READ & PREPARE

1- Problem Statement

- Read Carefully - Mark important details
- Input - constraints / Output - Format

2 – Sample Test Cases

-Trace, Check boundaries / Missed Cases

4 - Input Properties

- Over Flow (DP counting, ^*+, exp)
- Precision
- Graph: complete, general, bipartite, tree, DAG, connectivity, directivity, self/multi edges
- Polygon: simple, convex, duplicate points, degenerate
- Constrained Input Combinations

5 - Output Properties (Boundaries)

- Small: WA, RTE
- Large: overflow (intermediate), RTE

6- Constraints

- Small <= 42
-- n!, 2^n, 3^n, MeetInMiddle
- Medium
-- BF, NlogM vs MlogN, NsqrtN
- Big
-- Fake. Cancelled, Log, BinarySch
-- MatrixPow, Cycle tricks
-- Pre/After cycle, Simulate S steps
--Values reRank
-- Recursion Pruning
-- Functions: linear/quad, fake/exp

INVESTIGATE

- Solution Space Analysis: Problem type? bounds? Equ representation
- Domains? Graphical? Geometrical?
- Similar Problem? (mis) Lead?
- Abstraction(s) for Problem
- Search Space: Size? BF? BF State?
- Draw: elements, properties, relations, reformulate equations
- Reversed / Simplified Problem

THINK

- Think: On paper NOT on PC
- Think: Concretely & Symbolically
- Think: Divide & Conquer problem
- Think: Forward & Backward
- Think: With/out known Algorithms
- Observations – use PC if better
- KISS
- Solving problem OR sub-problem?
- Rank & Attack Ideas
- Guess & Check

SOLVE

- Found solution? Any simpler?
-Solution Verification
-- Test cases Verification
-- Logic, Correctness Proof/Intuitive
-- O(time), O(memory), Rec depth
-- Look back Verification
- Solution failure? Think-code go-back

BIG Order?

- Exact # of operations big?
- Reduced variables?
- Reference of locality
- Clever tricks
- Pre-computation
-- Full, Partial (Range Props)
-- Preprocessing

Simplifications?

- Adhock Simplification
- N Constraints -> 1 2 ... N
- 2D ->1*1, 1*2, 2*1, 1*N
- Polygons->convex->triangle
- N players -> 1->2..N Player
- Graph->DAG->Tree->Chain
- 3D->2D->1D
- Bases ->10, prime, [1-N]
- Big rectangles->Compressed

Reverse?

- Adhock Reversing
- (Value -> Idx) → BSch(idx)
- X→Y: Y=F(X) indicative, X Searchable
- Property Reverse
-- MinSum =Total - MaxSum
-- Subsets with X = Total – Subset !X
-- Probability(X) = 1-prop(!X)

Optimization

Common:
- Fake/dfs
- DP/greedy/bf
-Binary Search/TS
-Branch & Bound
- RMQ/LCA
- Line sweep
- AlgoX

Minimization
- MCMF
- Min cut / vertex
- MST / Dijkstra
- Chull / mec

Maximization
- Max flow / MCMF
- Max Independent Set
- Kruskal Reverse
- LIS/GCD

Search Algorithms
- BFS / DFS / ID-dfs
- Backtracking
- Binary Search/TS
- Golden Ratio
- Meet in middle
- Divide & Conquer
- Branch & Bound
- Min Enclosing Circle

DP

General
- State representation(s)
- Diff sub-states calls?
-- move to state
- Cycles?
-- Depth?
-- Dijkstra / Bfs
-- Dec(rement)-inc-dec

Types
- Restricted / Range
- Counting
- Tree / Partitioning
- Extending table

Concerns
- Base case order
- Search space?
-- Constrained pars
- Redundant pars

States
- Canonical states?
- Local Minima
- Small substates cnt?
- Large pars
- Reduces fast? (e.g. /)

Counting Problems
- DP
- Combinations / Perms
- Inclusion-exclusion
- Graph Power

Data Structures
- Set/Heap /DisjointSets
- BIT
- Segmentation Tree
- Treab, KDT
- LCA/RMQ
- Hashing
- Interval Compression
- Quad Tree

Graph Algorithms
- MST: Kruskal / Prime
- Dijkstra / Topological
- Convex Hull / Floyd
- Max Flow/Min Cut
- Max Matching
- Max Indep Set
- Min path/vertex cover
- Bellman / DConsts
- Euler/Postman

String Algorithms
- Trie
- Permutation Cycles
- LIS / LCS
- Polynomial Hashing
- KMP / Aho Corasick
- Suffix tree/array

Mathematics
- GCD/LCM/Phi/Mob
- NIM/Grundy/Chinese
- Seive/Factorization
- System of Linear Eqs
- Determinant
- Simplex/ Pick's Theo
- Numerical Integration
- Matrix Power
- Closed Form
- Pigeon Hole
- Triangle inequality
- Voronoi diagram

Adhock Algorithms
- Greedy
- Line Sweep
- Sliding Window
- Canonical Form
- Grid Compression
- Constructive algos
- Test cases driven
- Randomization
- Time cut-off
- Stress Test & Observe

Decision Algorithms
- 2SAT
- Difference constraints
- Grundy
- Bipartite?