**First Year Students:**

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| STL | Vector, Queue, Deque  Stack, List,  Set, Unordered Set,  Map, Unordered Map,  Pair, Structure,  Sort, Reverse, Unique,  Next\_Permutation,  Iterator, Priority Queue, Operator Overloading |
| Mathematics | Modular Inverse,  Fast Exponentiation/BigMod,  Sieve, Bitwise Sieve,  Segmented Sieve,Euler Totient Function |
| Greedy | Task Scheduling |
| Graph Algorithms | Graph Representation,  DFS, BFS, Dijkstra, Bicoloring, Topological Sort,  Floyd Warshall, Bellman Ford,  Minimum Spanning Tree |
| Recursion and Dynamic Programming | Coin Change Dp and its variations, Basic Classical Dp problems |
| Miscellaneous | Binary Search, Cumulative Sum Technique |

**Second Year Students:**

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| Mathematics | Extended Euclid,  Chinese Remainder Theorem, Probability, Combinatorics, Stars and Bars Theorem, Game Theory Basics |
| Graph Algorithms | Strongly Connected Component,  Articulation Point, Bridge,  Maximum Flow, Maximum Bipartite Matching, Weighted Bipartite Matching, Vertex Cover, Graph Coloring, Maximum Independent Set, Edge Cover |
| Data Structures | Segment Tree, Segment Tree with Lazy Propagation, Disjoint Set Union, Trie, Binary Indexed Tree, Least Common Ancestor, Sparse Table, Square Root Decomposition |
| Dynamic Programming | Matrix Chain Multiplication, Bitmask DP, Traveling salesman problem, Modular DP(DP with MOD value as a state) Tree Dp and variations, All Divide and Conquer approach technique |
| String Algorithms | KMP, Z-Algorithm,Hashing |

**Other Advanced Topics:**

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| Game Theory | Nim, Grundy Number and Dp Formulation, etc, Alpha Beta Pruning Minimax\* Hackenbush\*, Minimum Weighted Bipartite Matching/Kuhn-Munacres/Hungarian/Chinese Postman |
| Mathematics | Shanks Algorithm, Dilworth's theorem\*, Burnside Lemma,  Finding Real roots of an n degree Equation, Wilson's Theorem\*, Lucas Theorem\* |
| Data Structures | Treap, Splay Tree, FFT, HLD and others |
| Graph | 1. Minimum Spanning Tree ( For Directed Graphs ) 2. Euler Path (Construction and optimization) 3. Gomory-Hu Tree 4. Largest Clique 5. IDA\* Search Problem 6. 15 Puzzle 7. Group Theory 8. Hamiltonian Cycle 9. Min Weight Cycles in Graph 10. Stoer Wagner ( Finding the minimum cut of a graph ) 11. Planar Graph Detection Havel-Hakimi Algorithm (Construct graph given degree of nodes) 12. Maximum Matching(Blossom Shrinking) 13. Max cost-max flow(min cost flow for negative cycle) |
| Geometry | 1. Point inside Convex Polygon ( log(n) ) 2. Number of Lattice Points inside a polygon 3. Binary Search, Ternary Search 4. Segment Segment Intersection 5. Area Of A Concave Polygon Point Inside A Polygon (Convex and Concave) 6. Minimum Circle Covering all Points Union of rectangle ( How to cluster, how to make it in nlogn, bently ), Closet pair 7. Convex Hull 8. 3D Line Sweeping/Angle Sweep 9. Fitting a Rectangle inside Another Polygon 10. Intersection Area of a 3d Polygon 11. Polygon Clipping\* 12. Rotating Calipers\* 13. Optimal BST 14. KD tree 15. Link-cut tree 16. Interval Tree 17. Quad tree |
| Miscellaneous | 1. Meet In the Middle Approach 2. Konigs and Matrix Tree Theorem, 3. Joseph Problem(both O(n2) and O(n)), 4. Biginteger 5. Tower of Hanoi, Variations, 6. Permutation and combination, 7. N-Queen Problem, 8. Finding Determinant of a Matrix 9. Traveling Salesman Problem (Backtracking with pruning), 10. Finding kth number from a sequence of unsorted numbers in log(n) 11. Transforming Hexagonal grid, 12. Triangular grid to 3d coordinate system Solving Linear Recurrence with Matrix Exponentiation, |