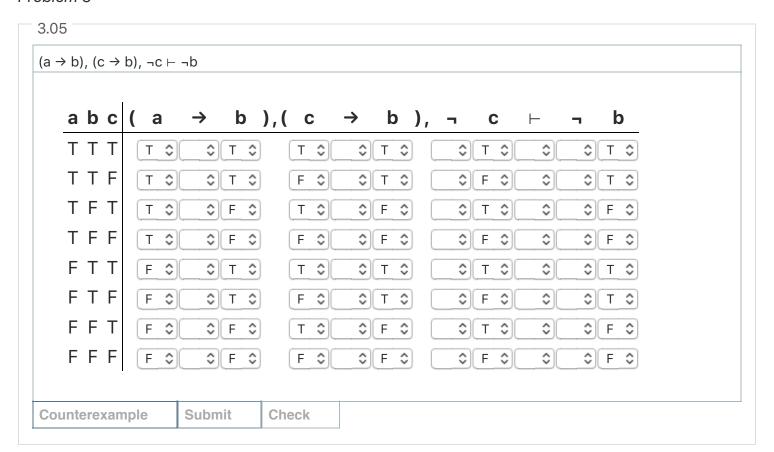


Problem 3

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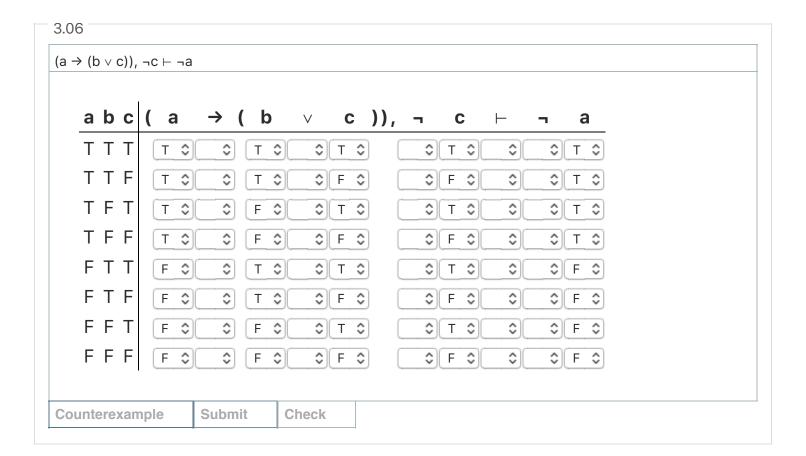


