

$$\sim \left[(\forall x)(Fx \supset \sim Gx) \equiv \sim (\exists x)(Fx \& Gx) \right] \quad \checkmark \quad \text{NF}$$

$$(\forall x)(Fx \supset \sim Gx) \setminus a$$

$$\sim (\forall x)(Fx \supset \sim Gx) \checkmark \quad \setminus a$$

$$\sim (\exists x)(Fx \& Gx) \checkmark$$

$$\sim (\exists x)(Fx \& Gx) \checkmark$$

$$(\exists x)(Fx \& Gx) \checkmark \quad \setminus a \quad 3 \sim$$

$$(\exists x) \sim (Fx \supset \sim Gx) \checkmark \quad \setminus a$$

$$Fa \& Ga \quad \checkmark \quad 4E1$$

$$(\forall x) \sim (Fx \& Gx) \setminus a$$

$$Fa \quad 5\&$$

$$\sim (Fa \supset \sim Ga) \checkmark$$

$$Ga \quad 5\&$$

$$\sim (Fa \& Ga) \checkmark$$

$$Fa \supset \sim Ga \quad 2 \cup 1$$

$$Fa$$

$$\sim \sim Ga$$

$$\sim Fa \quad \sim Ga$$

$$\sim Fa$$

$$\sim Ga$$

$$x \quad (6,9)$$

$$x \quad (7,9)$$

$$x \quad (8,10)$$

$$x \quad (9,10)$$

All paths close. Therefore the formula is a tautology.

Teaching Logic Online:
What do you do when
the student needs to
draw the answer?

Stephanie Gibbons

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Logic is difficult to put online because we use

- Tables
- Special symbols
- Truth trees (semantic tableaux)

p	q	r	$p \& q$	$q \supset r$	$\therefore p \vee r$
T	T	T	T	T	T
T	T	F	T	F	T
T	F	T	F	T	T
T	F	F	F	T	T
F	T	T	F	T	T
F	T	F	F	F	T
F	F	T	F	T	F
F	F	F	F	T	F

There is no row where the premises are true and the conclusion false.
 \therefore the argument is valid.

$$(\forall x)(Fx \supset \sim Gx) \equiv (\exists z)(\forall y)(Rzy \vee Hz)$$

Both of these can be typed relatively easily.

The real problem is trees...

It might be possible to type some trees...

- But some would be really difficult

1.	$p \vee q$	✓	P
2.	$q \supset r$	✓	P
3.	$\sim(p \vee r)$	✓	NC
4.	$\sim p$		$3 \sim \vee$
5.	$\sim r$		
6.	p	q	$1 \vee$
	x		
	$(4,6)$		
7.	$\sim q$	r	$2 \supset$
	x	x	
	$(6,7)$	(x)	

All paths close.
 \therefore The argument is valid.

- There are challenges for
- providing the feedback needed for learning
 - delivering the instruction
 - receiving assessment

PHILO102-19B Test 2 A

7. Draw a truth tree to test whether the following formula is a tautology. Clearly state whether the formula is a tautology or not, and why. Where the formula is not a tautology, give a counter-example. Your tree should be fully annotated. [12 marks]

$[(A \supset C) \vee (B \supset C)] \supset [(A \vee B) \supset C]$

1.	$\sim\{[(A \supset C) \vee (B \supset C)] \supset [(A \vee B) \supset C]\}$	✓	NP		
2.	$(A \supset C) \vee (B \supset C)$	✓	$1 \sim \supset$		
3.	$\sim[(A \vee B) \supset C]$	✓			
4.	$A \vee B$	✓	$3 \sim \vee$		
5.	$\sim C$				
6.	$A \supset C$	✓	$2 \vee$		
7.	$\sim A$	C	$\sim B$	C	$6 \supset$
	x	x	x	x	
	$(5,7)$	$(5,7)$			
8.	A	B	A	B	$4 \vee$
	x		x		
	$(7,8)$		$(7,8)$		

$A=F, B=T, C=F$ the formula is false.
 \therefore not a tautology.

