[https://www.codechef.com/certification/data-structures-and-algorithms/prepare#foundation](https://www.codechef.com/certification/data-structures-and-algorithms/prepare" \l "foundation)

**Learning Resources:**

* **Asymptotic analysis (Big-O notation)**
  + Basic
    - youtube.com - [Time complexity of a computer program](https://www.youtube.com/watch?v=V42FBiohc6c&list=PL2_aWCzGMAwI9HK8YPVBjElbLbI3ufctn)
    - youtube.com - [Big-O notation in 5 minutes - The basics](https://www.youtube.com/watch?v=__vX2sjlpXU)
    - youtube.com - [Definition Of Big O Notation - Intro to Theoretical Computer Science](https://www.youtube.com/watch?v=i1F_Uu0bYCc)
    - youtube.com - [Algorithms Lecture 1 -- Introduction to asymptotic notations](https://www.youtube.com/watch?v=aGjL7YXI31Q)
    - iarcs.org.in - [Measuring the efficiency of algorithms](https://www.iarcs.org.in/inoi/online-study-material/topics/efficiency.php)
    - interactivepython.org - [Particularly for Big-O notation](http://interactivepython.org/courselib/static/pythonds/AlgorithmAnalysis/toctree.html)
  + Advanced
    - rob-bell.net - [A beginner's guide to Big O notation](https://rob-bell.net/2009/06/a-beginners-guide-to-big-o-notation/)
    - youtube.com - [Big O Notation, Gayle Laakman McDowell](https://www.youtube.com/watch?v=v4cd1O4zkGw)
    - web.mit.edu - [Big O notation](http://web.mit.edu/16.070/www/lecture/big_o.pdf)
    - youtube.com - [Time and space complexity analysis of recursive programs - using factorial](https://www.youtube.com/watch?v=ncpTxqK35PI)
    - [A very nice tutorial with examples](https://web.archive.org/web/20171215122943/http:/eniac.cs.qc.cuny.edu/andrew/csci700/lecture2.pdf)
  + Practice Problems
    - Check some MCQs on space and time complexity [here](https://discuss.codechef.com/questions/122289/multiple-choice-questions-related-to-testing-knowledge-about-time-and-space-complexity-of-a-program).
    - You can see some problems with solutions here: [Time complexity of an algorithm](http://www.iitk.ac.in/esc101/08Jul/lecnotes/practise_sol.pdf)
* **Arrays**
  + Resources
    - codechef.com - [Data Structure Tutorial: Array](https://discuss.codechef.com/questions/87915/data-structure-tutorial-array)
    - cs.cmu.edu - [Arrays](https://www.cs.cmu.edu/~rjsimmon/15122-f14/lec/04-arrays.pdf)
    - geeksforgeeks.org - [Arrays Data Structure](http://www.geeksforgeeks.org/array-data-structure/)
  + Practice Problems
    - codechef.com - [LECANDY](https://www.codechef.com/problems/LECANDY), [editorial](https://discuss.codechef.com/questions/1108/lecandy-editorial)
    - codechef.com - [CNOTE](https://www.codechef.com/problems/CNOTE), [editorial](https://discuss.codechef.com/questions/65992/cnote-editorial) ;
    - codechef.com - [SALARY](https://www.codechef.com/problems/SALARY), [editorial](https://discuss.codechef.com/questions/5144/salary-editorial)
    - codechef.com - [CHN15A](https://www.codechef.com/problems/CHN15A), [editorial](https://discuss.codechef.com/questions/77487/chn15a-editorial)
    - codechef.com - [RAINBOWA](https://www.codechef.com/problems/RAINBOWA), [editorial](https://discuss.codechef.com/questions/107967/rainbowa-editorial)
    - codechef.com - [FRGTNLNG](https://www.codechef.com/problems/FRGTNLNG), [editorial](https://discuss.codechef.com/questions/75211/frgtnlng-editorial)
