Glossary of Symbols

symbol	meaning
$::=$	is defined to be
■	end of proof symbol
$\neq$	not equal
$\wedge$	and, AND
$\vee$	or, OR
$\longrightarrow$	implies, if $\ldots$, then $\cdots$, IMPLIES
$\longrightarrow$	state transition
$\neg P$, $\overline{P}$	not P, NOT(p)
$\longleftrightarrow$	iff, equivalent, IFF
$\oplus$	xor, exclusive-or, XOR
$\exists$	exists
$\forall$	for all
$\in$	is a member of, is in
$\subseteq$	is a (possibly =) subset of
$\not\subseteq$	is **not** a (possibly =) subset of
$\subset$	is a proper (not =) subset of
$\not\subset$	is **not** a proper (not =) subset of
$\cup$	set union
$\bigcup_{i \in I} S_i$	union of sets S_i where i ranges over set I of indices
$\cap$	set intersection
$\bigcap_{i \in I} S_i$	intersection of sets S_i where i ranges over set I of indices
$\emptyset$	the empty set, $\{\}$
$\overline{A}$	complement of set A
$-$	set difference
pow(A)	powerset of set, A
$A \times B$	Cartesian product of sets A and B
S^n	Cartesian product of n copies of set S
$\mathbb{Z}$	integers
$\mathbb{N}$, $\mathbb{Z}^{\geq 0}$	nonnegative integers
$\mathbb{Z}^+$, $\mathbb{N}^+$	positive integers
$\mathbb{Z}^-$	negative integers
$\mathbb{Q}$	rational numbers
$\mathbb{R}$	real numbers
$\mathbb{C}$	complex numbers
$\lfloor r \rfloor$	the *floor* of r: the greatest integer $\leq r$
$\lceil r \rceil$	the *ceiling* of r: the least integer $\geq r$
$\lvert r \rvert$	the absolute value of a real number r

symbol	meaning
$R(X)$	image of set X under binary relation R
R^{-1}	inverse of binary relation R
$R^{-1}(X)$	inverse image of set X under relation R
surj	A surj B iff $\exists f : A \to B.\ f$ is a surjective *function*
inj	A inj B iff $\exists R : A \to B.\ R$ is an injective *total relation*
bij	A bij B iff $\exists f : A \to B.\ f$ is a bijection
$[\leq 1$ in$]$	injective property of a relation
$[\geq 1$ in$]$	surjective property of a relation
$[\leq 1$ out$]$	function property of a relation
$[\geq 1$ out$]$	total property of a relation
$[= 1$ out, $= 1$ in$]$	bijection relation
$\circ$	relational composition operator
λ	the empty string/list
A^*	the finite strings over alphabet A
A^ω	the infinite strings over alphabet A
rev(s)	the reversal of string s
$s \cdot t$	concatenation of strings s, t; append(s, t)
$\#_c(s)$	number of occurrences of character c in string s
$m \mid n$	integer m divides n; m is a factor of n; $\exists k \in \mathbb{Z}.\ km = n$
gcd	greatest common divisor
log	the base 2 logarithm, log_2
ln	the natural logarithm, log_e
lcm	least common multiple
$[k..n]$	$\{i \mid k \leq i \leq n\}$
$(k..n]$	$[k..n] - \{k\}$
$[k..n)$	$[k..n] - \{n\}$
$(k..n)$	$[k..n] - \{k, n\}$
$\sum_{i \in I} r_i$	sum of numbers r_i where i ranges over set I of indices
$\prod_{i \in I} r_i$	product of numbers r_i where i ranges over set I of indices
qcnt(n, d)	quotient of n divided by d
rem$(n,\ d)$	remainder of n divided by d
$\equiv \pmod n$	congruence modulo n
$\not\equiv$	not congruent
$\mathbb{Z}_n$	the ring of integers modulo n
$+_n, \cdot_n$	addition and multiplication operations in $\mathbb{Z}_n$
$\mathbb{Z}_n^*$	the set of numbers in $[0, n)$ relatively prime to n
$\phi(n)$	Euler's totient function $::= \lvert\mathbb{Z}_n^*\rvert$
$\langle u \to v \rangle$	directed edge from vertex u to vertex v
Id_A	identity relation on set A: $a \mathrm{Id}_A a'$ iff $a = a'$

symbol	meaning
R^*	path relation of relation R; reflexive transitive closure of R
R^+	positive path relation of R; transitive closure of R
$\mathbf{f}\,\widehat{x}\,\mathbf{g}$	merge of walk $\mathbf{f}$ with end vertex x
	and walk $\mathbf{g}$ with start vertex x
$\mathbf{f}^\frown\mathbf{g}$	merge of walk $\mathbf{f}$ and walk $\mathbf{g}$
	where $\mathbf{f}$'s end vertex equals $\mathbf{g}$'s start vertex
$\langle u—v\rangle$	undirected edge connecting vertices $u \neq v$
$E(G)$	the edges of graph G
$V(G)$	the vertices of graph G
C_n	the length-n undirected cycle
L_n	the length-n line graph
K_n	the n-vertex complete graph
H_n	the n-dimensional hypercube
$L(G)$	the "left" vertices of bipartite graph G
$R(G)$	the "right" vertices of bipartite graph G
$K_{n,m}$	the complete bipartite graph with n left and m right vertices
$\chi(G)$	chromatic number of simple graph G
H_n	the nth Harmonic number $\sum_{i=1}^{n} 1/i$
$\sim$	asymptotic equality
$n!$	n factorial $::= n \cdot (n-1) \cdots 2 \cdot 1$
$\binom{n}{m}$	$::= n!/m!((n-m)!$; the binomial coefficient
$o()$	asymptotic notation "little oh"
$O()$	asymptotic notation "big oh"
$\Theta()$	asymptotic notation "Theta"
$\Omega()$	asymptotic notation "big Omega"
$\omega()$	asymptotic notation "little omega"
$\Pr[A]$	probability of event A
$\Pr\left[A \mid B\right]$	conditional probability of A given B
$\mathcal{S}$	sample space
I_A	indicator variable for event A
PDF	probability density function
CDF	cumulative distribution function
$\mathrm{Ex}[R]$	expectation of random variable R
$\mathrm{Ex}[R \mid A]$	conditional expectation of R given event A
$\mathrm{Ex}^2[R]$	abbreviation for $(\mathrm{Ex}[R])^2$
$\mathrm{Var}[R]$	variance of R
$\mathrm{Var}^2\left[R\right]$	the square of the variance of R
σ_R	standard deviation of R