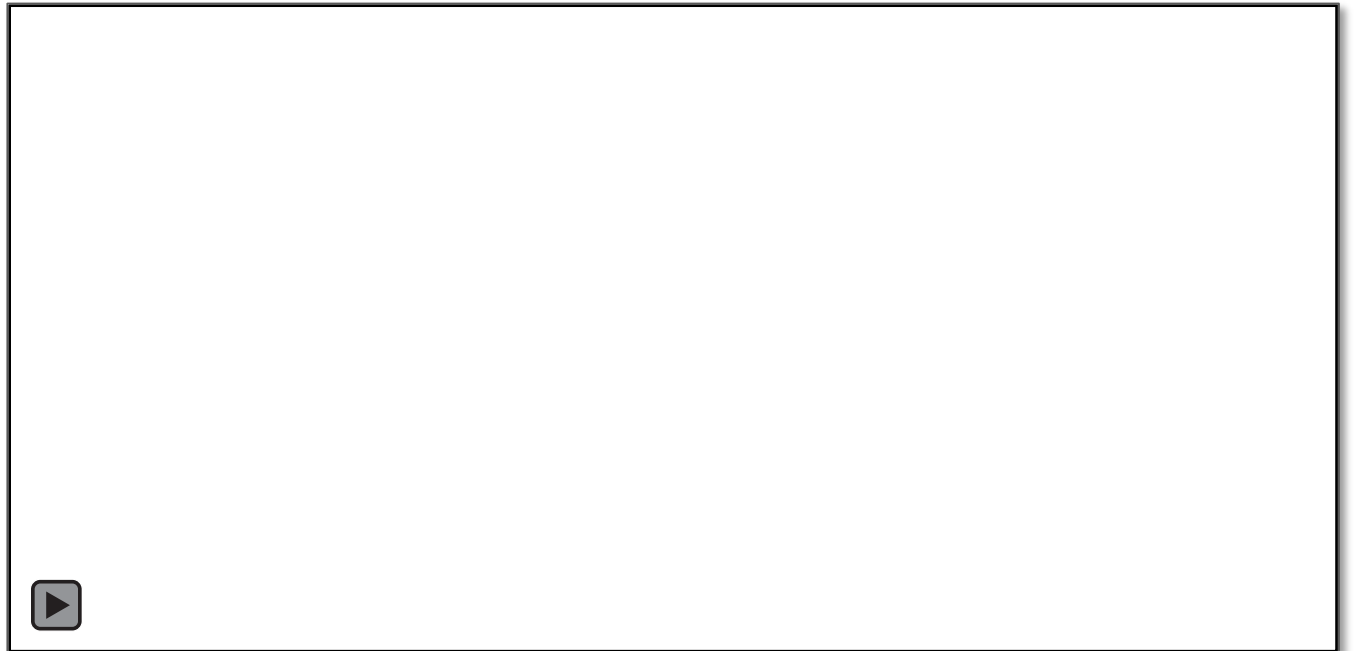
An alternative counter-example is
 $A=T, B=F, C=F$

Requirements

- If possible, everything should be done through Moodle
- No special software!
- No special equipment
- Everything needs to be accessible for those who are not tech-savvy.
- Students need to show they can solve problems themselves.
- I need to know it is their own work.

What needed to be adapted?

- Skills building quizzes
 - Lectures
 - Tutorials
 - Tests



These already existed

What needed to be adapted?

- Skills building quizzes
- **Lectures**
- Tutorials
- Tests



Each lecture was replaced with a lesson with embedded videos, and questions about the material.

What needed to be adapted?

- Skills building quizzes
- Lectures
- **Tutorials**
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Chapter 2 Exercises

A. Fill in the gaps of the following truth tables

p	q	p & q	(p & q) ≡ p	~[(p & q) ≡ p]
T	T	T	T	F
T	F	F		
F	T	F	T	
F	F			

p	q	r	~r	p ∨ q	~r & (p ∨ q)
T	T	T	F		
T	T	F		T	
T	F	T			
T	F	F			
F	T	T			
F	T				
F	F	T			
F	F				