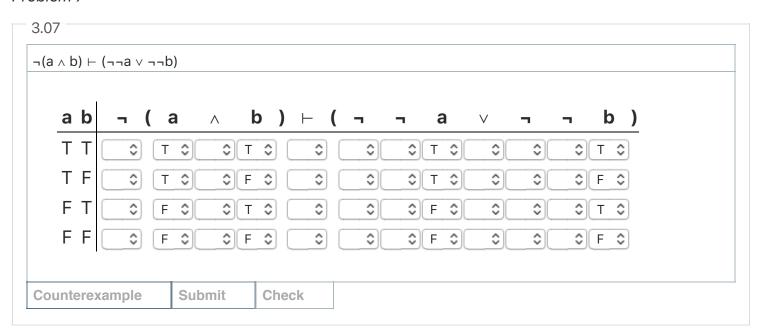




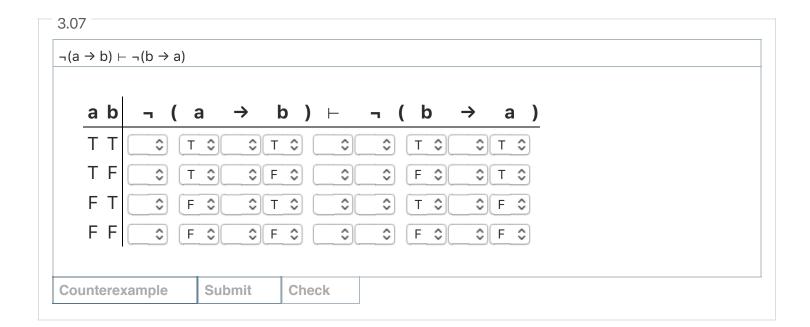
Problem 6

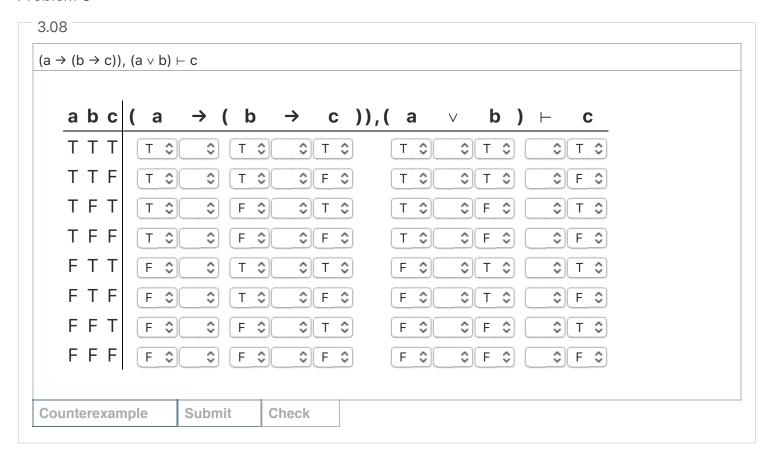
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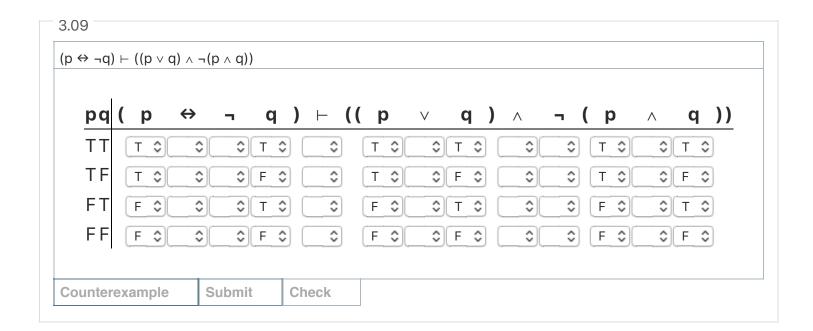
Problem 7

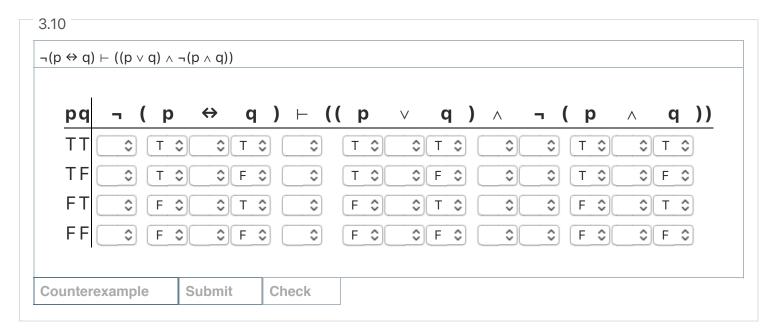




Problem 9

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Assessing validity via equivalences and substitution

Consider reviewing the examples in the Week 3 Lecture 1 sections Valid arguments and equivalences and Valid arguments from substitution before trying these next five problems. While they are multiple choice and thus in some sense easier, please make sure you understand *how* to get the right answer, since we will be asking similar questions in the exam.

The following is a valid argument:

$$\neg(\neg a \lor \neg b) \vdash a \land b$$

Which laws can you use to see this, by using the valid arguments obtained from equivalences and by replacing equivalents by equivalents?

Which lav	e?	
VVIIICITIA	<u> </u>	
ODeM	organ and law of non-contradiction.	
ODistr	bution and double-negation.	
ODeM	organ and double-negation.	
○Com	nutativity of disjunction and DeMorgan.	
Submit	Check	

Problem 12

The following is a valid argument:

$$p \vee q, p \vee r \vdash p \vee (q \wedge r)$$

Which laws can you use to see this, by using the valid arguments obtained from equivalences and by viewing the premises of an argument as joined together with conunctions?

3.12				
Which laws?				
ODeMorgan.				
ODistribution.				
OAssociativity of disjunction.				
OCommutativity of disjunction.				
Submit Check				

The following is a valid argument:

$$a \land (b \land c) \Rightarrow d \lor (e \lor f), \neg (d \lor (e \lor f)) \vdash \neg (a \land (b \land c))$$

It can be obtained from modus tollens $p \to q$, $\neg q \vdash \neg p$ by doing a substitution. Which substitution should you do in order to obtain it?

Which sub	stitution?	
Subst	titute a/\ (b/\ c) for \sim p, and substitute d\/(e\/f) for \sim q.	
Subst	titute a/\ (b/\ c) for p, and substitute d\/(e\/f) for q.	
Subst	titute a/\ (b/\ c) for ~p, and substitute d\/(e\/f) for q.	
Subst	titute a/\ (b/\ c) for q, and substitute $dV(eVf)$ for p.	

