Lecture 2.

To do: Read 1-2, 1-3, finish exercise in 1-2.
Webwork orientation by Wed & finish the demo
HW1, which is due on Friday night


A+O/O  A+O/A  A/O

First check the "mixed" box. e.g pick an apple.

De Morgan's Law:
$\neg(p \wedge q) = \neg p \vee \neg q$

Destributive law: $p \wedge (q \vee r) = (p \wedge q) \vee (p \wedge r)$
$p \vee (q \wedge r) = (p \vee q) \wedge (p \vee r)$

Commucative law:
$p \vee q = q \vee p$

Absorption law: $p \vee (p \wedge q) = p$
$p \wedge (p \vee q) = p$

Associative law:
$p \wedge (q \wedge r) = p \wedge q \wedge r$
$p \vee (q \vee r) = p \vee q \vee r$

The first De Morgan law: $\neg(p \wedge q) = \neg p \vee \neg q$

| p | q | $\neg(p \wedge q)$ | | $\neg p \vee \neg q$ | | |
|---|---|---|---|---|---|---|
| T | T | F | T | F | F | F |
| T | F | T | F | F | T | T |
| F | T | T | F | T | T | F |
| F | F | T | F | T | T | T |

Simplification:
e.g. $\neg(\neg p \vee q) \wedge p$

"=" is inappropriate here

is equiv to $(p \wedge \neg q) \wedge p$ Second De Morgan's law
" " " $p \wedge \neg q \wedge p$ Associative law.
" " " $p \wedge \neg q$

Tautology: A formula that is always true.
i.e. $p \vee \neg p$

Contradiction: A formula that is always false.
i.e. $p \wedge \neg p$

Neither: A formula that is neither a tautology or a contradict

e.g. Are these Tautology, Contridiction, or neither:

| | |
|---|---|
| $P$ | Neither |
| $Q$ | Neither |
| $P \vee Q \vee \neg P$ | Tautology |
| $P \wedge \neg(Q \vee \neg Q)$ | Contradiction |
| $P \vee \neg(Q \vee \neg Q)$ | Neither |

Tautology Laws:

| | | |
|---|---|---|
| $P \wedge$ (taut) | is equivlent to | $P$ |
| $P \vee$ (taut) | | taut |

Contradiction Laws:

| | | |
|---|---|---|
| $P \vee$ (cont) | is equivlent to | $P$ |
| $P \wedge$ (cont) | | cont |

i.e. $P \vee Q \vee \neg P$

is equiv to $(P \vee \neg P) \vee Q$

--- (taut) $\vee Q$

--- taut

$P \wedge \neg(Q \vee \neg Q)$

is equiv to $P \wedge \neg$ (taut)

--- $P \wedge$ (contr)

--- contr.

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

is equiv to $P \vee \neg$ (taut)

--- $P \vee$ (contr)

--- $P$