

MATH 170 IDEAS IN MATHEMATICS (SUMMER 2006)
Problem Set 3: More truth tables and de Morgan's Laws
 Due in class Thursday, May 25th

1. de Morgan's Laws

Let P and Q be propositions (i.e. statements that are either true or false). Recall the symbolic logic notation \neg for “not”, \wedge for “and”, and \vee for “or”, and also recall their corresponding truth tables:

P	$\neg P$
T	F
F	T

P	Q	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

P	Q	$P \vee Q$
T	T	T
T	F	T
F	T	T
F	F	F

where T stands for “true” and F for “false.”

a. Complete the following truth tables:

P	Q	$P \wedge Q$	$\neg(P \wedge Q)$
T	T		
T	F		
F	T		
F	F		

P	Q	$\neg P$	$\neg Q$	$(\neg P) \vee (\neg Q)$
T	T			
T	F			
F	T			
F	F			

P	Q	$P \vee Q$	$\neg(P \vee Q)$
T	T		
T	F		
F	T		
F	F		

P	Q	$\neg P$	$\neg Q$	$(\neg P) \wedge (\neg Q)$
T	T			
T	F			
F	T			
F	F			

b. What do you notice about the truth values of the following propositions?

$$\neg(P \wedge Q) \quad \text{versus} \quad (\neg P) \vee (\neg Q)$$

$$\neg(P \vee Q) \quad \text{versus} \quad (\neg P) \wedge (\neg Q)$$

(Hint: Use the words “logically equivalent.”) You’ve just proved *de Morgan's Laws*. Do they make sense to you? Also, create propositions in English for P and Q to exemplify de Morgan's Laws.