National College of Ireland

DISCRETE MATHEMATICS FORMULAE AND TABLES

UNDERGRADUATE

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Contents

IMPORTANT SYMBOLS

Terms	Meaning
$\{\}$	A collection of objects
$A \Delta B$	Objects that belong to A or B but not their intersection Symmetric difference
$A \cap B^C$	Set Difference
$\wp(A)$	Power Set of A All subsets of A
(a, b)	Ordered Pair or Couple Collection of two elements
$A \times B$	Cartesian Product Set of all ordered pairs from A to B
$\emptyset$	Empty Set
U	Universal Set Set of all possible values
aRb	Equivalence relation *a and b of a set are equivalent with respect to a relation R*
$f \circ g$	*f after g or f composed with g*

SET THEORY OPERATIONS

Terms	Meaning
$x \in A$	x is an element of the set A
$x \notin A$	x is not an element of the set A
$A = B$	Sets A and B are equal
$A \subseteq B$	A is a subset of B
$A \nsubseteq B$	A is not a subset of B
$A - B$ alternatively $A \setminus B$	Elements of A not in B Difference of B in A
$\wp(A)$	Power set of A

Terms	Meaning
$A \subset B$	A is a proper subset of B
$A \not\subset B$	A *is not a proper subset of* B
$A \cup B$	A union B
$A \cap B$	A *intersection* B
$A \oplus B$ alternatively $A \Delta B$	*Symmetric difference of* A *and* B
A' alternatively A^c	Compliment of A
#A alternatively |A|	Cardinality of A

Principle of Inclusion-Exclusion for Two Sets	$\|\mathbf{U}\| = \|A\| + \|B\| + \|(A \cup B)'\| - \|A \cap B\|$

Principle of Inclusion-Exclusion for Three Sets	$\|\mathbf{U}\| = \|A\| + \|B\| + \|C\| + \|(A \cup B \cup C)'\|$ $-\|A \cap B\| - \|A \cap C\| - \|B \cap C\| + \|A \cap B \cap C\|$

NUMBER SYSTEMS

Number System	Definition
Natural Numbers	$\mathbb{N} = \{1, 2, 3, \dots\}$
Integer Numbers	$\mathbb{Z} = \{0, \pm 1, \pm 2, \pm 3, \dots\}$
Rational Numbers	$\mathbb{Q} = \left\{\frac{a}{b} : a, b \in \mathbb{Z} \text{ and } b \neq 0\right\}$
Real Numbers	$\mathbb{R} = \{x : -\infty < x < +\infty\}$
Complex Numbers	$\mathbb{C} = \{a + bi : a, b \in \mathbb{R}, i = \sqrt{-1}\}$

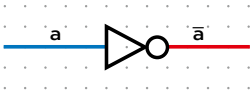
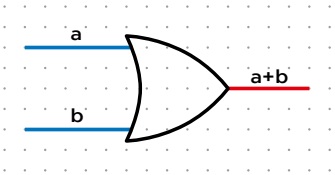
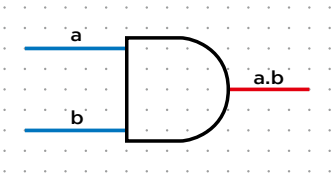
BOOLEAN ALGEBRA IDENTITIES

Terms	Boolean OR	Boolean AND
Commutative	$A + B = B + A$	$A.B = B.A$
Associative	$(A + B) + C = A + (B + C)$	$(A.B).C = A.(B.C)$
Distributive	$A + (B.C) = (A + B).(A + C)$	$A.(B + C) = (A.B) + (A.C)$
Identity	$A + 0 = A$	$A.1 = A$
Idempotent	$A + A = A$	$A.A = A$
Universal Bound	$A + 1 = 1$	$A.0 = 0$
Negation	$A + \bar{A} = 1$	$A.\bar{A} = 0$
Absorption	$A + (A.B) = A$	$A.(A + B) = A$
DeMorgan's Law	$\overline{(A + B)} = \bar{A}.\bar{B}$	$\overline{(A.B)} = \bar{A} + \bar{B}$
Complements of 1 and 0	$\bar{1} = 0$	$\bar{0} = 1$
Double Negation	$\bar{\bar{A}} = A$	

PROPOSITIONAL AND PREDICATE LOGIC

Terms & Operators	Meaning
p, q, r	Propositions
$\bar{p}$	Negation
$\wedge$	Logical AND
$\vee$	Logical OR
$\Rightarrow$	Implication
$\Leftrightarrow$ $\equiv$ $\leftrightarrow$	Equivalence
$\forall$	Universal Quantification: "for all"
$\exists$	Existential Quantification: "there exists"
$P(x)$	Predicate or Propositional Function

LOGIC GATES

Meaning	Symbolic Representation
The **not** gate	
The **or** gate	
The **and** gate	

QUADRATIC ROOTS

Roots of a Quadratic Equation	Given a quadratic equation $ax^2 + bx + c = 0$ its roots are given by $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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