    - codechef.com - [COPS](https://www.codechef.com/problems/COPS), [editorial](https://discuss.codechef.com/questions/72499/cops-editorial)
* **Strings**
  + Resources
    - tutorialspoint.com - [C++ strings](https://www.tutorialspoint.com/cplusplus/cpp_strings.htm)
    - guru99.com - [Java strings](https://www.guru99.com/java-strings.html)
    - docs.python.org - [Python strings](https://docs.python.org/2/library/string.html)
    - tutorialspoint.com - [Python strings](https://www.tutorialspoint.com/python/python_strings.htm)
    - geeksforgeeks.org - [Many string questions](http://www.geeksforgeeks.org/string-data-structure/)
  + Practice Problems
    - codechef.com - [CSUB](https://www.codechef.com/problems/CSUB), [editorial](https://discuss.codechef.com/questions/47237/csub-editorial)
    - codechef.com - [LAPIN](https://www.codechef.com/problems/LAPIN), [editorial](https://discuss.codechef.com/questions/13991/lapin-editorial)
* **Stack and Queue**
  + Resources
    - geeksforgeeks.org - [Stack Data Structure](http://www.geeksforgeeks.org/stack-data-structure/)
    - geeksforgeeks.org - [Introduction and Array Implementation](http://www.geeksforgeeks.org/queue-set-1introduction-and-array-implementation/)
    - tutorialspoint.com - [Data Structures Algorithms](https://www.tutorialspoint.com/data_structures_algorithms/stack_algorithm.htm)
    - cs.cmu.edu - [Stacks](https://www.cs.cmu.edu/~wlovas/15122-r11/lectures/10-stacks.pdf)
    - cs.cmu.edu - [Stacks and Queues](https://www.cs.cmu.edu/~adamchik/15-121/lectures/Stacks%20and%20Queues/Stacks%20and%20Queues.html)
    - cs.cmu.edu - [Stacks and Queues](https://www.cs.cmu.edu/~rjsimmon/15122-s13/09-queuestack.pdf)
  + Practice Problems
    - spoj.com - [JNEXT](http://www.spoj.com/problems/JNEXT/)
    - spoj.com - [STPAR](http://www.spoj.com/problems/STPAR/)
    - spoj.com - [ONP](http://www.spoj.com/problems/ONP/)
    - codechef.com - [COMPILER](https://www.codechef.com/problems/COMPILER)
    - spoj.com - [MMASS](http://www.spoj.com/problems/MMASS/)
    - spoj.com - [HISTOGRA](http://www.spoj.com/problems/HISTOGRA/)
    - codeforces.com - [D. Maximum Xor Secondary](http://codeforces.com/problemset/problem/281/D)
    - spoj.com - [ANARC09A](http://www.spoj.com/problems/ANARC09A/)
    - codeforces.com - [C. Minimal string](http://codeforces.com/contest/797/problem/C)
    - codeforces.com - [B. Alternating Current](http://codeforces.com/contest/343/problem/B)
    - codeforces.com - [C. Longest Regular Bracket Sequence](http://codeforces.com/contest/5/problem/C)
* **Basic math operations (addition, subtraction, multiplication, division, exponentiation)**
  + codechef.com - [A tutorial on Fast Modulo Multiplication](https://discuss.codechef.com/questions/20451/a-tutorial-on-fast-modulo-multiplication-exponential-squaring)
* **Euclid’s GCD Algorithm**
  + Resources
    - youtube.com - [Mycodeschool video](https://www.youtube.com/watch?v=7HCd074v8g8" \t "_blank)
    - khanacademy.org - [The Euclidean Algorithm](https://www.khanacademy.org/computing/computer-science/cryptography/modarithmetic/a/the-euclidean-algorithm)
    - geeksforgeeks.org - [Example program to find gcd in c++:](http://www.geeksforgeeks.org/c-program-find-gcd-hcf-two-numbers/)
* **Prime Numbers, divisibility of numbers**
  + Resources:
    - Only O(sqrt(n)) algorithm for finding whether a number is a prime, factorization of a number.
