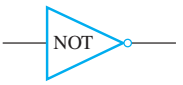
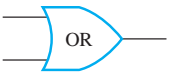
List of Symbols

Subject	Symbol	Meaning	Page
Logic	$\sim p$	not p	25
	$p \wedge q$	p and q	25
	$p \vee q$	p or q	25
	$p \oplus q$ or p XOR q	p or q but not both p and q	28
	$P \equiv Q$	P is logically equivalent to Q	30
	$p \rightarrow q$	if p then q	40
	$p \leftrightarrow q$	p if and only if q	45
	$\therefore$	therefore	51
	$P(x)$	predicate in x	97
	$P(x) \Rightarrow Q(x)$	every element in the truth set for $P(x)$ is in the truth set for $Q(x)$	104
	$P(x) \Leftrightarrow Q(x)$	$P(x)$ and $Q(x)$ have identical truth sets	104
	$\forall$	for all	101
	$\exists$	there exists	103
Applications of Logic		NOT-gate	67
		AND-gate	67
		OR-gate	67
		NAND-gate	75
		NOR-gate	75
	$\mid$	Sheffer stroke	74
	$\downarrow$	Peirce arrow	74
	n_2	number written in binary notation	78
	n_{10}	number written in decimal notation	78
	n_{16}	number written in hexadecimal notation	91
Number Theory and Applications	$d \mid n$	d divides n	170
	$d \nmid n$	d does not divide n	172
	$n \; div \; d$	the integer quotient of n divided by d	181
	$n \; mod \; d$	the integer remainder of n divided by d	181
	$\lfloor x \rfloor$	the floor of x	191
	$\lceil x \rceil$	the ceiling of x	191
	$\lvert x \rvert$	the absolute value of x	187
	$\gcd(a, b)$	the greatest common divisor of a and b	220
	$x := e$	x is assigned the value e	214

Subject	Symbol	Meaning	Page
Sequences	$\ldots$	and so forth	227
	$\sum_{k=m}^{n} a_k$	the summation from k equals m to n of a_k	230
	$\prod_{k=m}^{n} a_k$	the product from k equals m to n of a_k	223
	$n!$	n factorial	237
Set Theory	$a \in A$	a is an element of A	7
	$a \notin A$	a is not an element of A	7
	$\{a_1, a_2, \ldots, a_n\}$	the set with elements $a_1, a_2, \ldots, a_n$	7
	$\{x \in D \mid P(x)\}$	the set of all x in D for which $P(x)$ is true	8
	$\mathbf{R}, \mathbf{R}^-, \mathbf{R}^+, \mathbf{R}^{nonneg}$	the sets of all real numbers, negative real numbers, positive real numbers, and nonnegative real numbers	7, 8
	$\mathbf{Z}, \mathbf{Z}^-, \mathbf{Z}^+, \mathbf{Z}^{nonneg}$	the sets of all integers, negative integers, positive integers, and nonnegative integers	7, 8
	$\mathbf{Q}, \mathbf{Q}^-, \mathbf{Q}^+, \mathbf{Q}^{nonneg}$	the sets of all rational numbers, negative rational numbers, positive rational numbers, and nonnegative rational numbers	7, 8
	$\mathbf{N}$	the set of natural numbers	8
	$A \subseteq B$	A is a subset of B	9
	$A \not\subseteq B$	A is not a subset of B	9
	$A = B$	A equals B	339
	$A \cup B$	A union B	341
	$A \cap B$	A intersect B	341
	$B - A$	the difference of B minus A	341
	A^c	the complement of A	341
	(x, y)	ordered pair	11
	$(x_1, x_2, \ldots, x_n)$	ordered n-tuple	346
	$A \times B$	the Cartesian product of A and B	12
	$A_1 \times A_2 \times \cdots \times A_n$	the Cartesian product of $A_1, A_2, \ldots, A_n$	347
	$\emptyset$	the empty set	361
	$\mathscr{P}(A)$	the power set of A	346

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Subject	Symbol	Meaning	Page
Counting and Probability	$N(A)$	the number of elements in set A	518
	$P(A)$	the probability of a set A	518
	$P(n, r)$	the number of r-permutations of a set of n elements	553
	$\binom{n}{r}$	n choose r, the number of r-combinations of a set of n elements, the number of r-element subsets of a set of n elements	566
	$[x_{i_1}, x_{i_2}, \ldots, x_{i_r}]$	multiset of size r	584
	$P(A \mid B)$	the probability of A given B	612
Functions	$f\colon X \to Y$	f is a function from X to Y	384
	$f(x)$	the value of f at x	384
	$x \xrightarrow{f} y$	f sends x to y	384
	$f(A)$	the image of A	397
	$f^{-1}(C)$	the inverse image of C	397
	I_x	the identity function on X	387
	b^x	b raised to the power x	405, 406
	$\exp_b(x)$	b raised to the power x	405, 406
	$\log_b(x)$	logarithm with base b of x	388
	F^{-1}	the inverse function of F	411
	$f \circ g$	the composition of g and f	417
Algorithm Efficiency	$x \cong y$	x is approximately equal to y	237
	$O(f(x))$	big-O of f of x	727
	$\Omega(f(x))$	big-Omega of f of x	727
	$\Theta(f(x))$	big-Theta of f of x	727
Relations	$x\ R\ y$	x is related to y by R	14
	R^{-1}	the inverse relation of R	444
	$m \equiv n \pmod{d}$	m is congruent to n modulo d	473
	$[a]$	the equivalence class of a	465
	$x \preceq y$	x is related to y by a partial order relation $\preceq$	502

