Basic Mathematical Concepts and Notations

sets

empty set: $\emptyset$

singleton set: $\{a\}$

family of sets: $\{S_i | i \in I\}$

union: $A \bigcup B, \ \bigcup_{i \in I} A_i$

intersection: $A \bigcap B, \ \bigcap_{i \in I} A_i$

difference: $A \backslash B, \quad A - B$

disjoint sets: $A \bigcap B = \emptyset$

subset: $A \subseteq B$

proper subset: $A \subset B$

powerset: $\mathcal{P}(A)$

pair, triple, n-tuple: $(a, b), \ (a, b, c), \ (a_1, \ldots, a_n)$

Cartesian product: $A \times B, \ A \times B \times C, \ \prod_{i \in I} A_i$

relations

binary relation: $R \subseteq A \times B, \ R(a, b)$

binary relation on a set S: $R \subseteq S \times S$

n-ary relation: $R \subseteq A_1 \times \ldots \times A_n$

domain of a relation: $dom(R)$

range (codomain) of a relation: $range(R)$

composition of binary relations: $R_1 \circ R_2$

image of a set under a binary relation: $R(A)$

inverse image of a set under a binary relation: $R^{-1}(A)$

reflexive relation

irrefexive relation

transitive relation

symmetric relation

antisymmetric relation

reflexive closure of a relation

transitive closure of a relation: R^+

reflexive, transitive closure of a relation: R^*

functions (single-valued binary relation)

domain of a function: $dom(f)$

range (codomain) of a function: $range(f)$

partial function

total function

composition of functions: $f \circ g$
one-to-one function (injective function, injection)
onto function (surjective function, surjection)
one-to-one, onto function (bijective function, bijection)
image (of a set or element) under a function: $f(A)$
inverse image (of a set or element) under a function: $f^{-1}(A)$
inverse of a function: f^{-1}

equivalence relations: $a \equiv b$
    reflexive, symmetric, transitive relation
partition of a set (induced by an equivalence relation)
equivalence class of an element
quotient set under an equivalence relation
congruence relation (equivalence relation preserving functions)

partial orders
preorder
    transitive, reflexive relation
partial order: $\leq$, $\sqsubseteq$
    antisymmetric preorder
strict partial order: $<$, $\sqsubset$
total order
chain (of elements of a partial order)
co-chain (of elements of a partial order)
ω-chain
well-founded partial order
upper bound (of a set of elements)
lower bound (of a set of elements)
least-upper-bound (*lub*, *supremum*, *join*)
greatest-lower-bound (*glb*, *infimum*, *meet*)
minimal element
maximal element
bottom (least element): $\perp$
top (greatest element): $\top$
limit of a chain (lub of a chain)
complete partial order (CPO)
monotonic function (preserves ordering)
continuous function (preserves limits of chains)