

COMP 1113 Pre-reqCOMP 3761

logic ← common sense?

probability

proofs ←

Set

alg. efficiency ←

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<http://netstorage.bcit.ca>Out
Comp
2121

} jason's materials

Lots of work]
Lots of reward]

Quiz on Mondays →

Q+A

quiz

lecture

lab - practice

Look online for textbook errata.

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A woman has 2 children,
one of which is a girl.
What's the probability the other
is a girl?

~~BB~~

BG

GB

GG

$\frac{1}{3}$ GG

If you trust in yourself
and believe in your dreams
and follow your star

... you'll still get beaten
by people who spent their time working hard
and learning things
and weren't so lazy.

(Terry Pratchett)

Chapter 2 of required text!

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Logic

(pg 1-15 handout)

dfn: Statement: a sentence that is either true or false but not both.

$5 = 6$ a false statement

"it is snowing" a false statement.

$4 \leq 5$ a true statement

$x \leq 5$ not even a statement.
↳ "a statement form"

"this sentence is false" not a statement

Use symbols to represent statements.
 ↳ variables
 ↳ logical connectives

e.g. let $P =$ "it is raining"
 ↑
 statement variable

\sim "not"

aka \neg

$\sim P =$ "it is not raining"

$=$ "it is not the case that it is raining"

$\sim P$ has the opposite truth value of P .

Truth table:

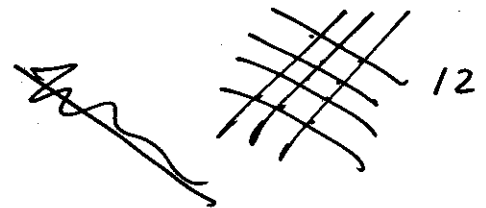
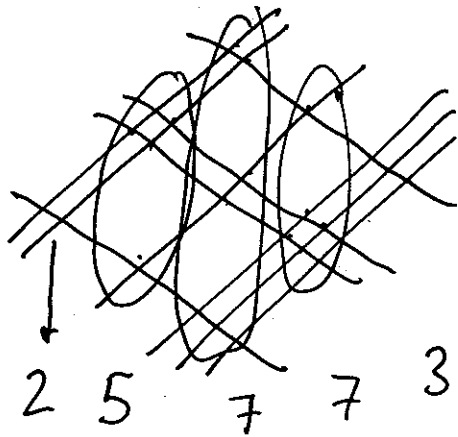
table of all combinations
of truth values for our
statement variables:

P	$\sim P$
T	F
F	T

P	Q
T	F T
T	F
F	T
F	F

$$\underline{2} \underline{1} \underline{3} \times \underline{1} \underline{2} \underline{1}$$

$$3 \times 4 = 12 \quad -6-$$



Logical Connectives

(1) Conjunction "AND" \wedge

★ let $P =$ "it is raining"
let $Q =$ "the ground is wet"

$P \wedge Q$

P and Q

"it is raining and the ground is wet"

TT:

P	Q	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

"AND" is true when
and only when both/all
statements are true.

(2) Disjunction

"OR"

\vee

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it is raining P	the ground is wet Q	$P \vee Q$
T	T	T
T	F	T
F	T	T
F	F	F

Inclusive or

exclusive or:

"tea or coffee" } not both
"salad or fries" }

Order of operations

$\sim p \wedge q \vee r$

① NOT P evaluated first
② then "and"
③ lastly, evaluate or

So $\sim p \wedge q \vee r \rightarrow ((\sim p) \wedge q) \vee r$

Put brackets wherever you want, to change/force the order:

$(\sim(p \wedge q)) \vee r$ is different than

Order of Operations:

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- ① Evaluate parentheses first
- ② Evaluate negation second
- ③ Evaluate and next
equal to each other

$p \wedge q \vee r$ } in Comp 2121 do not write ambiguously like this.

instead, write as $(p \wedge q) \vee r$
or $p \wedge (q \vee r)$

Ok! $p \wedge q \vee r$
Ok! $p \vee q \vee r$
Not ok! $p \vee q \wedge r$

Is $(p \wedge q) \vee r = p \wedge (q \vee r)$?

p	q	r	$p \wedge q$	LHS	$q \vee r$	RHS	LHS = RHS
T	T	T	T	T	T	T	✓
T	T	F	T	T	T	T	✓
T	F	T	F	T	F	F	✓
T	F	F	F	F	F	F	✓
F	T	T	F	T	T	T	✗ No
F	T	F	F	F	T	F	✓
F	F	T	F	T	F	F	✗ No
F	F	F	F	F	F	F	✓

LHS RHS

Midterm Exam: June 30 (Monday)

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Q1 Write the following statement using symbols:
"it is raining but the ground is not wet"

A1 Let $p =$ "it is raining"
Let $q =$ "the ground is wet"

$$p \wedge \sim q$$

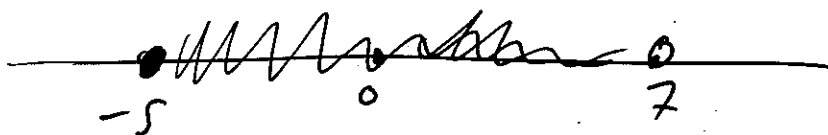
Q2 Write this using symbols:
 $x \geq 4$

