**Set:** an unordered collection of objects

**Elements:** objects in the set (aka members of the set). A set is said to contain its elements.

**Roster Method for Describing Sets:** set = {//list of elements in set}. Order is not important

**Important sets:**

N = natural numbers

Z = integers

Z+ = positive integers

R = set of real numbers

R+ = set of positive real numbers

C = set of complex numbers

Q = set of rational numbers

**Set-Builder Notation** - Set = {domain | condition}, S = {x | P(x)}

**Universal Set**: denoted by U, the universal set contains everything currently under consideration. It is sometimes implicit or explicitly stated depending on the content.

**Empty set**: a set with no elements, symbolized as Ø, but {} is also used

**Set Equality**: two sets are equal if and only if they have the same elements

**Subset:** a set A is a **subset** of B, if and only if every element of A is also an element of B, A⊆ B

**Proper Subset**: if A ⊆ B, but A != B, then A is a proper subset of B, denoted by A ⊂ B

**Set Cardinality**: if there are exactly n distinct elements in S where n is a nonnegative integer, then S is finite. Otherwise, it is infinite. The cardinality of a finite set A, denoted by |A|, is the number of distinct elements of A

**Power Sets**: the set of all subsets of a set A, denoted by *P*(A), is called the power set of A

**Tuples:** ordered n-tuple (a1,a2,a3…,an), 2-tuples are called **ordered pairs**

**Cartesian Product**: denoted by A × B, it is the set of ordered pairs (a, b) where a set of ordered pairs (a,b) shows a ∈ A and b ∈ B

**Relation:** a subset of the Cartesian product A × B is called a relation from the set A to the set B

**Truth Sets of Quantifiers**: given a predicate P and a domain D, we define the truth set of P to be the set of elements in D for which P(x) is true. The truth set of P(x) is denoted by {x ∈ D | P(x)}

**Union**: Unionof sets A and B is denoted by A U B

**Intersection:**  A ∩ B = {x | x ∈ A ^ x ∈ B} – what’s in common between A and B

**Complement:** If A is a set, then the complement of the A (with respect to U), denoted by Ā is the set U – A

**Difference:** A and B are sets with respect to U – the difference between them is denoted by A – B – contains elements of A that are not in B

**Inclusion-Exclusion**: |A U B| = |A| + |B| - |A ∩ B|

**Disjoint:** two sets are disjoint if their intersection is an empty set (A ∩ B = Ø)

**Symmetric Difference**: denoted by A (XOR) B

**Generalized Unions**: the union of a collection of sets is the set that contains those elements that are members of at least 1 set in the collection

**Generalized Intersection:** the intersection of a collection of sets is the set that contains those elements that are members of the sets in the collection

**function:** f from A to B, denoted f:A à B, is an assignment of each element of A to exactly one element of B, can be specified as an explicit statement of the assignment, a formula, or a computer program

**Injections**: function f is said to be this if and only if f(a) = f(b), which implies that a = b for all a and b in the domain of f (an injection if it is one-to-one)

**Surjections:** function f from A to B is called onto or surjective if and only if for every element b in B, there is an element a in A with f(a) = b

**Bijections**: one-to-one correspondence, if it is both one to one and onto (surjective and injective)

**Inverse Function:** f = bijection from A to B, then the inverse of f (f-1) is the function from B to A defined as

**Composition:** let *f*:BàC and *g*:AàB. The composition of f with g (denoted f ○ g) is the function from A to C defined as

**Floor Function:** f(x) = |\_x\_| – largest integer less than or equal to x

**Ceiling Function:** f(x) = |-x-| - smallest integer greater than or equal to x

**Factorial function:** *f*:NàZ+, denoted by f(n) = n!, product of the first n positive integer when n is nonnegative

**Sequence:** function from a subset of the integers to a set S – notation an (term of the sequence)

**Geometric progression**: sequence of the form where initial term *a* and common ratio *r* are real numbers

**Arithmetic progression:** initial term a and the common difference d are real numbers

**String:** a finite sequence of characters from a finite set (an alphabet)

**Recurrence Relations:** {an} is an equation that expresses an in terms of one or more of the previous terms of the sequence (an-1)

**Solution of Recurrence Relations**: a sequence is called a solution of a recurrence relation if its terms satisfy the recurrence relation

I**nitial Condition of Recurrence Relations**: initial conditions for a sequence specify the terms that precede the first term where the recurrence relation takes effect

**Fibonacci Sequence:** f0, f1, f2,… represented by initial condition f0 = 0, f1 = 1 and recurrence relation of fn = fn-1 + fn-2

**Closed Formula**: the formula for the nth term of the sequence generated by a recurrence relation

**Useful sequences**: n2, n3, n4, 2n, 3n, n!, fn

**Summation:** sum of the terms am, am+1, …, an from the sequence {an}

**Index of summation**: the letter j in the summation notation. It runs through all the integers starting with its lower limit m and ending with its upper limit n

**Matrix:** a rectangular array of numbers

**m × n matrix**: a matrix with m rows and n columns

**Square:** a matrix with the same number of rows as columns

**Equality of Matrices**: two matrices are equal if they have the same number of rows and columns and the corresponding entries in every position are equal

**Addition of Matrices**: Let A = [aij] and B = [bij] be m x n matrices. The sum of A and B, denoted by A + B, is the m x n matrix that has aij + bij as its (i,j)th element. In other words, A + B = [aij + bij]

**Multiplication of Matrices:** Let A be an m x k matrix and B be a k x n matrix. The product of A and B, denoted by AB, is the m x n matrix that has its (i,j)th element equal to the sum of products of the corresponding elements from the ith row of A and the jth column of B. In other words, if AB = [cij], then cij = ai1b1j + ai2b2j + … + akjb2j

**Identity Matrix of Order n:** It is the m x n matrix In = [δij], where δij = 1 if i = j and δij = 0 if i != j

**Powers of Square Matrices:** when A is an n x n matrix, we have: A0 = In and Ar = AAA...A where A is multiplied by itself r times

**Transposes of Matrices:** Let A = [aij] be an m x n matrix. The transpose of A, denoted by At, is the n x m matrix obtained by interchanging the rows and columns of A

**Symmetric Matrices:** a square matrix A is called symmetric if A = At. Thus, A = [aij] is symmetric if aij = aji for i and j with 1 <= i <=n and i <= j <=n. Square matrices do not change when their rows and columns are interchanged

**Zero-One Matrices:** a matrix all of whose entries are either 0 or 1. Algorithms operating on discrete structures represented by zero-one matrices are based on Boolean arithmetic defined by the following Boolean operations:

**Join of Zero-One Matrices:** Let A = [aij] and B = [bij] be m x n zero-one matrices. The join of A and B is the zero-one matrix with (i,j)th entry aij v bij. The join of A and B is dented by A v B.

**Meet of Zero-One Matrices:** Let A = [aij] and B = [bij] be m x n zero-one matrices. The meet of A and B is the zero-one matrix with (i,j)th entry aij ^ bij. The meet of A and B is denoted by A ^ B

**Boolean Product of Zero-One Matrices:**Let A = [aij] and B = [bij] be m x n zero-one matrices and B = [bij] be a k x n zero-one matrix. The Boolean product of A and B, denoted by A ⊙ B, is the m x n zero-one matrix with (i,j)th entry

**Boolean Powers of Zero-One Matrices:** Let A be a square zero-one matrix and let r be a positive integer. The rth Boolean power of A is the Boolean product of r factors of A, denoted by A[r]. Hence A[r] = A ⊙ A ⊙ … ⊙ A where A is multiplied r times.