

Semester roadmap:

Ch 1 & 2: Raw materials

Ch 3: Formal logic

—Test 1, Feb 12 —

Ch 4: Proofs

Ch 5: Relations

— Test 2, Mar 20 —

Ch 6: Self reference

Ch 7: Functions

— Test 3, Apr 19 —

Chapter 3 roadmap:

Today: Logical equivalences (Game 1)

Wednesday: Conditionals (SML)

Friday: Arguments (Game 2)

Next week Monday: Predicates and quantification (SML)

Next week Wednesday: Quantified arguments (Game 3)

Next week Friday: Review for test

Chapter 3 outline:

- ▶ Propositions, boolean logic, logical equivalences. **Game 1** (Monday)
- ▶ Conditional propositions. **SML** (Today)
- ▶ Arguments. **Game 2** (Friday)
- ▶ Predicates and quantification. **SML** (next week Monday)
- ▶ Quantified arguments. **Game 3** (next week Wednesday)
- ▶ Review for test (next week Friday)

So far:

- ▶ $\mathbb{B} = \{T, F\}$, \wedge , \vee , \sim , propositional calculus
- ▶ Verifying logical equivalences between propositional forms (Game 1)

Today—how to model propositional forms that have an if/then structure (§3.(5–7)):

- ▶ Highlight the most important parts
- ▶ Highlight the most confusing parts
- ▶ Work on some SML examples

| p | q | $p \wedge q$ | $p \vee q$ | $\sim p$ | $\sim p \vee q$ | $p \rightarrow q$ |
|-----|-----|--------------|------------|----------|-----------------|-------------------|
| T | T | T | T | F | T | T |
| T | F | F | T | F | F | F |
| F | T | F | T | T | T | T |
| F | F | F | F | T | T | T |

p

q

If 12 divides 36 evenly, then 3 divides 72 evenly.

If $3 < 72$, then 3 divides 72 evenly.

If 12 divides 36 evenly, then $72 < 3$.

If $72 < 3$, then 3 divides 72 evenly.

If $72 < 3$, then 12 divides 3 evenly.

| | | | | |
|---|---|---|---|---|
| T | S | R | Q | P |
| K | L | M | N | O |
| J | I | H | G | F |
| E | D | C | B | A |

1. Bob passed through *P*.
2. Bob passed through *N*.
3. Bob passed through *M*.
4. If Bob passed through *O*, then Bob passed through *F*.
5. If Bob passed through *K*, then Bob passed through *L*.
6. If Bob passed through *L*, then Bob passed through *K*.

“If Fred was at the dock at midnight, then he’s the murderer.”

“If it’s raining at home and the windows are still open, then water is coming in.”

“If I were John and John were me, then he’d be six and I’d be three.” — A. A. Milne

“If the dryer is finished, then unload it.”

“If you finish your spinach, then I will give you some cake.”

“If it rains tomorrow, the zucchini will sprout.”

An even degree is a **necessary condition** for a polynomial to have no real roots .

means

If a polynomial function has no real roots, then it has an even degree.

A positive global minimum is a **sufficient condition** for a polynomial to have no real roots

means

If a polynomial function has a positive global minimum, then it has no real roots.

Values all of the same sign is a **necessary** and **sufficient** condition for a polynomial to have no real roots.

means

A polynomial function has values all of the same sign if and only if the function has no real roots.

| | | (original) | | | | | |
|-----|-----|-------------------|-------------------|-----------------------------|-----------------------------|-------------------|-----------------------|
| p | q | conditional | converse | inverse | contrapositive | negation | biconditional |
| | | $p \rightarrow q$ | $q \rightarrow p$ | $\sim p \rightarrow \sim q$ | $\sim q \rightarrow \sim p$ | $p \wedge \sim q$ | $p \leftrightarrow q$ |
| T | T | T | T | T | T | F | T |
| T | F | F | T | T | F | T | F |
| F | T | T | F | F | T | F | F |
| F | F | T | T | T | T | F | T |

With respect to the conditional proposition
If the jar is open, then the cookies are gone.

identify each of the following propositions.

- ▶ The jar is open.
- ▶ The cookies are gone.
- ▶ If the cookies are gone, then the jar is open.
- ▶ If the jar is not open, then the cookies are not gone.
- ▶ If the cookies are not gone, then the jar is not open.

Conditional expression:

```
if (expr1) then (expr2) else (expr3)
```

For next time:

Pg 108: 3.5.(1 & 2)

Pg 114: 3.7.(1, 2, 7, 8, 9, 12, 13)

Read 3.(8 & 9)

Take quiz