# IUT ACM Student Chapter Competitive Programming Course Syllabus

Mehran Aghabozorgi

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## 1 Resources

- Competitive programmers handbook
- Competitive programming by Felix Halim
- Emaxx english (website)
- Codeforces blogs

## 2 Topics

1. Introduction
   (a) Programming languages
   (b) Input & output
   (c) Shortening code
   (d) Resources
   (e) Contests
2. Time & memory complexity
3. Basic (STL) data structures & sorting
   (a) Sorting theory
   (b) Binary search (BS the answer)
   (c) *Ternary search [1]
4. Complete search
5. Greedy algorithms
6. Basic dynamic programming
7. Graph theory
   (a) Basics of graphs
   (b) Graph traversal
      i. BFS
      ii. DFS
      iii. Applications
   (c) Bipartite Checking (2-coloring)
   (d) Shortest paths
   (e) Tree algorithms & spanning trees
   (f) Directed graphs
      i. Directed acyclic graphs (DAGs)
   (g) Connectivity
      i. Connected components
      ii. *Bridges & articulation points
      iii. Strong connectivity
         A. Basics
         B. *2-sat
   (h) *Binary lifting method
      i. Basics
      ii. Lowest common ancestor and applications
   (i) Matching
   (j) *Flows & cuts
      i. Minimum cost maximum flow
8. Number theory
   (a) Fundamentals
   (b) Primes & factors
   (c) Modular arithmetic
9. Combinatorics
   (a) Inclusion/exclusion principle
   (b) *Stars & bars method
   (c) *Burnside lemma
10. String algorithms
    (a) Z-function
    (b) String hashing
11. *Square root algorithms
    (a) SQRT decomposition
    (b) Mo's algorithm
12. Advanced data structures
    (a) Disjoint set union
    (b) *Segment tree
       i. Basics
       ii. Lazy propagation
    (c) *Fenwick tree (binary indexed tree)
       i. Basics
       ii. N-dimensionality
    (d) *Heavy light decomposition
13. *Dynamic programming revisited
    (a) DP on trees
    (b) DP optimization techniques
    (c) Matrix exponentiation
14. *Sweep line algorithms

[1] Topics specified by * are more advanced and can be skipped in the beginning for start