Speed Running Calculus

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Contents

Author's Notes

This actually isn't the first copy of my discrete math notes...I had an earlier copy that got corrupted, so now I'm just going to constantly upload to GitHub because I'm afraid of them getting wiped again 😭

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These notes are based off of the textbook *Discrete Mathematics and Its Applications* by *Kenneth H. Rosen*, as well as from the lectures of *Serdar Erbatur* from the *Fall 2023* semester.

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If you have any complaints, or suggestions regarding these notes, please email me at mdn220004@utdallas.edu

1 Propositional Logic

> **Definition** **Proposition**
>
> Declarative statements that are either `true` or `false`

Table 1: Examples of propositions

Statement	Proposition?
$1 + 1 = 2$	✔
What class are ya takin?	⛔
I am happy	✔

Propositons can be combined to form another proposition with the use of *logical operators*

> **Note**
>
> Common labels for propositions in discrete mathematics include letters like $P, Q, R, S...$

Table 2: Logical Operators in Discrete Mathematics

Symbol	Meaning	Expression
$\neg$	negation / not	$\neg P$
$\wedge$	conjunction / and	$P \wedge Q$
$\vee$	disjunction / or	$P \vee Q$
$\oplus$	exclusive disjunction/ xor	$P \oplus Q$
$\implies$	implication / conditional	$P \implies Q$
$\iff$	biconditional	$P \iff Q$

> **Note** **Logical Operator Precedence**
>
> Order matters when it comes to evaluating logical operators:
>
> 1. negaiton
> 2. conjunction
> 3. disjunctions
> 4. conditionals
>
> Where negation is evaluated first, and conditionals last.

Theorem More on Conditionals

Conditionals can also be expressed in three other ways:

Contrapositive: $\neg Q \implies \neg P$

Converse: $Q \implies P$

Inverse: $\neg P \implies \neg Q$

Example

Conditional: If it is raining, then I am not going to town

Contrapositive: If I go to town, then it is not raining

Converse: If I do not go to town, then it is raining

Inverse: If it is not raining, then I am going to town

Definition Truth Table

They are used as a way of seeing all possible values of a proposition

Table 3: Truth Table of $P \implies Q$

P	Q	$P \implies Q$
F	F	T
F	T	T
T	F	F
T	T	T