Slides for September 11 Quiz

(with solutions)

September 12, 2017

Section 1

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

Section 2

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

Initial Analysis

It's good to begin by making a truth table for the formula. Here it is, for the formulas presented to both sections.

p	q	$p \oplus q$	$p \vee q$	$p \wedge q$	$(p \oplus q) \rightarrow (p \wedge q)$	$(p \vee q) \rightarrow (p \wedge q)$
T	T	F	T	T	T	T
T	F	T	T	F	F	F
F	T	T	T	F	F	F
F	F	F	F	F	T	T

Answers to the questions.

The formulas for the two sections are equivalent: The formula is true if and only if both p and q have the same value. This is exactly the definition of $p \leftrightarrow q$, so the first answer is true. This is different from the exclusive-or (in fact it is exactly the negation of the exclusive-or), and it is different from all the other possibilities offered with just one occurrence of p and q, since for all of these, there are either 1 or 3 satisfying assignments, rather than 2. Thus 2,3,4,7,8 are all false.

You have to look a little more closely at the formulas in 5 and 6. But you might recognize that

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

which is exactly the definition of $p \oplus q$, so this is not equivalent to our original formula. Thus the answer to question 5 is false.

For question 6,

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

you can tabulate the truth values, or you can observe that it is identical to the preceding formula with q replaced by $\neg q$. Thus this

Answers to the questions–continued.

The circuit diagrams are trickier. But there is a large hint: The first diagram (with NAND gates)shows the output when p and q are both false to be false, so it cannot be equivalent to our original formula. For the second one, with the NOR gates, showing the value on a single assignment does not give the answer away (though you might very well guess that this is true). You could simplify the circuit a bit, but that's probably no more efficient than directly testing the three other assignments to confirm that this is true.

How'd you do?

Pretty well. This one was definitely harder than the last. The average was 85% across both sections, with Question 10 the most frequent incorrect answer. Nearly half the students got a perfect score.

Quiz--Propositional Logic 1

This is a preview of the published version of the quiz

Started: Sep 12 at 11:56am

Quiz Instructions

You will be shown a propositional formula on the screen in front of the classroom. This will be followed by a series of questions each displaying a propositional formula, sometimes in the form of a circuit. You are to select true if the formula displayed in the question is equivalent to the original formula, false otherwise.

Question 1 — 1 pts

$p \leftrightarrow q$

- True
- False

Question 2 — 1 pts

$p \oplus q$

- True
- False

Question 3 — 1 pts

$p|q$

- True
- False

Question 4 — 1 pts

$\neg p \vee \neg q$

- True
- False

Question 5 1 pts

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

- True
- False

Question 6 1 pts

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

- True
- False

Question 7 1 pts

$\neg p \wedge \neg q$

- True
- False

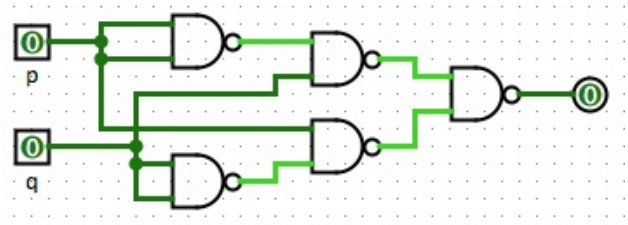
Question 8 1 pts

$q \rightarrow p$

- True
- False

Question 9

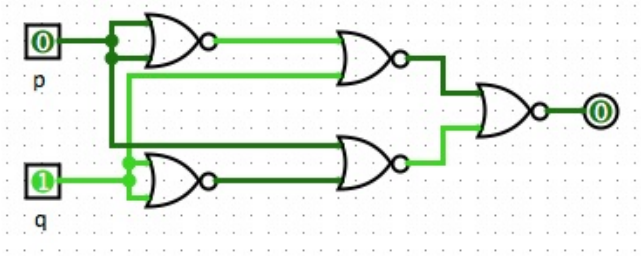
1 pts



- True
- False

Question 10

1 pts



- True
- False

Quiz saved at 12:08pm

Submit Quiz