

Logic, First Course, Winter 2020. Week 2, Homework (due **Tuesday** 11:59pm of the beginning of Week 3).

## Week 2, Homework

The homework problems in this set fall into four groups:

- [Translating and conditionals](#)
- [Necessary and sufficient conditions](#)
- [Tautologies](#)
- [Equivalences](#)

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. Here is [a nice pdf of this page](#).

## Translating and conditionals

The translating examples here and in the next section come from the [British National Corpus](#).

Before beginning these translations, consider reviewing [Three quick notes on about the translation-checker](#). In these translations, if you run into problems, be sure to check that you got the letters right, and also make sure that you did not miss any negations.

### Problem 1

$p$ = it appears that the prosecution has failed to prove an essential element of the offence

$e$ = its evidence has been discredited in cross-examination

$n$ = there is *no* case to answer

$d$ = the defence responds

2.01

Submit

If it appears that the prosecution has failed to prove an essential element of the offence, or if its evidence has been discredited in cross-examination, there is no case to answer and the defence does not respond.

### Problem 2

$p$ = paragraph two above will apply

y= you have a Legal Expenses section in your Holiday Insurance Policy

2.02

Submit

Paragraph two above will apply only if you do not have a Legal Expenses section in your Holiday Insurance Policy.

#### Problem 3

s= only a single character is suggested

d= word knowledge is used to *detect* errors

c= word knowledge is used to *correct* errors

2.03

Submit

If only a single character is suggested then word knowledge is used to detect errors and word knowledge is used to correct errors.

#### Problem 4

d= there is a *double* liability

a= party A is insolvent

b= party B is insolvent

2.04

Submit

There is a double liability if both party A is insolvent and party B is insolvent.

#### Problem 5

p= a *patient* was considered to have a previous diagnosis of asthma

e= they were enrolled in the pulmonary clinic with the diagnosis of asthma

r= they were *receiving* chronic bronchodilator therapy

f= they had a FEV of not less than one litres

2.05

Submit

A patient was considered to have a previous diagnosis of asthma if they were enrolled in the pulmonary clinic with the diagnosis of asthma, and they were receiving chronic bronchodilator therapy, and they had a FEV of not less than one litres.

## Necessary and sufficient conditions

#### Problem 6

b= Glasgow has a strong local *business* base

e= its has a strong economic future.

2.06

Submit

Glasgow having a strong local business base is a necessary condition for its having a strong economic future.

Problem 7

$u$  = the author may well have made a significant development in her own *understanding*

$p$  = she has secured a *publication*

2.07

Submit

The author may well have made a significant development in her own understanding, but that is not a sufficient condition of her having secured a publication.

On problem 7, if you run into trouble, make sure you are translating both what comes before and what comes after the "but." In doing this translation, ask yourself what the "that" is standing for.

Problem 8

$i$  = the *indifference curve* through P has a slope less than at Q

$c$  = consumption is a normal good.

2.08

Submit

A sufficient condition for the indifference curve through P not to have a slope less than at Q is that consumption is a normal good.

In the following two problems, consider reviewing the section [Asserting necessary but not sufficient](#) prior to beginning.

Problem 9

$i$  = there is *investment*

$e$  = there is economic growth

2.09

Submit

There being investment is a necessary, but by no means sufficient condition for there being economic growth.

Problem 10

$u$  = individuals should feel *unintimidated*

$d$  = there is free discussion

$c$  = there is free consent

2.10

Submit

That individuals should feel unintimidated is certainly a necessary condition of there being free discussion and there being free consent; but it is not a sufficient condition.

# Tautologies

In the following problems, you are to determine whether the formula is a tautology or not. If it is a tautology, fill out the truth-table correctly so that its main connective column is all true, check your answer and then after the answer turns green, **press submit**. If it is not a tautology, then find a row where the formula is false, click the 'Non-tautology' button, and enter in the truth-values of the basic propositional letters on that row, and after the answer turns green, **press submit**.

Note 1: please do **not** attempt these problems prior to the Thursday lecture of Week 2-- we will go over these problems at that point.