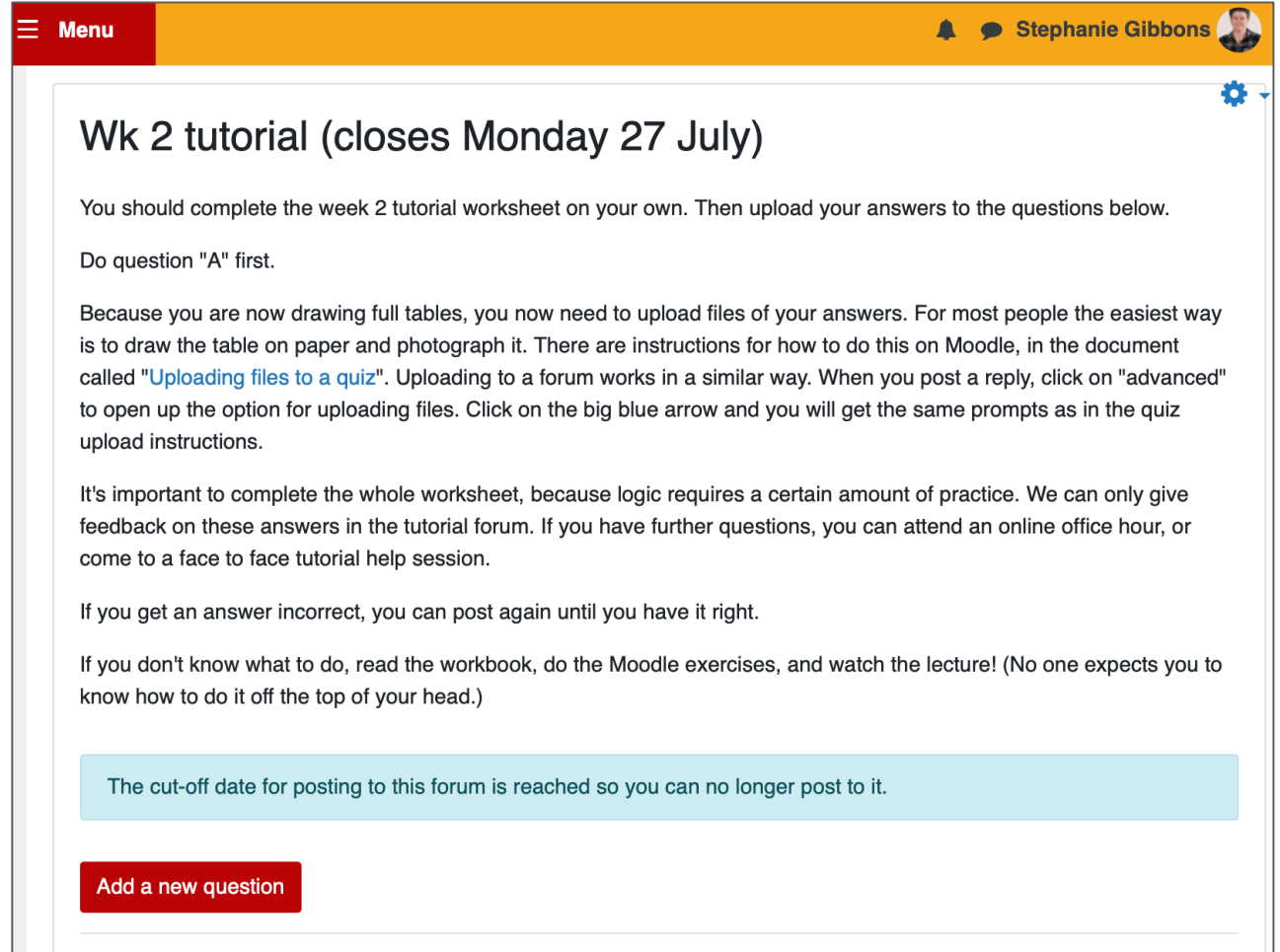
B. Draw a truth table for each of the following.

1. $p \vee q$
2. $A \& \sim B$
3. $(p \equiv \sim q) \& r$

Online students did the same worksheets, and uploaded selected answers to a forum

What needed to be adapted?

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The screenshot shows a Moodle forum page. At the top, there is a red 'Menu' button and a yellow header bar with a notification bell, a speech bubble, and the name 'Stephanie Gibbons' next to a profile picture. The main content area has a title 'Wk 2 tutorial (closes Monday 27 July)' and a gear icon. The text of the post includes instructions to complete a worksheet, upload answers, and post questions. A light blue box contains a warning about the posting deadline. At the bottom, there is a red button labeled 'Add a new question'.

Menu

Stephanie Gibbons

Wk 2 tutorial (closes Monday 27 July)

You should complete the week 2 tutorial worksheet on your own. Then upload your answers to the questions below.

Do question "A" first.