    - [Finding prime factors by taking the square root](https://math.stackexchange.com/questions/1039519/finding-prime-factors-by-taking-the-square-root/1039525#1039525)
  + Practice Problems:
    - community.topcoder.com - [DivisorInc](https://community.topcoder.com/stat?c=problem_statement&pm=6186&rd=9823" \t "_blank)
    - community.topcoder.com - [Prime Polynom](https://community.topcoder.com/stat?c=problem_statement&pm=4475&rd=8012)
    - community.topcoder.com - [Prime Anagrams](https://community.topcoder.com/stat?c=problem_statement&pm=3458&rd=5869)
    - community.topcoder.com - [Refactoring](https://community.topcoder.com/stat?c=problem_statement&pm=2986&rd=5862)
* **Basic Recursion**
  + Resources
    - topcoder.com - [An Introduction to Recursion, Part 1](https://www.topcoder.com/community/data-science/data-science-tutorials/an-introduction-to-recursion-part-1/)
    - topcoder.com - [An Introduction to Recursion: Part 2](https://www.topcoder.com/community/data-science/data-science-tutorials/an-introduction-to-recursion-part-2/)
    - geeksforgeeks.org - [Recursion](http://www.geeksforgeeks.org/recursion/) ;(along with questions)
    - web.mit.edu - [Recursion](http://web.mit.edu/6.005/www/fa15/classes/10-recursion/)
    - csee.umbc.edu - [Recursion](https://www.csee.umbc.edu/~chang/cs202.f98/readings/recursion.html) ;(Examples with exercises)
    - loveforprogramming.quora.com - [Backtracking, Memoization & Dynamic Programming](https://loveforprogramming.quora.com/Backtracking-Memoization-Dynamic-Programming)
    - byte-by-byte - [Recursion for Coding Interviews](https://www.byte-by-byte.com/recursion/)
  + Practice Problems
    - codechef.com - [NOKIA](https://www.codechef.com/problems/NOKIA), [editorial](https://discuss.codechef.com/questions/1280/nokia-editorial)
    - codechef.com - [TRISQ](https://www.codechef.com/problems/TRISQ), [editorial](https://discuss.codechef.com/questions/64151/trisq-editorial)
    - codechef.com - [LFSTACK](https://www.codechef.com/problems/LFSTACK), [editorial](https://discuss.codechef.com/questions/84364/lfstack-editorial)
    - codechef.com - [FICE](https://www.codechef.com/problems/FICE), [editorial](https://discuss.codechef.com/questions/85839/fice-editorial)
* **Greedy Algorithms**
  + Resources
    - iarcs.org.in - [Greedy Algorithms](https://www.iarcs.org.in/inoi/online-study-material/topics/greedy.php)
    - iarcs.org.in - [Greedy Algorithms](https://www.iarcs.org.in/inoi/online-study-material/problems/buffalos-soln.php#solution)
    - topcoder.com - [Greedy Algorithms](https://www.topcoder.com/community/data-science/data-science-tutorials/greedy-is-good/)
    - [Greedy Algorithms](http://jeffe.cs.illinois.edu/teaching/algorithms/book/04-greedy.pdf)
  + Practice Problems
    - codechef.com - [TACHSTCK](https://www.codechef.com/problems/TACHSTCK), [editorial](https://discuss.codechef.com/questions/18267/tachstck-editorial)
    - codechef.com - [CIELRCPT](https://www.codechef.com/problems/CIELRCPT), [editorial](https://discuss.codechef.com/questions/1748/cielrcpt-editorial)
    - codechef.com - [MAXDIFF](https://www.codechef.com/problems/MAXDIFF), [editorial](https://discuss.codechef.com/questions/8114/maxdiff-editorial)
    - codechef.com - [CHEFST](https://www.codechef.com/problems/CHEFST), [editorial](https://discuss.codechef.com/questions/77629/chefst-editorial)
    - codechef.com - [CAKEDOOM](https://www.codechef.com/problems/CAKEDOOM), [editorial](https://discuss.codechef.com/questions/1119/cakedoom-editorial)
    - codechef.com - [CLETAB](https://www.codechef.com/problems/CLETAB), [editorial](https://discuss.codechef.com/questions/49342/cletab-editorial)
    - codechef.com - [TADELIVE](https://www.codechef.com/problems/TADELIVE), [editorial](https://discuss.codechef.com/questions/60005/tadelive-editorial)
    - codechef.com - [MANYCHEF](https://www.codechef.com/problems/MANYCHEF), [editorial](https://discuss.codechef.com/questions/5606/manychef-editorial)