Note 2: the formulas here are more complicated than we have seen previously. If you need help finding the main connectives, consider first doing [Helper sheet for Week 2 Homework](#) for help on identifying the main connectives for these specific formulas.

Note 3: even when the formula is not a tautology, it is possible to get credit for the problem simply by filling out the entire table-- this is because in the event that it is not a tautology you will have found one place in the main connective column where it is false by filling out the entire truth-table. But often in practice one can show something is not a tautology without having to fill out the entire table. In exam situations, you will additionally be asked explicitly after this kind of problem whether the formula is a tautology or not.

2.11

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

p	q	(	¬	(	p	→	q	)	→	¬	q	)
T	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Non-Tautology

Submit

Check

2.12

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

p	q	(	¬	(	p	→	q	)	→	¬	p	)
T	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Non-Tautology

Submit

Check

2.13

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

$p$	$q$	$((p \wedge q) \vee ((p \wedge \neg q) \vee ((\neg p \wedge q) \vee (\neg p \wedge \neg q))))$
T	T	<input type="checkbox"/>
T	F	<input type="checkbox"/>
F	T	<input type="checkbox"/>
F	F	<input type="checkbox"/>

Non-Tautology

Submit

Check

2.14

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

$p$	$q$	$((p \vee q) \wedge ((p \vee \neg q) \wedge ((\neg p \vee q) \wedge (\neg p \vee \neg q))))$
T	T	<input type="checkbox"/>
T	F	<input type="checkbox"/>
F	T	<input type="checkbox"/>
F	F	<input type="checkbox"/>

Non-Tautology

Submit

Check

2.15

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

$p$	$q$	$r$	$(((p \rightarrow (q \rightarrow r)) \wedge p) \rightarrow r)$
T	T	T	<input type="checkbox"/>
T	T	F	<input type="checkbox"/>
T	F	T	<input type="checkbox"/>
T	F	F	<input type="checkbox"/>
F	T	T	<input type="checkbox"/>
F	T	F	<input type="checkbox"/>
F	F	T	<input type="checkbox"/>
F	F	F	<input type="checkbox"/>

Non-Tautology

Submit

Check

## Equivalences

In the following problems, you are to determine whether the two formulas which are separated by a comma are equivalent or inequivalent. If they are equivalent, fill out the truth-table correctly, check your answer and **then press submit**. If they are inequivalent, then find a row where one is true and the other is false, click the 'Inequivalent' button, and enter in the truth-values of the basic propositional letters on that row, and after the answer turns green, **press submit**.

Note 1: please do **not** attempt these problems prior to the Thursday lecture of Week 2-- we will go over these problems at that point.

Note 2: even when the formula is not an equivalence, it is possible to get credit for the problem simply by filling out the entire table-- this is because in the event that it is not a equivalence you will have found one place in the main connective columns where the truth-values differ by filling out the entire truth-table. But often in practice one can show two things are inequivalent without having to fill out the entire table. In exam situations, you will additionally be asked explicitly after this kind of problem whether the two formulas are equivalent.

2.16

$(\neg p \rightarrow q), (p \vee q)$

$p$	$q$	$(\neg p \rightarrow q), (p \vee q)$					
T	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Inequivalent

Submit

Check

2.17

$\neg(p \rightarrow q), (p \vee q)$

$p$	$q$	$\neg(p \rightarrow q), (p \vee q)$					
T	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Inequivalent

Submit

Check

2.18

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

$p$	$q$	$r$	$(\neg p \wedge (\neg q \vee \neg r)), ((\neg p \wedge \neg q) \vee (\neg p \vee \neg r))$									
T	T	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	T	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	F	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	F	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	T	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	T	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	F	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	F	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Inequivalent

Submit

Check

2.19

 $(p \rightarrow (p \rightarrow q)), (p \rightarrow q)$ 

$p$	$q$	$(p \rightarrow (p \rightarrow q)), (p \rightarrow q)$							
T	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Inequivalent

Submit

Check

2.20

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

$p$	$q$	$r$	$(p \rightarrow (q \rightarrow r)), ((p \rightarrow q) \rightarrow r)$											
T	T	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	T	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	F	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
T	F	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
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F	T	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	F	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F	F	F	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Inequivalent

Submit

Check

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