## Chapter 3:

- ▶ Propositions, booleans, logical equivalence. §3.(1 & 2) (Today)
- Conditional propositions, conditional expressions. §3.3 (next week Monday)

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- Arguments and predicates. §3.(5 & 6) (next week Wednesday)
- Predicates and quantification. §3.(6 & 7) (next week Friday)
- (Begin proofs week-after)

Today:

- Retrospective on test and some recent homework
- ▶ Highlight main points of §3.1: Propositions, forms, etc
- Work through §3.2: Logical equivalences (Game 1)

A proposition is a sentence that is true or false, but not both.

It is snowing and it is not Thursday.

A propositional form is like a proposition but with content replaced by variables.

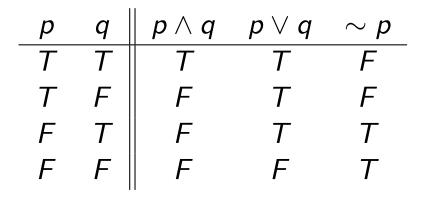
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p and not q

 $p\wedge \sim q$ 

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Evaluate (to T or F) this logical expression:

 $(T \land (\sim F \lor F)) \land (T \land T)$ 

Evaluate (to T or F) this logical expression:

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 $(T \lor F) \land \sim (F \land T)$ 

Evaluate (to T or F) this logical expression:

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(F \lor F \lor T) \land (\sim T \land F)
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Commutative laws:	$p \wedge q$	≡	$q \wedge p$	$p \lor q$	≡	$q \lor p$
Associative laws:	$(p \land q) \land r$	≡	$p \wedge (q \wedge r)$	$(p \lor q) \lor r$	≡	$p \lor (q \lor r)$
Distributive laws:	$p \wedge (q \vee r)$	=	$(p \land q) \lor (p \land r)$	$p \lor (q \land r)$	≡	$(p \lor q) \land (p \lor r)$
Absorption laws:	$p \wedge (p \vee q)$	=	p	$p \lor (p \land q)$	≡	p
Idempotent laws:	$p \wedge p$	≡	p	$p \lor p$	≡	p
Double negative law:	$\sim \sim p$	=	p			
DeMorgan's laws:	$\sim (p \wedge q)$	=	$\sim p ee \sim q$	$\sim (p \lor q)$	≡	$\sim p \wedge \sim q$
Negation laws:	$p \lor \sim p$	=	Т	$p\wedge\sim p$	=	F
Universal bound laws:	$p \lor T$	=	Т	$p \wedge F$	≡	F
Identity laws:	$p \wedge T$	=	p	$p \lor F$	=	p
Tautology and contradiction laws:	$\sim T$	≡	F	$\sim$ F	=	Т

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Remember from high school algebra that there are "simplify" problems and "solve" problems.

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■ Simplify  $3x(2+3x)^2 + 1$ .  $3x(2+3x)^2 + 1$   $= 3x(4+12x+9x^2) + 1$   $= 12x + 36x^2 + 27x^3 + 1$   $= 27x^3 + 36x^2 + 12x + 1$ ■ Solve 12x = 57 - 7x for x. 12x = 57 - 7x 19x = 57x = 3 Suppose we were to show that  $\sim (\sim p \land q) \lor (p \lor \sim p) \equiv p \lor \sim q$ .

Do this:

$$\begin{array}{l} \sim (\sim p \land q) \lor (p \land \sim p) \\ \equiv & \sim (\sim p \land q) \lor F \\ \equiv & \sim (\sim p \land q) \lor F \\ \equiv & \sim (\sim p \land q) \\ \equiv & p \lor \sim q \end{array}$$
 by negation law by identity law

Don't do this:

## For next time:

Do Exercises 3.2.(2, 4, 8-12)

You may redo Exercise 2.3.10 (interweave\_list) and/or 2.3.17 (quick\_sort)

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Read 3.4 Take quiz