    - codechef.com - [MMPROD](https://www.codechef.com/problems/MMPROD), [editorial](https://discuss.codechef.com/questions/82151/mmprod-editorial)
    - codechef.com - [CHEFTMA](https://www.codechef.com/problems/CHEFTMA), [editorial](https://discuss.codechef.com/questions/78212/cheftma-editorial)
    - codechef.com - [STICKS](https://www.codechef.com/problems/STICKS), [editorial](https://discuss.codechef.com/questions/82568/sticks-editorial)
    - spoj.com - [BAISED](http://www.spoj.com/problems/BAISED/)
    - spoj.com - [BALIFE](http://www.spoj.com/problems/BALIFE/)
    - spoj.com - [GCJ101BB](http://www.spoj.com/problems/GCJ101BB/)
    - codechef.com - [FGFS](https://www.codechef.com/problems/FGFS)
    - codechef.com - [KNPSK](https://www.codechef.com/problems/KNPSK)
    - codechef.com - [LEMUSIC](https://www.codechef.com/problems/LEMUSIC)
    - spoj.com - [ARRANGE](http://www.spoj.com/problems/ARRANGE/)
    - spoj.com - [FASHION](http://www.spoj.com/problems/FASHION/)
* **Dynamic programming (Basic DP)**
  + Resources
    - medium.freecodecamp.org - [Demystifying Dynamic Programming](https://medium.freecodecamp.org/demystifying-dynamic-programming-3efafb8d4296)
    - iarcs.org.in - [Dynamic Programming - Tiling](https://www.iarcs.org.in/inoi/online-study-material/topics/dp-tiling.php)
    - topcoder.com - [Dynamic Programming – From Novice to Advanced](https://www.topcoder.com/community/data-science/data-science-tutorials/dynamic-programming-from-novice-to-advanced/)
    - illinois.edu - [Dynamic Programming](http://jeffe.cs.illinois.edu/teaching/algorithms/book/03-dynprog.pdf) ;(Exercises are recommended)
    - codechef.com - [Dynamic Programming](https://www.codechef.com/wiki/tutorial-dynamic-programming)
    - geeksforgeeks.org - [Dynamic Programming](http://www.geeksforgeeks.org/dynamic-programming/) ;(Contains a lot of practice sessions)
    - <https://qr.ae/pGvoP8>
    - MIT OCW (Contains some Advanced topics as well)
      * [Dynamic Programming I](https://www.youtube.com/watch?v=OQ5jsbhAv_M)
      * [Dynamic Programming II](https://www.youtube.com/watch?v=ENyox7kNKeY)
      * [Dynamic Programming III](https://www.youtube.com/watch?v=ocZMDMZwhCY)
      * [Dynamic Programming IV](https://www.youtube.com/watch?v=tp4_UXaVyx8)
  + Practice Problems
    - codechef.com - [ALTARAY](https://www.codechef.com/problems/ALTARAY), [editorial](https://discuss.codechef.com/questions/80137/altaray-editorial)
    - codechef.com - [DELISH](https://www.codechef.com/problems/DELISH), [editorial](https://discuss.codechef.com/questions/13727/delish-editorial)
    - codechef.com - [DBOY](https://www.codechef.com/problems/DBOY), [editorial](https://discuss.codechef.com/questions/4443/dboy-editorial)
    - codechef.com - [XORSUB](https://www.codechef.com/problems/XORSUB), [editorial](https://discuss.codechef.com/questions/58422/xorsub-editorial)
    - codechef.com - [GRID](https://www.codechef.com/problems/GRID), [editorial](https://discuss.codechef.com/questions/51454/grid-editorial)
    - codechef.com - [TADELIVE](https://www.codechef.com/problems/TADELIVE), [editorial](https://discuss.codechef.com/questions/60005/tadelive-editorial)
    - codechef.com - [FROGV](https://www.codechef.com/problems/FROGV), [editorial](https://discuss.codechef.com/questions/47239/frogv-editorial)
    - codechef.com - [MATRIX2](https://www.codechef.com/problems/MATRIX2), [editorial](https://discuss.codechef.com/questions/22491/matrix2-editorial)
    - codechef.com - [AMSGAME2](https://www.codechef.com/problems/AMSGAME2), [editorial](https://discuss.codechef.com/questions/10495/amsgame2-editorial)
    - spoj.com - [MDOLLS](http://www.spoj.com/problems/MDOLLS/)
    - spoj.com - [MSTICK](http://www.spoj.com/problems/MSTICK/)
    - spoj.com - [MCARDS](http://www.spoj.com/problems/MCARDS/)
    - spoj.com - [MIXTURES](http://www.spoj.com/problems/MIXTURES/)
    - spoj.com - [SAMER08D](https://www.spoj.pl/problems/SAMER08D/)
    - spoj.com - [AIBOHP](https://www.spoj.pl/problems/AIBOHP/)
* **Naive string searching**
  + Resources
