CS 2022 - Discrete Math

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1 Logic

Logic allows us to handle problems involving true and false statements. This is very useful in computer science, as well as general mathematical proofs.

Proposition A declarative statement which is either true or false.

Ex. It is a sunny day: true or false
$2 + 3 = 5$ (proposition, true)
$2 + x = 5$ (not a proposition)
$2 + 7 = 5$ (proposition, false)

A proposition can also be evaluated to T (true) or F (false).

1.1 Operations on Propositions

The following operations can be applied to propositions. Let p and q be propositions in the following statements.

- Negation: $\neg p$ (not p)
- Conjunction: $p \wedge q$ (p and q)
- Disjunction: $p \vee q$ (p or q)
- Exclusive or: $p \bigoplus q$

Ex. $\neg T = F$
$T \wedge F = F$
$T \wedge T = T$
$F \wedge F = F$
$T \vee T = T$
$T \vee F = T$
$3 < 5$ T
$\neg(3 < 5) = (3 \geq 5)$ F
$(3 < 5) \wedge (5 < 3)$ F
$(3 < 5) \vee (5 < 3)$ T

1.1.1 Truth Tables

Negation

p	$\neg p$
T	F
F	T

Other Operations

p	q	$p \vee q$	$p \wedge q$	$p \bigoplus q$
T	T	T	T	F
T	F	T	F	T
F	T	T	F	T
F	F	F	F	F