

# CS/MA 320 HW1-Part 1 (See also HW1-Part 2)

Your solutions are due in class, Wed., 9/21 or under my door by Tuesday, 9/22 by 2:00 PM. (NO LATER OR IT WON'T COUNT!). Pencil on paper is fine. Solutions will be on-line by Tuesday evening, and Quiz 1 will be on Wednesday, in the first 25 minutes.

1. State the converse, contrapositive, and inverse (labeling clearly) of the following implication: If it snows tonight then I will stay at home. Which of pairs of those forms mean the same thing (two pairs of implications are identical in meaning).
2. Construct a truth table for each of these compound propositions (you can use the same frame for all truth tables). Are any of them Contradictions or Tautologies?  
(a)  $p \wedge \neg p$  (b)  $(p \wedge q) \rightarrow (p \vee q)$  (c)  $p \oplus (p \vee q)$  (d)  $p \vee (q \wedge r) \leftrightarrow (p \vee q) \wedge (p \vee r)$   
(e)  $(p \wedge q) \wedge r \leftrightarrow p \wedge (q \wedge r)$
3. Note precedence diagram below. (a) Could the parentheses be left out of 2.(b) above without changing the meaning? (b) Same question for 2.(c). Note that the symbol  $\Leftrightarrow$  we've been using for tautological equivalence will be  $\equiv$  from now on.

Precedence of  
Logical Operators

Operator	Precedence
$\neg$	1
$\wedge$	2
$\oplus$	3
$\vee$	4
$\rightarrow$	5
$\leftrightarrow$	6

4. Determine whether these system requirements are consistent.

"If the file system is not locked, then new messages will be queued."

"If the file system is not locked, then the system is functioning normally, and conversely."

"If new messages are not queued, then they will be sent to the message buffer."

"New messages will not be sent to the message buffer."

5. (a) Show that  $\neg(p \oplus q)$  and  $p \leftrightarrow q$  are logically equivalent (a tautology).  
(b) Show that  $(p \vee q) \wedge \neg(p \vee r) \rightarrow (q \vee r)$  is a tautology.