Problem 14

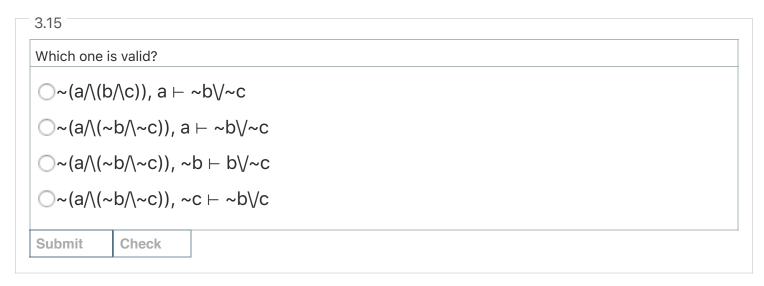
The following is a valid argument:

$$(a \rightarrow b) \rightarrow \neg c, a \rightarrow b \vdash \neg c$$

It can be obtained from modus ponens $p \to q, p \vdash q$ by doing a substitution. Which substitution should you do in order to obtain it?

3.14			
Which substitution?			
OSubstitute a for p, and substitute b->~c for q.			
OSubstitute (a->b) for q, and substitute ~c for p.			
○Substitute (a->b)->~c for p, and substitute a->b for q.			
OSubstitute (a->b) for p, and substitute ~c for q.			
Submit Check			
0110011			

One and only one of the following is a valid argument. Which is it? *Hint: it can be obtained from the disjunctive syllogism together with DeMorgan*.



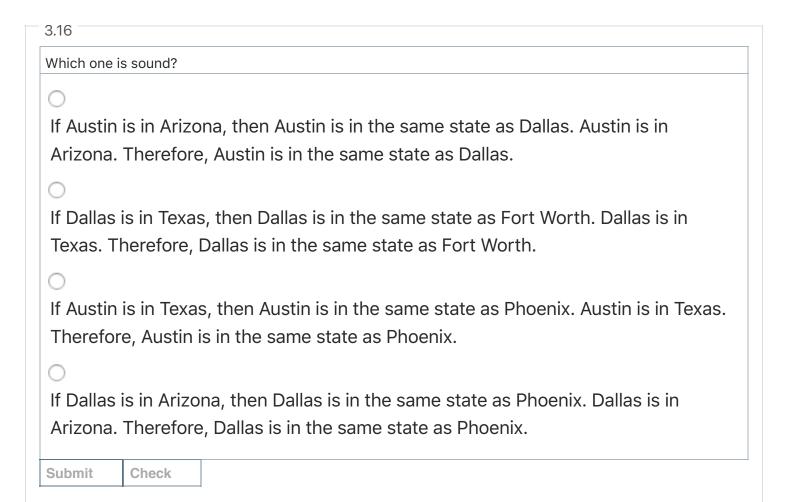
Assessing soundness

In the following three problems, we focus on the following set of facts from this Wikipedia page on American cities, their state, and their size:

- Phoenix, Arizona, 1,660,272
- Philadelphia, Pennsylvania, 1,584,138
- San Antonio, Texas, 1,532,233
- San Diego, California, 1,425,976
- Dallas, Texas, 1,345,047
- San Jose, California, 1,030,119
- Austin, Texas, 964,254
- Jacksonville, Florida, 903,889
- Fort Worth, Texas, 895,008
- Columbus, Ohio, 892,533
- San Francisco, California 883,305

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?



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

Submit Check

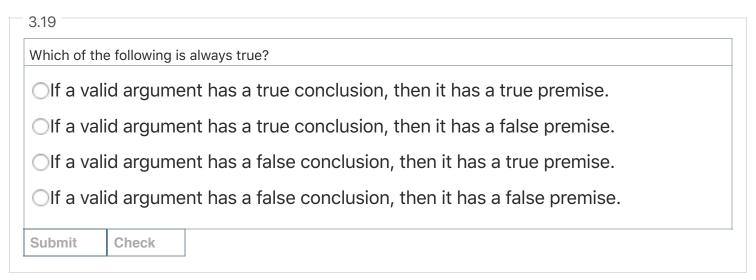
Jacksonville.

Problem 18

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

3.18				
Which one is sound?				
Not both Austin and Fort Worth are the biggest cities in Texas. But Austin is the				
biggest city in Texas. Therefore, Fort Worth is not the biggest city in Texas.				
Not both Los Angeles and San Jose are the biggest cities in California. But Los				
Angeles is the biggest city in California. Therefore, San Jose is not the biggest city				
in California.				
Not both Austin and Fort Worth are in Texas. But Austin is in Texas. Therefore,				
Forth Worth is not in Texas.				
Not both Los Angeles and Fort Worth are in California. But Fort Worth is in				
California. Therefore, Los Angeles is not in California.				
damorria.				
Submit Check				

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



Which of the following is impossible?

3.20						
Which of the following is impossible?						
Oa valid	Oa valid unsound argument					
Oa valid	Oa valid sound argument					
Oan invalid sound argument						
Oan invalid unsound argument						
Submit	Check					

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

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