A2 $(x > 4) \vee (x = 4)$

Q3 Write this using symbols:

$$-5 \leq x < 7$$

$$((x > -5) \vee (x = -5)) \wedge (x < 7)$$



dfn: negation:

exactly expresses what it means
for a statement to be false

dfn: Conjunction:

$(p \wedge q)$ is true when and only when
 p is true and q is true.

dfn: disjunction:

$(p \vee q)$ is false when and only when
 p is false and q is false.

dfn: A statement form is a sentence made
of statement variables and logical
connectives that becomes a statement
when actual statements are substituted
for the variables.

Truth tables are drawn for statement forms.

Statement: it is raining here now (Content)

St. form: let $r =$ "it is raining here now" (form)
 r

Statement: "the ground is wet"

St. form: let $t =$ "the ground is wet"
 $r \wedge t$ is a statement form.

These two statements have the same form: -11-

I studied hard and I scored an A.

The Earth is flat and I am 20 feet tall.

St. or st form:

$$x \leq 5$$

form (variable)

$$3 \leq 5$$

st. (true)

"the instructor sucks" ^{st.} st. form

Exclusive or!

one or the other is true BUT NOT BOTH!

$p \text{ xor } q$: do this using our symbols:

$$(p \wedge \sim q) \vee (q \wedge \sim p)$$

or

$$(p \vee q) \wedge \sim (p \wedge q)$$

dfn: Logical Equivalence

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~~Def~~ Statements are logically equivalent if and only if they have identical truth values for every row in their truth tables.

Quiz

ie Different ways of saying the same thing

$$6 > 2$$

$$2 < 6$$

Q Is $(p \wedge q) \equiv (q \wedge p)$?

A/

p	q	$p \wedge q$	$q \wedge p$
T	T	T	T ✓
T	F	F	F ✓
F	T	F	F ✓
F	F	F	F ✓

yes.

Q Is $\sim(\sim p \wedge q) \equiv \sim p \wedge \sim q$?

p	q	$\sim p$	$\sim p \wedge q$	$\sim(\sim p \wedge q)$	$\sim q$	$\sim p \wedge \sim q$
T	T	F	F	T	F	F
T	F	F	F	T	T	F
F	T	T	T	F	F	F
F	F	T	F	T	T	T

LHS = RHS?

x STOP

Not

LE

LHS

RHS

$$Q) \sim(\sim P) \stackrel{?}{=} P$$

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A)

P	$\sim P$	$\sim(\sim P)$	LHS = RHS
T	F	T	✓
F	T	F	✓
RHS		LHS	

LE

$$X = 10$$

$$\frac{X}{3} = \frac{10}{3}$$

$$\frac{X}{3} = 3.333...$$

$$X = 9.9999...$$

De Morgan's Laws:

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Negations of "and" / "or"

Quiz

$$\textcircled{1} \sim(p \wedge q) \equiv \sim p \vee \sim q$$

$$\textcircled{2} \sim(p \vee q) \equiv \sim p \wedge \sim q$$

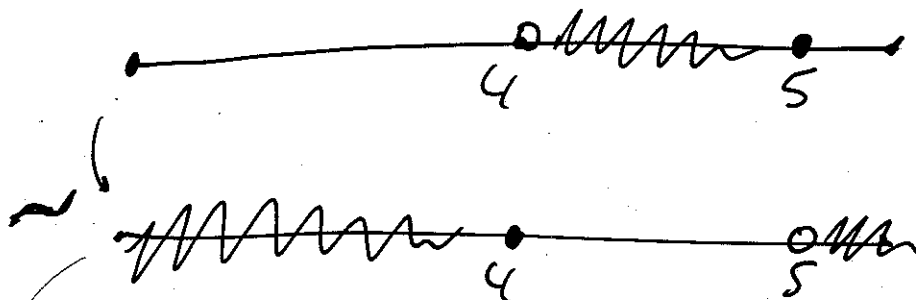
Negate this statement:

Q "Markus Naslund is a woman and Markus Naslund hates children"

A "M.N. is not a woman or M.N. does not hate children"

Q Negate: "4 < x < 5"

A



$$(x \leq 4) \vee (x \geq 5)$$

Quiz

defn Tautology:

a statement form that is
always true.

$$p \vee \sim p$$

p	$\sim p$	$p \vee \sim p$
T	F	T
F	T	T

defn A contradiction is a statement form
that is always false.

$$p \wedge \sim p$$

p	$\sim p$	$p \wedge \sim p$
T	F	F
F	T	F

Lab! Handouts:

① update textbook errata

② Page 15:

86ce # 34 # 51

30 # 44

ALL QUESTIONS - Pg 15 Handout
- 2.1, 2.2 of required text } +5%
over all keep it