[Get 75% of students to turn on cameras]

"How do I know whether my 20/20 means I got it perfectly or whether I just put in enough effort?" "You won't know unless you read the solutions!"

Be careful about submitting HW by phone.

However you submit, be sure to CHECK that your homework made its way onto Blackboard.

I hear that if you want to turn a bunch of photos into a single PDF, some great software to use is "ilovepdf". Have any of you used it? Adobe Scan works too!

Questions? Issues?

Are the lecture videos accessible from both sites?

Section 3.1: Propositions and Logical Operators

- Know the basic logical operators and their truth tables: negation ($\neg$), conjunction ($\wedge$), disjunction ($\vee$), conditional ($\rightarrow$), biconditional ($\leftrightarrow$)
- Given a statement in English, express the statement symbolically in terms of propositions and logical operators.
- Given a symbolic statement involving propositions and logical operators, translate the statement into English.
- Given a conditional statement, write the contrapositive and converse.

Define these terms. Give examples. Compare.

Mnemonic: $\wedge$ looks like the “A” in “and”, missing the horizontal stroke

Questions on 3.1?

The truth table for $\neg p \vee q$:

p	q	$\neg p$	$(\neg p) \vee q$
0	0	1	1
0	1	1	1
1	0	0	0
1	1	0	1

Note that the last column of the table (1,1,0,1) is the same as the last column in the truth table for $p \rightarrow q$.

[See Definition 3.1.6 and Example 3.1.8.]

If the truth table for $p \to q$ seems confusing, you're right! We'll come back to this in a bit. What do YOU think the truth table for "implies" should be?

Please don't write

p	q	$\neg p$	$(\neg p) \vee q$
F	F	T	T
F	T	T	T
T	F	F	F
T	T	F	T

or

p	q	$\neg p$	$(\neg p) \vee q$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

on homework or tests in this class.

Order of operations (if parentheses don't override): first **not** ($\neg$), then **and** ($\wedge$), then **or** ($\vee$); then **implies** ($\rightarrow$), **is implied by** ($\leftarrow$), and **is equivalent to** ($\leftrightarrow$). (I'm not sure how the last three compare to one another, priority-wise; I'm guessing there's no universal agreement about this. Some students thought CS has left-to-right as the default.)

These all take priority over $\Rightarrow$, $\Leftarrow$, and $\Leftrightarrow$.

(We'll discuss the difference between $\rightarrow$ and $\Rightarrow$ next time.)

Note that we also call $\neg$ "negation", but it doesn't have anything to do with what's called negation in arithmetic. So the negation of the sentence 2=3 is not the sentence –2=–3, but rather the sentence $2\neq3$.

.

Group work: 3.1.2 (recall that a prime number is an integer greater than 1 that has exactly two positive divisors, namely 1 and itself; the primes as $2, 3, 5, 7, \ldots$) (10 min.; consider dividing up the problem and working in parallel at the start; email me the whiteboard before you leave the room)

For each of the following propositions, identify simple propositions, express the compound proposition in symbolic form, and determine whether it is true or false:

(a) The world is flat or zero is an even integer.

(b) If 432,802 is a multiple of 4, then 432,802 is even.

(c) 5 is a prime number and 6 is not divisible by 4.

(d) $3 \in \mathbb{Z}$ and $3 \in \mathbb{Q}$.

(e) $2/3 \in \mathbb{Z}$ and $2/3 \in \mathbb{Q}$.

(f) The sum of two even integers is even and the sum of two odd integers is odd.

..?..

Note that part (b), and variations, help us understand why the truth table for "→" was chosen to be what it is. If the general proposition "For all integers *n*, if *n* is a multiple of 4 then *n* is even" is true, then specific propositions like "If 3 is a multiple of 4 then 3 is even" should be true as well.

Other questions on 3.1?

Section 3.2: Truth Tables and Propositions Generated by a Set

- Write down the truth table for a compound proposition.

Questions on 3.2?

Group work: 3.2.2(abc) (12 minutes; again, "divide and conquer"; and send me the whiteboard when done)

Construct the truth tables of:

(a) $\neg(p \wedge q)$

(b) $p \wedge (\neg q)$

(c) $(p \wedge q) \wedge r$

..?..

Do (a) row by row, (b) column by column.

p	q	$p \wedge q$	$\neg(p \wedge q)$
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

p	q	$\neg q$	$p \wedge (\neg q)$
0	0	1	0
0	1	0	0
1	0	1	1
1	1	0	0

Poll: Row by row, or column by column? Discuss.

I avoid errors by doing one column at a time.

This truth table shows that for all propositions p and q,

(*) $p \wedge \neg q \rightarrow \neg(p \wedge q)$:

p	q	$p \wedge q$	$\neg(p \wedge q)$	$\neg q$	$p \wedge (\neg q)$	(*)
0	0	0	1	1	0	1
0	1	0	1	0	0	1
1	0	0	1	1	1	1
1	1	1	0	0	0	1

Using truth tables, you can show that $p \wedge (q \vee r)$, does NOT have the same truth table as $(p \wedge q) \vee r$, so they are not equivalent propositions; that's why it's important to have a convention about precedence of operations.

Regarding section 3.4: You won't need to absorb or memorize Table 3.4.3.