

INFO I201
Homework 1
Due 05/9/13

- **Reading assignment:** Read Chapter 1, Section 2.1, and the first two pages of Section 2.2 of the textbook.
- **Regular problems:**

1. Determine whether each of the following propositions is true or false.

- $1 + 1 = 3$ if and only if pigs can fly.
- If pigs can fly, then $1 + 1 = 3$.
- If $2 + 2 = 4$, then $1 + 2 = 3$.
- If $0 > 1$ and $1 + 1 = 2$, then $1 = 1$.

2. Construct the truth table for each of the following formulas:

- (a) $(A \vee B) \wedge C$
- (b) $(\neg A \vee B) \longrightarrow (\neg A)$
- (c) $(A \longrightarrow B) \longleftrightarrow ((\neg B) \longrightarrow (\neg A))$
- (d) $A \longrightarrow ((B \longrightarrow A) \longrightarrow C)$

3. Let us define a new binary connective denoted $A \otimes B$, as follows:

A	B	$A \otimes B$
t	t	t
t	f	t
f	t	f
f	f	t

Construct the truth table for the formula $(A \longleftrightarrow B) \otimes (A \longleftrightarrow \neg B)$.

4. We say that $B \longrightarrow A$ is the *converse* of $A \longrightarrow B$ and that $\neg B \longrightarrow \neg A$ is the *contrapositive* of $A \longrightarrow B$. Find the converse and the contrapositive of the following implications.
- If n is less than 4, then n^2 is less than 16.
 - If p is a prime number, then it is less than 3.
5. Is a tautology satisfiable? Is a satisfiable formula a tautology? Is a satisfiable formula a contradiction? Explain your answers.
6. Which of the following are tautologies? (Use truth table to prove or a counterexample to disprove.)

- $((A \longrightarrow B) \wedge (B \longrightarrow C)) \longrightarrow (A \longrightarrow C)$
- $(A \longrightarrow B) \longleftrightarrow ((\neg B) \longrightarrow (\neg A))$
- $\neg(A \wedge B) \longleftrightarrow ((\neg A) \vee (\neg B))$
- $(A \longrightarrow B) \longrightarrow (\neg A \longrightarrow \neg B)$
- $(A \longleftrightarrow B) \longleftrightarrow (\neg A \longleftrightarrow \neg B)$