**Data Structure and Algorithm List**

by Ridowan Mohammad **STL**

string

vector

pair

stack

queue

sort

priority\_

queue

reverse

next\_permutation

set

map

unordered map

iterator

pbds

**Number Theory/Math**

Prime Generation, Sieve and How to Optimize

Bitwise Sieve

Modular Arithmatic ( + - \*)

Modular Inverse (/)

Big Mod ( a^b % p)

Extended Euclid

Euler Phi Inverse phi

Prime Factorization

Number of Divisor

Sum of Divisor

Factorizing n!

Shanks Algorithm

Probability Theory (Topcoder)

Dilworth's theorem

Chinese Reminder Theorem

Gaussian Elimination

Burnside Lemma

Finding Real roots of an n degree Equation

Given sum of divisors find possible n

Miller Rabin primality test

Pollard's rho algorithm

Taking modulo of Power (a^(b%MOD))%MOD

Lukas Theorem

Inclusion

Exclusion

Mobius Floyds Cycle Finding Algorithm

**Comnibatorics**

Sterling Number 1

Sterling Number 2

Catalan Number Derrangement

**Graph**

Graph Representations (Adjacency Matrix)

Graph Representations (Adjacency List using vector)

Breadth First Search BFS

Bicoloring

Depth First Search DFS

Topological Sorting

Articulation Point

Bridge

Strongly Connected Components SCC

Dijkstra and variations

Bellman Ford and variations

Floyd Warshall and variations

Kth Shortest Path

Minimum Spanning Tree ( Prims)

Minimum Spanning Tree ( Kruskal)

Minimum Spanning Tree ( For Directed Graphs )

Euler Path (Construction and optimization)

Maximum Flow ( Ford Fulkerson )

Maximum Flow ( Dinic )

Maximum Bipartite Matching and Variations

Hopkroft Karp (BPM)

Maximum Independent Set

Minimum Cost

Maximum Flow

Vertex Cover

Edge Cover

Largest Clique

Weighted Bipartite Matching (Hungarian)

IDA\* Search Problem, 15 Puzzle

Group theory

Hamiltonian Cycle

Min Weight Cycle in Graph

Graph Coloring

Stable Marriage Problem

Stoer Wagner ( Finding the minimum cut of a graph )

Planar Graph Detection

Havel-Hakimi Algorithm (Construct graph given degree of nodes)

Erdos & Gallai Theorem

Biconnected Components

2-Sat Centroid Decomposition

**Greedy**

Task Scheduling

Maximum Sum 1D in O(n)

Maximum Sum 2D in O(n^3)

Maximum Rectangle O(n^2)

**Dynamic Programming**

Longest Common Subsequence LCS

Coin change

Edit Distance

LIS/LDS in nlogn

Matrix Chain Multiplication

Bitmask DP (Traveling salesman problem)

Modular DP(DP with MOD value as a state)

Knuth Optimization

Divide and Conquer

Optimization

Convex Hull Optimization

Memory Optimizaion in DP

SOS DP

**Geometry**

Convex Hull

Point inside Convex Polygon ( log(n) )

Picks Theorem

Binary Search

Ternary Search

Segment Segment Intersection

Area Of A Concave Polygon

Point Inside A Polygon (Convex and Concave)

Line Sweeping

Fitting a Rectangle inside Another

Polygon Intersection

Minimum Circle Covering all Points

Area of a 3d Polygon

Union of rectanlge O(n^2)

Union of rectangle O(nlogn)

Closest Pair

Voronoi Diagrams Using Fortune's algorithm

Largest Empty Circle O(nlogn)

Rotating Callipers

**Data Structure**

Trie

Union Find

BST and variations

Treap

Splay Tree

Heap Binary Indexed Tree and Applications

Optimal BST

Segment tree

KD tree

Least Common Ancestor

Sparse Table

Range Minimum Query

Heavy Light Decomposition

Sqrt Decmposition

Mo's Algorithm

Snapshot Algorithm (Ref: Tanzir RM)

Persistent Segment Tree

**Game Theory**

Nim Misere

Nim Bogus

Nim Staircase

Nim

Grundy Number Dp Formulation

Alpha Beta Pruning Minimax

Red Hackenbush

Red/Blue Hackenbush

Green Hackenbush

**String Algorithms**

KMP Matcher

Suffix Array Construction

Longest Common Substring

Aho Corasick Algorithm

Z Algorithm

Manachers Algorithm

Palindromic Tree

Rabin Karp Algorithm

Finite automata based Algorithm

Boyer Moore Algorithm

**Miscellaneous**

Meet In the Middle Approach

Konigs Theorem

Matrix Tree Theorem

Joseph Problem (Using queue n^2)

Joseph Problem (Using recursion n)

Managing Biginteger

Permutations and Combinations

Tower of Hanoi,

Variations N Queens Problem

Hashing

Finding Nth Permutation

Huffman Coding

Traveling Salesman Problem (Backtracking with pruning)

Finding Determinant of a Matrix

Finding kth number from a sequence of unsorted numbers in log(n)

Transforming Hexagonal grid,

Triangular grid to 3d coordinate system

Matrix Multiplication

Solving Linear Recurrence with Matrix Exponentiation

Sliding Window

Prime Counting in Sublinear Time

Lagrange's Polynomial Interpolation

Rope

Dancing Links

FFT/NTT/Karatsuba

Linear Programming