## Preparation Before Starting (1 day):

- পিসিতে "My Collection for Programming Contest" নামে একটা ফোল্ডার খুলে রাখব। নেট থেকে বা অন্য কোথাও থেকে দরকারি কোন তথ্য বা ট্রিক্স পেলে সাথে সাথে নোট করার মতো ধৈর্য বা সুযোগ হয়তো সবসময় থাকে না। তাই তা এই ফোল্ডার এ প্রথমে জমা করে রেখে দিবো। পরে তার থেকে যা যা লাগে তা জায়গামত নোট করে বা লিস্ট করে অপ্রয়োজনীয় তথ্য ডিলেট করে দিবো।

- প্রোগ্রামিং এর পাঁচটা নোট খাতা বানাবো। মেথ (বেসিক + এডভান্স), ল্যাঙ্গুয়েজ সিনট্যাক্স নোট (এখানে সি, সি++, জাভা এর দরকারি সিনট্যাক্স গুলা কালেক্ট করা থাকবে। ), ডাটা স্ট্রাকচার নোট, এলগরিদম নোট (কন্টেস্ট এর মুহূর্তে এই নোট করা দরকারি এল্গরিদমগুলো কাজে দিবে), কন্টেস্ট ট্রিক্স নোট (বিভিন্ন দরকারি জিনিসগুলো, বিভিন্ন জায়গা থেকে পাওয়া ট্রিক্সগুলো, বিভিন্ন বিল্ড ইন ফাংশন হেডারফাইলসহ, কন্টেস্ট করার জন্য প্রোগ্রামগুলো লিখার একটা কমন নিয়ম নোট করা থাকবে এখানে + "Common mistakes in Programming Contest" attached করা ফাইলটা থেকে দরকারি জিনিসগুলো নওট করতে হবে)।

- পিসিতে একটা "wrong ans folder" খুলতে হবে যেটা এই ফাইল এর সাথে attached থাকবে। এই ফোল্ডার এর ভিতর যে যে প্রবলেমগুলো পারবনা সেগুলোর প্রত্যেকটির জন্য আলাদা ফোল্ডার থাকবে। এই ফোল্ডারগুলোর নাম হবে problem1_(Adhoc),problem2_(NumberTheory),,,,,,, এরকম থাকবে। ফোল্ডারগুলোর ভিতর নোটপেড এ ওই প্রবলেম এর নাম্বার আর নামসহ লিঙ্ক বা প্রবলেম কপি করে রাখা হবে। ওই প্রবলেম এর অন্য কারো করা সলুশন বা নিজের ট্রাই করা আংশিক সলুশন রাখতে পারবো।

- নতুন কোন প্রবলেম পেলে নিচে সিলেবাস এর সাথে সেগুলো ক্যাটাগরি অনুযায়ী লিস্ট করে ফেলতে হবে।

- নিচের ৪টা লেভেল এ প্রিপারেশন কমপ্লিট করতে হবে।

## Syllabus of Training Camp(Level 0):

- C++(C is a subset of C++), Java.
- Basic Math ("HSC এর basic। শুধুমাত্র যেসব অঙ্ক পরিক্ষায় আসে সেসব করলে হবে না, বইএর কোন অংক বাদ দেয়া যাবে না। বিশেষ করে সমাবেশ-সন্নিবেশ, জ্যামিতি, calculus এর ধারনা CP এর চেয়ে আর কোথাও বেশি কাজে লাগে কি না আমার জানা নাই। এটা ছাড়া কেও যদি discrete math (Rosen এরটা ভাল) শেষ করে তাইলে অনেক ভাল (পারলে Knuth এর concrete math টা করতে পারলে আরও ভাল)। math Olympiad লেভেলের Combinatorics করা থাকলে আরও ভাল।"~by Sayad Shahriar Manjur Dip (Problem setter of NCPC, IUPC, ICPC Dhaka region).

