**Coding Flow**

**Learn Language (C++/JAVA)**

**Basic**

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**1: Pattern printing problems**

**2: Analysis of time complexity**

**3: Linear Search problems**

**4: Circular array using simple array**

**5: Palindrome, Perfect number, armgs**

**6: Simple Hashing problems, freq count**

**7: Prefix Sum Problems 1D/2D - solve problems**

**8: Sliding window technique (1/5)**

**Intermediate**

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**1: Binary Search problems (2/5)**

**2: Find GCD of 2 numbers in LogN (Euclidean and Extended euclidean algo)**

**3: Linear Diphantine Equation**

**4: Prime in Sqrt(n) complexity**

**5: Seive of Eratosthenes**

**6: Segmented Seive**

**7: Finding the prime factorization of a number in logn per query**

**8: Euler Totient function**

**9: Fermet Little theorem**

**10: Wilson's theorem - HE**

**Number Theory**

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**1: Finding x^n in LogN**

**2: Modular Arithmetic**

**3: Module Inverse of a number**

**4: Chinease remainder theorem**

**5: Factorial Modulo Mod**

**6: Finding nCr & nPr in queries**

**7: Inclusion Exclusion principle -HE**

**8: Modular Exponentiation**

**Some Advanced**

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**1: Learn about basic sorting Algorithms (Bubble, Selectiom, Insertion)**

**2: Constructive and having swap terms in it**

**3: Solve problems related to Two Pointer Approach**

**4: Bit Manupulation problems(Left shift,Right shift, Set bit, MSB LSB etc) (Hackerearth as good tuts)**

**5: Power set of a given array or string using BIT**

**6: Number of subarray with XOR as ZERO (Not alogirithm, but a must do problem)**

**7: Problems related to Greedy Algoriths Tag - CF**

**8: Kadane's Algorithms and problem related to them**

**9: Job sequesnce and activity selection problem**

**Recursion (All Basic)**

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**1: Recurssion probelms like finding factorial**

**2: Implement Binary search using recursion**

**3: Implement modular exponent**

**4: Solve recursion problem like finding subset with given sum and other problems**

**Advanced**

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**1: Learn Merge Sort & Quick sort algorithms - count inversion**

**2: Do backtracking problems like Sudoku and N-Queen problem (Help in DP path problems)**

**3: Meet in the middle algo and problem**

**4: Divide & Conquer problesm on Codeforces**

**5: Find next greater / Next samller element using stack**

**6: problesm related to paranthesis using stack**

**7: Largest rectangular area in Histogram**

**8: Probleam related to Heap (Priority Queue)**

**Practice Hard on above problems**

**More Advanced Don't GiveUP (1-4 hr in a problem)**

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**1: Hashing on strings, know when collision happens (cpalgorithm site)**

**2: Rabin karp algo(it uses hashing)**

**3: Prefix function**

**4: KMP Algo**

**5: Z-Function**

**6: Manacher's Algo (Solve bunch of problem in above topic)**

**Trees – SPOJ - CF**

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**1: Tree / Graph representation**

**2: DFS/BFS traversal in tree /graph**

**3: Diameter of a tree/Height**

**4: Euler Tour of tree**

**5: Finding LCA using Euler Tour and using Binary Lifting**

**6: Distance b/w two nodes**

**7: Subtree Problems (Solve prob on above tree prob)**

**Graph**

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**1: Connected Components**

**2: Topological sort**

**3: Cyclic detection in graph**

**4: Bipartite check in graph**

**5: Shotest Connected Component using Kosaraju's alog**

**6: Dijkarta's Algo**

**7: Bellmanford Algo**

**8: Floyd warshall algo (Solver more problems on above topic - Hackerearth/Codeforce)**

**9: Bridge in Graph**

**10: Articulation point in graph**

**11: Minimum spanning tree & kruskal algo**

**12: Prim's Alog**

**13: 0/1 BFS in linear time (cpalgo)**

**14: Finding bridges online (Solve prob)**

**Dynamic Programming**

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**1: Start with Recusion & Memoization with strong knowledge. - AND MEMORIZE SOLUTION**

**2: Knapsack and LCS prob solve**

**3: Solve AtCoder Educational contest on DP 26/26 solve**

**4: MUST Solve problem from SPOJ(specially), then Codeforces.**

**5: Understand how we write recurrence for Digit DP(CF blog)**

**6: Read DP with bitmasks and solve on hackerearth**

**7: DP in trees (Rachit jain video)**

**8: SOS DP - CF**

**Practice More(NOT EASY)**

**More**

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**1: Disjoint Set(Using all optimizations)**

**2: Offline Quesries using Disjoint Set**

**3: Kruskal's Alog**

**4: Sparse Table (Not Imp)**

**5: Fenwick Tree (Read Update Trick also) - refer video tuf**

**6: Binary Lifting on fenwick tree (More Solve prob)**

**And More**

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**1: Matrix Exponentiation**

**2: Sqrt Decomposition -gfg**

**3: Update and query operations**

**4: Mo's Algo (Codeforce blog must)**

**5: Mo's Algo on Trees**

**6: Segment Tree (Most Imp topic - Range queries and point updates)**

**7: Lazy propogation in segment tress**

**This help you to E- level problems on Codeforces as least**

**At Last**

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**1: Sprague-Grundy Theorem -Gaurav Sen video**

**2: Flows and related prob**

**3: Heavy light decomposition - refer Anudeep blog at google**

**4: Convex Hull Alog - blog on CF**

**5: FFT/NTT**

**Learn all basic algos on Hackerearth.**