

MATH 2610
Discrete Mathematics for Computer Science
Wednesday January, 12 2005

Here's how the homework gig is gonna go down. I'll assign you problems during the week and collect them the following Tuesday. I will then select a few problems to grade. Please try to make an effort to write your homework neatly so that I can read it and staple the pages together. If you need any help, come by and see me in my office (boyd 601A) or send me an email. Please don't hesitate to ask for help. It's my job.

(1) Use truth tables to verify these equivalences.

- (a) $p \wedge \mathbf{T} \equiv p$
- (b) $p \vee \mathbf{F} \equiv p$
- (c) $p \wedge \mathbf{F} \equiv \mathbf{F}$
- (d) $p \vee \mathbf{T} \equiv \mathbf{T}$
- (e) $p \vee p \equiv p$
- (f) $p \wedge p \equiv p$

(2) Use a truth table to verify the distributive law $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$.

(3) Use a truth table to prove De Morgan's laws

- (a) $\sim (p \wedge q) \equiv (\sim p) \vee (\sim q)$
- (b) $\sim (p \vee q) \equiv (\sim p) \wedge (\sim q)$

(4) Show that each of these implications is a tautology by using truth tables.

- (a) $[\sim p \wedge (p \vee q)] \rightarrow q$
- (b) $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$
- (c) $[p \wedge (p \rightarrow q)] \rightarrow q$
- (d) $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$

(5) Show that each compound proposition in the previous exercise is a tautology *without* using truth tables. You may find Table 6 and Table 7 helpful (page 24).

(6) Determine whether $(\sim p \wedge (p \rightarrow q)) \rightarrow \sim q$ is a tautology.

(7) Show that $\sim p \leftrightarrow q$ and $p \leftrightarrow \sim q$ are logically equivalent.

(8) Show that $\sim p \rightarrow (q \rightarrow r)$ and $q \rightarrow (p \vee r)$ are logically equivalent.

(9) Show that $(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r)$ is a tautology.