## Some Problems of Basic Math:

**Ans the following with explanation (day1):-**

1. How many different ways 5 people can stand in a line?
2. How many different ways 5 people can sit in a round table?
3. How many different ways a necklace with 5 beads can be made?
4. How many ways the letters of the word "MAKERS" can be arranged?
5. How many ways the letters of the word "ARMADA" can be arranged?
6. How many ways the letters of the word "BELLEVUE" can be arranged?
7. Suppose you want to arrange 7 people, A, B, C, D, E, F, and G in seats at a movie theater. But A, B, and C have been best friends since first grade and insist on sitting together (although not necessarily in the order ABC). How many ways can they be seated?
8. Suppose you want to arrange A, B, C, D, E in seats at a movie theater, except that A refuses to sit next to B (she knows what she did). How many ways can the people be seated?
9. Suppose you want to arrange 7 people, A, B, C, D, E, F, and G, in seats at a movie theater, subject to the rules:
   i)A, B, and C must sit together
   ii)E and F must sit together
10. Same Problem(Problem-9), subject to the rules:
   i) A, B, and C must sit together
   ii)C and D must sit together
11. Same Problem(Problem-9), subject to the rules:
   i)A, B, and C are sitting next to each other
   ii)D is sitting next to the ABC-group
12. How many ways 16 distinct balls can be grouped in 5 distinct basket.?
13. How many ways 16 identical balls can be grouped in 5 distinct basket.?
14. How many ways 16 distinct balls can be grouped in 5 identical basket.?
15. How many ways 16 identical balls can be grouped in 5 identical basket.?
16. x1+x2+x3+x4+x5=18, what is the number of solutions to this equation in non-negative integers?
17. How many unique ways can you arrange the letters in the word EMBEDDED?
18. Suppose you have 5 beads: 1 yellow, 1 red, 1 blue, and 2 green, and you want to arrange them on a necklace. (Remember that the necklace can be rotated, so for example the order YRBGG is the same as the order BGGYR, and the necklace can also be flipped over, so the order YRBGG is the same as the order GGBRY.) How many unique ways can the beads be arranged on the necklace?
19. If you have five friends A, B, C, D, E sitting in a row at a movie theater, how many ways can they be seated so that B is not sitting immediately to the right of C?
20. If you have the same five friends A, B, C, D, E sitting in a row, how many ways can they be seated so that B is sitting anywhere to the right of C (not necessarily next to C)? (Hint: Consider all the possible arrangements. For every arrangement with B sitting to the right of C, there is an opposite arrangement with B sitting to the left of C...)
21. You are sorting assigning 6 people, A, B, C, D, E and F, into 3 different hotel rooms. How many ways can they be sorted such that A is in the same room with C, and B is not in the same room with D? (Some hotel rooms may be empty.)

22. Again, you are sorting A, B, C, D, E and F into 3 different hotel rooms. How many ways can they be sorted such that A is in the same room with B, but B is not in the same room with C?

**Ans the following with explanation (day2):-**

1. How many different ways 20 people can be divided into 4 identical groups?
2. How many different ways 20 people can be divided into 4 distinct groups?
3. How many different ways 20 people can be divided into 4 identical groups where ordering of people inside each groups matters (i.e. 1234 is not same as 4231)?
4. How many different ways 20 people can be divided into 4 distinct groups where ordering of people inside each groups matters (i.e. 1234 is not same as 4231)?
5. How many different ways 20 people can be divided equally into 4 identical groups?
6. How many different ways 20 people can be divided equally into 4 distinct groups?
7. How many different ways 20 people can be divided equally into 4 identical groups where ordering of people inside each groups matters (i.e. 1234 is not same as 4231)?
8. How many different ways 20 people can be divided equally into 4 distinct groups where ordering of people inside each groups matters (i.e. 1234 is not same as 4231)?

Find total number of non-negative integer solutions of these equations:-

9. x1+x2+x3+x4+x5=26.
10. x1+x2+x3+x4=98. Here all these variables are odd integers.
11. x1+x2+x3+x4=96. Only x1,x2 are odd integers.
12. x1+x2+x3+x4=100. Exactly 2 variables are odd integers.
13. x1+x2+x3+x4+x5=109. Maximum 4 variables are odd integers.
14. x1+x2+x3+x4+x5=71. x1>2,x2>3.
15. x1+x2+x3=79. x1 is odd where x1>=3.
16. x1+x2+x3=72. 2<x1<20, 3<=x2<=30, x3<=40.
17. x1+x2+x3=69. x1<20.
18. How many non-decreasing sequences of 7 decimal digits are there?

