Chapter 1

Specific Heuristics

Consult these before and during contest. These only contain heuristics that are not obvious. For example to consider Minimum spanning tree during problem is hard, but once you saw that considering prim's/kruskal's is straightforward.

1.1 General/Adhoc

Topics to force

- Binary Search.
- Convex Hull trick.
- Dilworth's theorem.
- Longest increasing subsequence.
- Meet in the middle. (i.e $O(2^{\frac{n}{2}})$)
- Mo's algorithm
- Nearest small element on $O(n)$
- Stack.
- Ternary search.
- Two pointers.

Strategies

- If asked to count certain objects (pairs, subsequences, subarrays etc). Write down given required condition they should satisfy and also try to infer more conditions from them.
- Solve for the objects **not** satisfying the condition and subtract them from total.
- Inclusion-exclusion.
- Invariants/monovariants.
- For optimization problems one strategy is to construct the object first(like guess) and prove that object is optimal.
- Brute force with unexpected time complexity.
- operations can be converted in to equivalent forms. Any set of given operations can be interchanged with some set of our operations and vice-versa.
- In some problems only few variables are independent rest all are dependent on the former due to the condition given. We can use this to decrease our complexity.
- Bitsets for complexity reduction.

1.2 Bitwise

Topics to force

- Trie.
- Lexicographical ordering.
- SOS DP.

Strategies

- Consider each bit separately.
- Divide and conquer on sorted array(since bits are ordered).

1.3 Number Theory

Topics to force

- Binet's formula
- Euler's totient function
- Mobius function
- Fibonacci numbers.
- GCD.
- MEX.
- Prime decomposition.

1.4 Graph Theory

Topics to force

- Bipartite Graph.
- Centroid Decomposition.
- Graph coloring.
- Halls theorem.
- Heavy-Light decomposition.
- LCA.
- Matching
- Flow
- Spanning tree.
- Min cut.
- Strongly connected component.

1.5 Coding

- Unordered map.

1.6 Strings

Topics to force

- Hashing
- Z-algorithm.
- Suffix array.