Because you are now drawing full tables, you now need to upload files of your answers. For most people the easiest way is to draw the table on paper and photograph it. There are instructions for how to do this on Moodle, in the document called "[Uploading files to a quiz](#)". Uploading to a forum works in a similar way. When you post a reply, click on "advanced" to open up the option for uploading files. Click on the big blue arrow and you will get the same prompts as in the quiz upload instructions.

It's important to complete the whole worksheet, because logic requires a certain amount of practice. We can only give feedback on these answers in the tutorial forum. If you have further questions, you can attend an online office hour, or come to a face to face tutorial help session.

If you get an answer incorrect, you can post again until you have it right.

If you don't know what to do, read the workbook, do the Moodle exercises, and watch the lecture! (No one expects you to know how to do it off the top of your head.)

The cut-off date for posting to this forum is reached so you can no longer post to it.

Add a new question

- Forums used the Q and A setting: students cannot see other people's posts until they post
- Forums were graded, but students could keep posting until they gave the correct answer.

What needed to be adapted?

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Some answers can be typed

But usually students drew them on paper, photographed them with their phone, and uploaded the photograph

A photograph of a handwritten truth table on lined paper. The table has 7 columns and 8 rows. The columns are labeled: B, G, P, G & B, (G & B) & P, ~B & P, and (~B & P) > ~G. The rows represent combinations of truth values for B, G, and P. The final row is marked with an upward-pointing arrow. Below the table, there are interactive elements: 'Sum of ratings: 10 (1)', 'Rate...', 'Permalink', 'Show parent', 'Edit', 'Split', 'Delete', and 'Reply'.

	B	G	P	G & B	(G & B) & P	~B & P	(~B & P) > ~G
T	T	T	T	T	T	F	F
T	T	T	F	F	F	F	F
T	T	F	T	F	F	F	F
T	T	F	F	F	F	F	F
T	F	T	T	F	F	F	F
T	F	T	F	F	F	F	F
T	F	F	T	F	F	F	F
T	F	F	F	F	F	F	F

What needed to be adapted?

- Skills building quizzes
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- **Tests**

Tests offer the biggest challenge

- The 3 tests are the main assessment (20%; 25%, 25%)
- Some questions can be asked using multichoice, but the student also needs to be able to solve whole problems

- For a test, it needs to be easy and fast
- It needs to be accessible (no special equipment or software)
- I need to know it is the student's work
 - Online tests make it possible for students to share questions and answers
 - As it's online, the test needs to be open book
- I wanted a time limit
- But also a time window...

What needed to be adapted?

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I divided each test into two parts.

Both parts were completed using the Moodle quiz activity

Part A was multichoice questions:

- Each question was randomly selected from a category containing 5-12 questions
- Students answer 25 or so questions in 30 minutes

Question 21
Not yet answered
Marked out of 1.00
[Flag question](#)
[Edit question](#)

Is the following true or false?

If two propositions are logically equivalent then they must be both true.

Select one:

True

False

Question 22
Not yet answered
Marked out of 1.00
[Flag question](#)
[Edit question](#)

Here is the truth table for $(\sim p \ \& \ q) = \sim(p \supset q)$

p	q	$\sim p$	$\sim p \ \& \ q$	$p \supset q$	$\sim(p \supset q)$	$(\sim p \ \& \ q) = \sim(p \supset q)$
T	T	F	F	T	F	T
T	F	F	F	F	T	F
F	T	T	T	T	F	F
F	F	T	F	T	F	T

What does this table show?

Select one:

The table doesn't show anything about $(\sim p \ \& \ q) = \sim(p \supset q)$

$(\sim p \ \& \ q) = \sim(p \supset q)$ is contingent

$(\sim p \ \& \ q) = \sim(p \supset q)$ is consistent

$(\sim p \ \& \ q) = \sim(p \supset q)$ is contradictory

$(\sim p \ \& \ q) = \sim(p \supset q)$ is a tautology

What needed to be adapted?