**[Solutions are attachted in Folder].**

# Syllabus of ( For Beginners) Training Camp(Level 1):

- Problem Solving(Easy Problems)
- Basic Data Structure (STUCK, QUEUE, Searching, Sorting) + STL + Recursion. (Basic) + Discrete Mathematics'.
- Basic Algorithm (BFS,DFS)
- উপরের টপিকগুলো একসাথে চালাতে হবে।

# AD-HOC Problems:

## >> Uva-Easy-List

100 - The 3n + 1 problem
102 - Ecological Bin Packing
113 - Power of Cryptography
119 - Greedy Gift Givers
136 - Ugly Numbers
**151 Power Crisis**
160 - Factors and Factorials
256 - Quirksome Squares
272 - TEX Quotes
278 - Chess
**299 - Train Swapping**
371 - Ackermann Functions
374 - Big Mod
382 - Perfection
401 - Palindromes
412 - Pi
424 - Integer Inquiry
**440 Eeny Meeny Moo**
443 - Humble Numbers
444 - Encoder and Decoder
**458 - The Decoder**
**483 - Word Scramble**
**488 - Triangle Wave**
492 - Pig-Latin
494 - Kindergarten Counting Game
495 - Fibonacci Freeze
530 - Binomial Showdown
583 - Prime Factors
579 - ClockHands
**591 Box of Bricks**
694 - The Collatz Sequence
**913 - Joana and the Odd Numbers**
10038 - Jolly Jumpers
10018 - Reverse and Add
10035 - Primary Arithmetic
10055 - Hashmot A Brave Warrior
10071 - Back To High School Physics
10079 - Pizza Cutting
**10082 - WERTYU**
10106 - Product

10110 - Light, more light
10161 - Ant on a Chessboard
**10189 Mine Sweeper**
10222 - Decode the Mad man
10235 - Simply Emirp
10242 - Fourth Point
**10252 Common Permutation**
**10260 Soundex**
**10300 - Ecological Premium**
**10302 - Summation of Polynomials**
10323 - Factorial! You Must be Kidding!!!
10327 - Flip Sort
10340 - All in All
**10346 - Peter's Smokes**
**10370 - Above Average**
**10424 - Love Calculator**
10432 - Polygon Inside A Circle
10469 - To Carry or not to Carry
10696 - f91
**10783 - Odd Sum**
**10812 - Beat the Spread**
**10921 Find the Telephone**
10924 - Prime words
**10922 - 2 the 9s**
10929 - You can say 11
10931 - Parity
10945 - Mother bear
10970 - Big Chocolate
**11044 - Searching for Nessy**
11068 - An Easy Task
**11150 - Cola**
**11172 - Relational Operator**
**11185 - Ternary**
**11192 - Group Reverse**
11219 - How old are you?
**11332 - Summing Digits**
11479 - Is this the easiest problem
**11547 - Automatic Answer**
11636 - Hello World!
11689 - Soda Surpler
11727 - Cost Cutting
11799 - Horror Dash
11909 - Soya Milk

## >> Lightoj Beginner Problems (৩৯ টা).

# QUEUE

UVA: 10935 - Throwing cards away I

# STACK

UVA: 673 - Parentheses Balance

## Syllabus of Medium level Training Camp(Level 2):

Standard Template Library: (1 Day)

- String
- Vector
- Map
- Set
- Algorithm

Problem list :

UVa 120.
UVa 417.
UVa 484.
UVa 673.
UVa 10226.
UVa 10901.
UVa 10935.

Recursion and Backtracking (Basic):

UVA - 167, 208, 487, 524, 539, 571, 574, 598, 624, 628, 677, 729, 750, 10276, 10344, 10452, 10475, 11085, 11151, 11753,
LOJ - 1023

String Simulation: (3 Days)

**LightOJ**: 1338
**UVa**: 11734, 11541, 401, 353, 11530, 11233, 11743, 11716, 11713, 11362, 11572, 11697, 263, 10010, 10279, 457, 445
**TJU**: 1263, 2522, 1394

Number Theory: (10 days)

- Prime Number Generate (Using Seive Method)
- Primality Test
- Prime Factorization
- Euler Totient Function
- *Number of Divisors*
- Relative Prime
- *Sum Of Divisors*(Sigma Function)
- Logarithmic Exponentiation
- Extended GCD Algorithm
- Modular Arithmetic
- Fermat's Little Theorem
- Chinese Remainder Theorem
- *Euler phi, bigmod other elementary topics*

Problem List Number Theory:

**UVa Problems:** 160, 294, 543, 583, 406, 686, 884,914, 10042, 10061, 10235, 10299, 10392, 10394, 10533, 10539, 10699, 10738, 10780, 10789, 10852, 11064, 11415, 11466. *374, 10104, 10179, 10212, 10395, 10633, 10673, 11029, 11344, 11371, 11728, 11889, 12005.*
**LightOJ Problems:** 1045, 1014, 1028, 1035, 1045, 1054, 1067, 1090, 1098, 1109, 1213, 1214, 1245, 1282, 1336, 1340, 1341. *1007, 1024, 1077, 1138, 1215, 1220, 1234, 1259.*

