

Discrete Math Cram Sheet

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1 Propositional Logic

1.1 Truth Tables

p	T	T	F	F	
q	T	F	T	F	
$\neg p$	F	F	T	T	contradiction
$p \vee q$	F	F	F	T	joint denial
$p \leftarrow q$	F	F	T	F	converse nonimplication
$\neg p$	F	F	T	T	left negation
$p \rightarrow q$	F	T	F	F	nonimplication
$\neg q$	F	T	F	T	right negation
$p \oplus q$	F	T	T	F	exclusive disjunction
$p \bar{\wedge} q$	F	T	T	T	alternative denial
$p \wedge q$	T	F	F	F	conjunction
$p \leftrightarrow q$	T	F	F	T	biconditional
q	T	F	T	F	right projection
$p \rightarrow q$	T	F	T	T	implication
p	T	T	F	F	left projection
$p \leftarrow q$	T	T	F	T	converse implication
$p \vee q$	T	T	T	F	disjunction
T	T	T	T	T	tautology

1.2 Propositional Equivalences

Identity

- $p \wedge T \equiv p$
- $p \vee F \equiv p$

Domination

- $p \vee T \equiv T$
- $p \wedge F \equiv F$

Idempotent

- $p \wedge p \equiv p$
- $p \vee p \equiv p$

Commutative

- $p \wedge q \equiv q \wedge p$
- $p \vee q \equiv q \vee p$

Associative

- $p \wedge (q \wedge r) \equiv (p \wedge q) \wedge r$
- $p \vee (q \vee r) \equiv (p \vee q) \vee r$

Distributive

- $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$
- $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$

De Morgan's

- $\neg(p \wedge q) \equiv \neg p \vee \neg q$
- $\neg(p \vee q) \equiv \neg p \wedge \neg q$

Absorption

- $p \wedge (p \vee q) \equiv p$
- $p \vee (p \wedge q) \equiv p$

Negation

- $p \vee \neg p \equiv T$
- $p \wedge \neg p \equiv F$

Double Negation

- $\neg(\neg p) \equiv p$

Involving Biconditionals

- $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$
- $p \leftrightarrow q \equiv \neg p \leftrightarrow \neg q$
- $p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$
- $\neg(p \leftrightarrow q) \equiv p \leftrightarrow \neg q$

Involving Conditional Statements

- $p \rightarrow q \equiv \neg p \vee q$
- $p \rightarrow q \equiv \neg q \rightarrow \neg p$
- $p \vee q \equiv \neg p \rightarrow q$
- $p \wedge q \equiv \neg(p \rightarrow \neg q)$
- $(p \rightarrow q) \wedge (p \rightarrow r) \equiv p \rightarrow (q \wedge r)$
- $(p \rightarrow r) \wedge (q \rightarrow r) \equiv (p \vee q) \rightarrow r$
- $(p \rightarrow q) \vee (p \rightarrow r) \equiv p \rightarrow (q \vee r)$
- $(p \rightarrow r) \vee (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$

1.3 Rules of Inference

2 Proofs

2.1 Mathematical Induction

2.2 Strong Induction

3 Recurrence Relations

4 Number Theory

5 Graph Theory

6 Linear Algebra

7 Combinatorics

8 Probability