What to study?

Knowing just the basics of programming won't be fruitful for aspirants of ACM ICPC. One needs to have a thorough knowledge of advanced algorithms used as well. Following Topics list out the necessary Topics and Algorithms that one must surely know to improve and stand a chance in the actual competition.

Elementary data structures: To begin with competitive programming, one must master the Data Structures. Following is the list of most commonly used data structures:

- Array
- Stack
- Queue
- String
- Heap
- Hash
- Extensive list of Data structures

Advanced Data Structures

Priority queues, union-find sets, (augmented) interval trees, (augmented) balanced BSTs and binary indexed trees

- Binary Indexed Tree or Fenwick tree
- Segment Tree (RMQ, Range Sum and Lazy Propagation)
- K-D tree (See insert, minimum and delete)
- Union Find Disjoint Set (Cycle Detection and By Rank and Path Compression)
- Tries
- Interval Tree

More Advanced Data Structures.

Sorting and Searching : Concentrate to learn the basic concepts and also get familiar with all the library functions available.

- Binary Search
- Quick Sort
- Merge Sort
- Order Statistics

String manipulation : Strings make programming problems interesting and difficult too and probably thats the reason they are used extensively in such contests. Learning library functions for String actually proves very helpful (C++ :
See this and this, String in Java).

- KMP algorithm
- Rabin karp
- Z's algorithm
- Aho Corasick String Matching

Choosing the right Language : C++ is till date most preferred language followed by Java when it comes to programming contests but you should always choose a language you are comfortable with. Being CONFIDENT in any language is most important.

Standard Template Library : A quintessential especially for those using C++ as a language for coding

- Power up C++ STL by Topcoder – Part 1, Part 2
- C++ Magicians – STL Algorithms

Dynamic Programming

- Longest Common Subsequence
- Longest Increasing Subsequence

- Edit Distance
- Minimum Partition
- Ways to Cover a Distance
- Longest Path In Matrix
- Subset Sum Problem
- Optimal Strategy for a Game
- 0-1 Knapsack Problem
- Assembly Line Scheduling
- Optimal Binary Search Tree

All DP Algorithms

BackTracking

- Rat in a Maze
- N Queen Problem
- Subset Sum
- m Coloring Problem
- Hamiltonian Cycle

More articles on Backtracking

Greedy Algorithms

- Activity Selection Problem
- Kruskal’s Minimum Spanning Tree Algorithm
- Huffman Coding
- Efficient Huffman Coding for Sorted Input
- Prim’s Minimum Spanning Tree Algorithm

More articles on Greedy Algorithms

Graph Algorithms : One of the most important topic which you can not ignore if preparing for ACM – ICPC.

- Breadth First Search (BFS)
- Depth First Search (DFS)
- Shortest Path from source to all vertices **Dijkstra**
- Shortest Path from every vertex to every other vertex **Floyd Warshall**
- Minimum Spanning tree **Prim**
- Minimum Spanning tree **Kruskal**
- Topological Sort
- Johnson’s algorithm
- Articulation Points (or Cut Vertices) in a Graph
- Bridges in a graph

All Graph Algorithms

Basic Mathematics

Arithmetic : Programmers must know how integers and real numbers are represented internally and should be able to code high-precision numbers. Bit manipulation tricks and knowing library functions for number basic arithmetic would be very helpful.

Number theory : Knowing some of these concepts would save a lot of time and efforts while programming in the contests.

- Modular Exponentiation
- Modular multiplicative inverse
- Primality Test | Set 2 (Fermat Method)
- Euler’s Totient Function
- Sieve of Eratosthenes
- Convex Hull
- Basic and Extended Euclidean algorithms
- Segmented Sieve

- Chinese remainder theorem
- Lucas Theorem

Combinatorics : Although directly might not seam to be important, Combinatorics is important to estimate asymptotic complexity of algorithms.

- Analysis of Algorithms
- Combinatorial Game Theory | Set 1 (Introduction)

Geometrical Algorithms

- Convex Hull
- Graham Scan
- Line Intersection
- Matrix Exponentiation and this
- Online construction of 3-D convex hull
- Bentley Ottmann algorithm to list all intersection points of n line segments
- Rotating Calipers Technique
- Area/Perimeter of Union of Rectangles
- Closest pair of points
- Area of Union of Circles
- Delaunay Triangulation of n points
- Voronoi Diagrams of n points using Fortune's algorithm
- Point in a polygon problem

Network Flow Algorithms

- Maxflow Ford Furkerson Algo and Edmond Karp Implementation
- Min cut
- Stable Marriage Problem
- Dinic's Algorithm for Maximum Flow and Wiki
- Minimum Cost Flow Problem
- Successive Shortest path Algorithm
- Cycle Cancelling algorithm
- Maximum weighted Bipartite Matching (Kuhn Munkres algorithm/Hungarian Method)
  - Hungarian Algorithm Wiki
  - Hungarian Algorithm for Assignment Problem
  - Maximum Bipartite Matching
- Stoer Wagner min-cut algorithm
- Maximum matching in general graph (Blossom Shrinking)
- Gomory-Hu Trees
- Chinese Postman problem(Please see this too)
- Hopcroft–Karp Algorithm for Maximum Matching

All Articles on Geometric Algorithms

More Advanced Stuff

Bit Algorithms , Randomized Algorithms , Branch and Bound , Mathematical Algorithms , Heavy Light Decomposition, A* Search