Graph: (10 Days)

- Graph Representation (List + Matrix)
- BFS
- DFS

- Topological Sort
- Dijkstra Shortest Path
- Floyd Warshall
- BellManFord
- Set Operation
- MST(Kruskal & Prims)
- Strongly Connected Components(SCC)
- Articulation Point and Bridge, Bi Conn. Comp. (BCC)
- 2-SAT

Problems of Graph:

**UVA -** 124, 186, 200, 341, 423, 459, 469, 534, 544, 558, 567, 793, 821, 869, 872, 908, 929, 1000, 1056, 1112, 1160, 1174, 1208, 1216, 1234, 1235, 10034, 10048, 10099, 10147, 10171, 10178, 10187, 10246, 10274, 10305, 10356, 10369, 10397, 10462, 10486, 10525, 10583, 10600, 10608, 10685, 10724, 10793, 10801, 10803, 10842, 10947, 10986, 11015, 11060, 11228, 11377, 11463, 11492, 11503, 11631, 11686, 11710, 11721, 11733, 11747, 11833, 11857.
**LOJ -** 1002, 1029, 1040, 1041, 1059, 1123, 1019, 1174,1074, 1108, 1003, 1034, 1168, 1210, 1417,1099, 1254, 1281, 1316, 1321, 1379.

SCC/Bridge/Articulation Point/ BCC:

LOJ - 1003, 1026, 1034, 1063, 1168, 1210, 1291, 1300, 1417,
UVA - 247, 315, 610, 796, 10199, 10731, 11504, 11709, 11770, 11838.

DP: (15 Days)

- Standard Problem
- Coin Change
- SubSetSum
- *LIS and LCS and Palindrome*
- *Memory Optimization*
- MCM
- Assembly Line Scheduling
- 0-1 Knapsack
- *Digit Dp*
- String Related DP

- Bit Mask Basic
- *BitMask DP*
- Counting
- State Space Problem
- Advanced Dp(Digit Dp, Bitmask Dp, Node ordering, Bottom up Dp, row swapping technique).

DP Problems (Digit DP, Path DP, Non-Classical DP, Bitmask)

**SPOJ -** ASSIGN, SUBSUMS, 151, 3477, 3749, 4180, 7676, 8611.
**LOJ -** 1004, 1005, 1011, 1013, 1017, 1018, 1021, 1022, 1031, 1032, 1033, 1037, 1044, 1047, 1051, 1057, 1060, 1110, 1119, 1122, 1125, 1140, 1146, 1159, 1201, 1231, 1232, 1233, 1257, 1270, 1283, 1310, 1316, 1326, 1327, 1394, 1406, 1421.
**UVa -** 111, 116, 1049, 1172, 1244, 10003, 10036, 10069, 10271, 10325, 10337, 10364, 10400, 10405, 10419, 10446, 10453, 10465, 10482, 10496, 10520, 10626, 10651, 10721, 10817, 10910, 10911, 10912, 10943, 10944, 11026, 11151, 11218, 11407, 11420, 11450, 11472, 11703, 11795, 12030, 12241.
**Timus -** 101, 1005, 1009, 1013, 1014, 1017, 1048, 1152, 1197, 1658.
**POJ -** 3254.
**HDU -** 3555, 2089, 3652.

Geometry: (7 Days)

- Basic Geometry.
- Analytical Geometry
- Bisection
- Vector Concept (2D,3D)
- Line Segment Intersection
- Convex Hull

String Algorithm: (3 Days)

- KMP

{Problems: **UVa -** 11475, 11576, 12467. **POJ -** 2752, 3461**. HDU -** 3336, 2594, 3746, 1358, 2087**. LOJ -** 1255, 1258}.

- Z-Algorithm
- Trie
  {Problems: **LOJ -** 1114, 1129, 1224}.

