

1) Show that $(\neg p \vee q) \wedge (p \vee \neg q)$ is satisfiable (if you use a table, picture or calculation, be sure to include enough words too).

2) Let p and q be the propositions *The election is decided* and *The votes have been counted* respectively. Express each of these as English sentences:

a) $\neg q \rightarrow \neg p$

b) $p \leftrightarrow q$

3) State DeMorgan's Laws of Logic (both).

Bonus (approx 5 pts): Suppose there are signs on the doors to two rooms. The sign on the first door reads *In this room there is a lady and in the other room there is a tiger*. The sign on the second door reads *In one of these rooms, there is a lady and in the other a tiger*. Suppose that you know that one of these signs is true and the other is false. Behind which door is the lady ?

Remarks and Answers: I did not want this quiz to repeat the ones from my 2011 and 2012 classes. As an indirect result, it got a little further from the assigned HW than usual. Eg, Problem 3 is just a memory problem, and Problem 1 is based more on the lectures + reading than the HW. But it was still an easy quiz, with good results on all the problems. The average was about 80 out of 100, but among the top 30 students it was approx 94. Based on that, the scale for the quiz is higher than expected:

A's 96 to 105

B's 86 to 95

C's 76 to 85

D's 66 to 75

It seems likely that this will be the highest scale this term. Most quizzes in the past have had an average more more like 70 / 100, with a much lower scale.

1) [30 points] Construct a truth table, showing that $(\neg p \vee q) \wedge (p \vee \neg q)$ is True in two cases out of 4 [this step is worth about 15 out the 30 points]. Since it is True in at least one case, it is satisfiable, eg not a contradiction. You had to say something like this for full credit.

2a) [40 points] *If the votes have not been counted then the election is not decided*. I did not give full credit if you changed this into something logically equivalent, such as its contrapositive (why do that?). I accepted some rewording such as *When the votes have not been counted, the election is not decided*. I did not give full credit for *Since the votes have not been counted, therefore the election is not decided*. That language may be OK in

a proof, but it indicates (incorrectly) that *the votes have not been counted* is clearly True (but we do not know if this is True).

2b) The election is decided if and only if the votes have been counted.

3) [30 points] $\neg(p \wedge q) \equiv \neg p \vee \neg q$ and $\neg(p \vee q) \equiv \neg p \wedge \neg q$.

Bonus) [5 points max] Second door. If the first sign is T, then the second is also T (contradiction), so the first is F and the second is T. So, second door. I gave only 1 point for saying *second door*, if you did not explain it correctly.