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List of Symbols

Subject	Symbol	Meaning	Page
Formal Languages and Finite-State Automata	Σ	an alphabet of a language	780
	ϵ	the null string	529
	Σ^n	the set of all strings over Σ of length n	781
	Σ^*	the set of all strings over Σ	781
	Σ^+	the set of all strings over Σ with length at least 1	781
	LL'	the concatenation of languages L and L'	783
	L^*	the Kleene closure of L	783
	$(rs), (r \mid s), (r^*)$	regular expressions	783
	$[x_1 - x_n], [\hat{}x_m - x_n]$	character classes	787
	$x+, x?, x\{n\}, x\{m, n\}$	shorthand notations for regular expressions	788
	$N(s, m)$	the value of the next-state function for a state s and input symbol m	793, 794
	$\rightarrow (s_0)$	initial state	793
	$((s_a))$	accepting state	793
	$L(A)$	language accepted by A	795
	$N^*(s, w)$	the value of the eventual-state function for a state s and input string w	796, 797
	$s\ R_*\ t$	s and t are $*$-equivalent	809
	$s\ R_k\ t$	s and t are k-equivalent	810
	$\overline{A}$	the quotient automaton of A	813
Matrices	$\mathbf{A}$	matrix	661
	$\mathbf{I}$	identity matrix	669, 670
	$\mathbf{A} + \mathbf{B}$	sum of matrices $\mathbf{A}$ and $\mathbf{B}$	675
	$\mathbf{AB}$	product of matrices $\mathbf{A}$ and $\mathbf{B}$	666, 667
	$\mathbf{A}^n$	matrix $\mathbf{A}$ to the power n	678
Graphs and Trees	$V(G)$	the set of vertices of a graph G	626
	$E(G)$	the set of edges of a graph G	626
	$\{v, w\}$	the edge joining v and w in a simple graph	632, 633
	K_n	complete graph on n vertices	633
	$K_{m,n}$	complete bipartite graph on (m, n) vertices	633
	$deg(v)$	degree of vertex v	635
	$v_0e_1v_1e_2 \cdots e_nv_n$	a walk from v_0 to v_n	644
	$w(e)$	the weight of edge e	704
	$w(G)$	the total weight of graph G	704

Reference Formulas

Topic	Name	Formula	Page
Logic	De Morgan's law	$\sim(p \wedge q) \equiv \sim p \vee \sim q$	32
	De Morgan's law	$\sim(p \vee q) \equiv \sim p \wedge \sim q$	32
	Negation of $\rightarrow$	$\sim(p \rightarrow q) \equiv p \wedge \sim q$	42
	Equivalence of a conditional and its contrapositive	$p \rightarrow q \equiv \sim q \rightarrow \sim p$	43
	Nonequivalence of a conditional and its converse	$p \rightarrow q \not\equiv q \rightarrow p$	44
	Nonequivalence of a conditional and its inverse	$p \rightarrow q \not\equiv \sim p \rightarrow \sim q$	44
	Negation of a universal statement	$\sim(\forall x \text{ in } D,\ Q(x)) \equiv \exists x \text{ in } D \text{ such that } \sim Q(x)$	109
	Negation of an existential statement	$\sim(\exists x \text{ in } D \text{ such that } Q(x)) \equiv \forall x \text{ in } D,\ \sim Q(x)$	109
Sums	Sum of the first n integers	$1 + 2 + \cdots + n = \dfrac{n(n+1)}{2}$	248
	Sum of powers of r	$1 + r + r^2 + \cdots + r^n = \dfrac{r^{n+1} - 1}{r - 1}$	252
Counting and Probability	Probability in the equally likely case	$P(E) = \dfrac{N(E)}{N(S)}$	518
	Number of r-permutations of a set with n elements	$P(n, r) = \dfrac{n!}{(n-r)!}$	533
	Number of elements in a union	$N(A \cup B) = N(A) + N(B) - N(A \cap B)$	546
	Number of subsets of size r of a set with n elements	$\binom{n}{r} = \dfrac{n!}{r!(n-r)!}$	568
	Pascal's formula	$\binom{n+1}{r} = \binom{n}{r-1} + \binom{n}{r}$	593

Topic	Name	Formula	Page
Counting and Probability	Binomial theorem	$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k$	598
	Probability of the complement of an event	$P(A^c) = 1 - P(A)$	543
	Probability of a union	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	606
	Conditional probability	$P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}$	612
	Bayes' formula	$P(B_k \mid A) = \dfrac{P(A \mid B_k)P(B_k)}{P(A \mid B_1)P(B_1) + P(A \mid B_2)P(B_2) + \cdots + P(A \mid B_n)P(B_n)}$	616
Laws of Exponents		$b^0 = 1$	405
		$b^{-x} = \dfrac{1}{b^x}$	405
		$b^u \cdot b^v = b^{u+v}$	406
		$\dfrac{b^u}{b^v} = b^{u-v}$	406
		$(b^u)^v = b^{u \cdot v}$	406
		$(bc)^u = b^u \cdot c^u$	406
		$b^u = b^v \Rightarrow u = v$	406
Properties of Logarithms		$\log_b x = y \Leftrightarrow b^y = x$	406
		$\log_b(xy) = \log_b(x) + \log_b(y)$	406
		$\log_b(x^a) = a \log_b(x)$	406
		$\log_b\left(\dfrac{x}{y}\right) = \log_b(x) - \log_b(y)$	406
		$\log_c(x) = \dfrac{\log_b(x)}{\log_b(c)}$	406
		$\log_b(u) = \log_b(v) \Rightarrow u = v$	406