- Aho-Corasick
- Suffix Array

Advance Data Structure: (10 Days)

Segment Tree (Basic, Lazy Propagation, Fractional Cascading)

{Problems (Basic, Lazy Propagation): **LOJ -** 1080, 1082, 1083, 1085, 1087, 1089, 1093, 1097, 1103, 1112, 1135, 1164, 1183, 1187, 1188, 1204, 1207, 1339, 1348. **POJ –** 7259. **HDU –** 3333. **UVa -** 1513, 11297, 12086, 12532, 12697. **UVaLive –** 5902. **SPOJ -** 1043, 9889.}

- Range Minimum Query
- Binary Indexed Tree
- Lowest Common Ancestor(LCA)

{Problems: LOJ - 1081, 1082, 1101, 1128, 1162. UVA - 10938, 12238}.

## Other Problems:

Mat-Expo:

UVa - 10229, 10518, 10655, 10870, 11486, 12470.
LOJ - 1052, 1065, 1070, 1096, 1131, 1132, 1142, 1160, 1244, 1332.
POJ - 3233.
HDU - 1757, 2157, 1575, 2855.
SPOJ - 8001, 339.

# Syllabus of Advanced Training Camp(Level 3):

## 1. Advanced Number Theory

1. Reference Tito's 104-Number Theory Problems
2. Special Numbers: Stirling , Harmonic Number, Fibonacci etc.

## 2. Backtracking + Pruning

1. Tricks
2. IDFS(Iterative Depth First Search)
3. A* search Algorithm
4. Dancing Link (Algorithm X)

## 3. Advanced Dynamic Programming

1. Standard Problems
2. State Space Reduction
3. DP on trees
4. DP with Data Structure
5. DP on Probabilities + Expected Value

## 4. Greedy

1. Reading Tutorial on TopCoder

## 5. Graph Theory

1. Variants DFS/BFS/SCC/Bridge/Articulation Point/Topo Sort/Biconnected Comp/
2. Stable Marriage Problem
3. 2-SAT
4. Heavy Light Decomposition
5. Directed Minimum Spanning Tree
6. Variants Dijkstra / Floyd Warshall / Bellman Ford
7. Euler Tour/Circuit and Hamiltonian Tour/Circuit

## 6. Advanced Mathematics

1. Probability + Expected Value
2. Discrete and Continuous Probability
3. Counting
4. Inclusion Exclusion  (Problem: LOJ - 1117)
5. Group Theory/Burn Side Lemma
6. Matrix Exponentiation
7. Roots of Polynomial
8. Gaussian Elimination
9. Numerical Analysis
10. Chinese Postman Problem

## 7. Game Theory

1. Variants Nim Thoery Problems
2. Variants Grundy problems

## 8. Network Flow

1. MinCut Max Flow
2. Bipartite Matching
3. MinCost Max Flow
4. Hungarian Algorithm
5. Blossom BPM

## 9. Advanced Data Structure

1. Suffix Array
2. Suffix Automata
3. Aho Corasick
4. Binary Indexed Tree
5. Segment Tree
6. Manachar Algorithm
7. Line Sweep
8. Splay Tree
9. K-d tree
10. Meet in the Middle

10. **Hashing + Randomized Algorithm**

    1. Miller Rabin Karp Algorithm
    2. 2-D Pattern Matching
    3. String Matching
    4. Random with a fun

11. **Regular Expression + Grammar Parsing**

12. **Geometry**

    1. Variants Analytical Geometry
    2. Vector Concept
    3. Computational Geometry
    4. Graham Scan
    5. Area of Union Circle
    6. Point in Polygon
    7. Voronoi Diagram
    8. Line Sweep
    9. Pick's Theorem
    10. Closest Pair of Points

13. **Variants Binary Search + Ternary Search**

## *Some Important Blogs for Programmers:*

http://community.topcoder.com/tc?module=Static&d1=tutorials&d2=alg_index

http://www.codechef.com/wiki/tutorials

http://comeoncodeon.wordpress.com

http://sites.google.com/site/smilitude/tutorials

http://www.analyzemath.com/

http://one-problem-a-day.blogspot.com/

http://www.personal.kent.edu/~rmuhamma/

http://e-maxx.ru/algo/

http://compprog.wordpress.com

http://zobayer.blogspot.com/

http://problem-solving-notes.blogspot.com/

http://petr-mitrichev.blogspot.com/

http://pregatire.blasterz.net/Training%20Path.html

http://www.shafaetsplanet.com/planetcoding/

**//Tutorial Link:**

http://www.codechef.com/wiki/tutorial-number-theory

http://community.topcoder.com/tc?module=Static&d1=tutorials&d2=primeNumbers

http://comeoncodeon.wordpress.com

http://e-maxx.ru/algo/ (English Translation By Google Chrome)

http://theoremoftheweek.wordpress.com

# Thank You