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Part B used the 'essay question' in the Moodle quiz:

- This allows students to upload a file for their answer

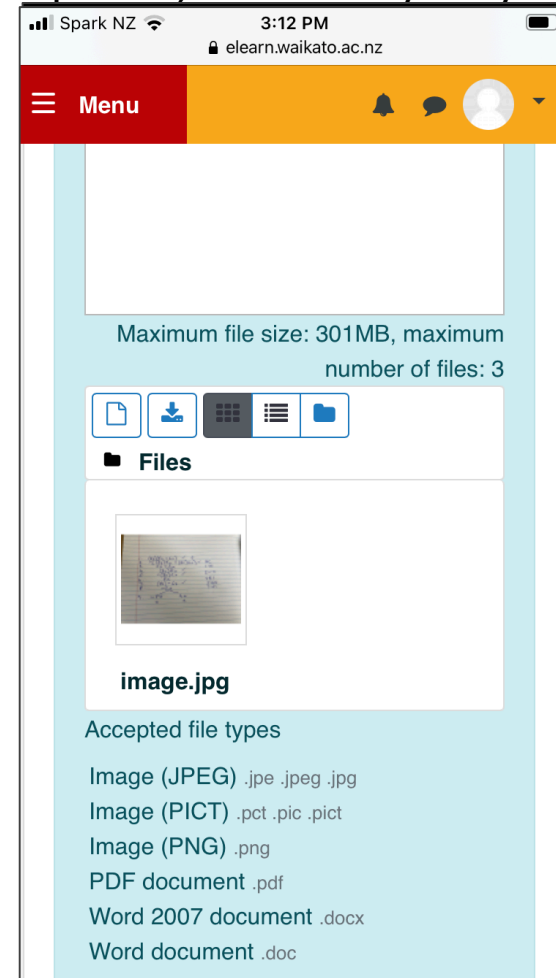
- Using the Moodle quiz allows me to set a time limit and a time window
- Questions are randomly selected from categories, so students don't all get the same questions. That makes it harder to share questions and answers.
- The only equipment needed is a smartphone (and pen and paper)

What needed to be adapted?

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How hard is it for students to use?

If they do the quiz on their phone, remarkably easy.
Here's what they see:



Write the answer on paper

This opens the camera

What needed to be adapted?

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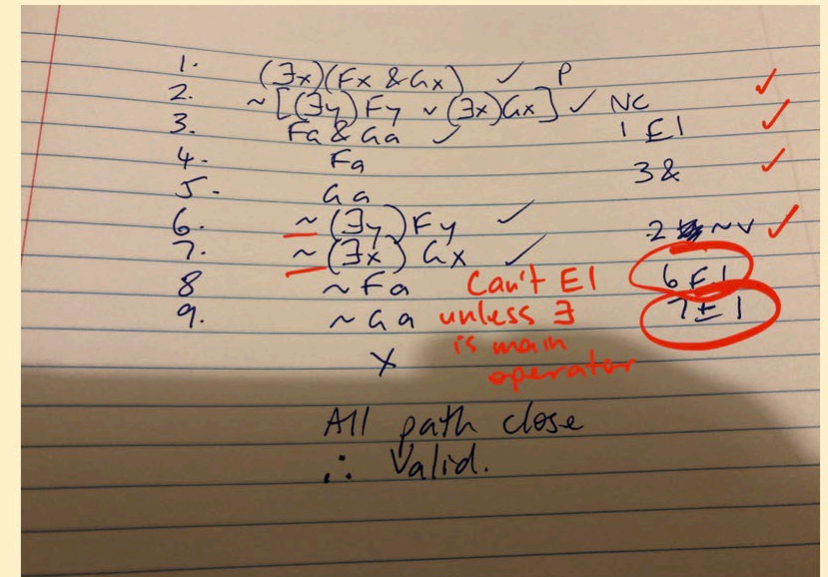
How hard is it to mark?

It's fiddlier than marking on paper – you have to open the photo, draw on it, then upload the marked image back to the test.

But I got faster at it.

image.jpg

Comment:



But how do you stop them cheating? or override mark

What needed to be adapted?

- Skills building quizzes
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How do you stop them cheating?

Students are permitted to use any course materials during the test. So looking up instructions doesn't count as cheating.

The value of sharing questions and answers is diminished by students getting different questions

Websites that solve problems pose a greater challenge.

- Students are required to set up their answers in specific ways, and lose marks for not doing so
- All students were required to do an oral component for Part B of their test

Pitfalls

- For the students
- For me

- Students took longer on Part B of their tests than I expected.
- Although they had opportunity to practice uploading files before the test, not all took it.
- Things can go wrong: internet, technology, life...
- I received fewer partial answers than I would in a paper test.

- I could no longer reuse tutorial questions or problems I had demonstrated in class in the test.
- It's harder to ask really difficult questions, because it's challenging to come up with alternatives that are equally difficult.

On the whole it went very smoothly

What about students who don't have a smartphone?