    - geeksforgeeks.org - [Naive Pattern Searching](http://www.geeksforgeeks.org/searching-for-patterns-set-1-naive-pattern-searching/)
* **Sorting**
  + [khanacademy.org](https://www.khanacademy.org/computing/computer-science/algorithms/sorting-algorithms/a/sorting)
  + [visualgo.net](https://visualgo.net/en/sorting?slide=1)
  + [iarcs.org.in](https://www.iarcs.org.in/inoi/online-study-material/topics/sorting.php)
  + Merge sort
    - youtube.com - [Merge sort algorithm](https://www.youtube.com/watch?v=TzeBrDU-JaY)
    - Practice Problems  
      codechef.com -[MRGSRT](https://www.codechef.com/problems/MRGSRT)
  + Quick sort
    - youtube.com - [Quicksort algorithm](https://www.youtube.com/watch?v=COk73cpQbFQ)
    - Practice Problems  
      codechef.com -[TSORT](https://www.codechef.com/problems/TSORT)
  + Counting sort
    - geeksforgeeks.org - [Counting Sort](http://www.geeksforgeeks.org/counting-sort/)
    - Practice Problems
      * codechef.com - [TACHSTCK](https://www.codechef.com/problems/TACHSTCK), [editorial](https://discuss.codechef.com/questions/18267/tachstck-editorial)
      * codechef.com - [STICKS](https://www.codechef.com/problems/STICKS), [editorial](https://discuss.codechef.com/questions/82568/sticks-editorial)
* **Binary Search**
  + Resources
    - [topcoder.com](https://www.topcoder.com/community/data-science/data-science-tutorials/binary-search/) (Try solving problems of Simple and Moderate level as mentioned in the end of the link)
    - [codechef.com](https://www.codechef.com/wiki/tutorial-binary-search)
    - [usfca.edu](https://www.cs.usfca.edu/~galles/visualization/Search.html)
    - [khanacademy.org](https://www.khanacademy.org/computing/computer-science/algorithms/binary-search/a/binary-search)
  + Detailed Theoretical analysis
    - [cmu.edu](https://www.cs.cmu.edu/~fp/courses/15122-f10/lectures/03-binsearch.pdf) (A theoretical analysis)
  + Problems
    - geeksforgeeks.org - [Binary Search](http://www.geeksforgeeks.org/binary-search) (Contains some solved problems)
    - codechef.com - [STRSUB](https://www.codechef.com/problems/STRSUB), [editorial](https://discuss.codechef.com/questions/66064/strsub-editorial)
    - codechef.com - [ASHIGIFT](https://www.codechef.com/problems/ASHIGIFT), [editorial](https://discuss.codechef.com/questions/66867/ashigift-editorial)
    - codechef.com - [STACKS](https://www.codechef.com/problems/STACKS), [editorial](https://discuss.codechef.com/questions/75205/stacks-editorial)
    - codechef.com - [DIVSET](https://www.codechef.com/problems/DIVSET), [editorial](https://discuss.codechef.com/questions/107068/divset-editorial)
    - codechef.com - [SNTEMPLE](https://www.codechef.com/problems/SNTEMPLE), [editorial](https://discuss.codechef.com/questions/99456/sntemple-editorial)
    - codechef.com - [SNAKEEAT](https://www.codechef.com/problems/SNAKEEAT), [editorial](https://discuss.codechef.com/questions/98802/snakeeat-editorial)
    - codechef.com - [SCHEDULE,](https://www.codechef.com/problems/SCHEDULE) [editorial](https://discuss.codechef.com/questions/92702/schedule-editorial)
    - codechef.com - [RIGHTTRI](https://www.codechef.com/problems/RIGHTTRI), [editorial](https://discuss.codechef.com/questions/82375/righttri-editorial)
    - codechef.com - [FORESTGA](https://www.codechef.com/problems/FORESTGA), [editorial](https://discuss.codechef.com/questions/81382/forestga-editorial)
    - codechef.com - [CHEFHCK2](https://www.codechef.com/problems/CHEFHCK2),[editorial](https://discuss.codechef.com/questions/6650/chefhck2-editorial)
    - spoj.com - [ABCDEF](http://www.spoj.com/problems/ABCDEF)
    - spoj.com - [NOTATRI](http://www.spoj.com/problems/NOTATRI)
    - spoj.com - [SCALE](http://www.spoj.com/problems/SCALE)
    - spoj.com - [SUMFOUR](http://www.spoj.com/problems/SUMFOUR)
    - spoj.com - [SUBSUMS](http://www.spoj.com/problems/SUBSUMS)
    - spoj.com - [ANARC05B](http://www.spoj.com/problems/ANARC05B)
    - spoj.com - [RENT](http://www.spoj.com/problems/RENT)
    - spoj.com - [PIE](http://www.spoj.com/problems/PIE)
    - spoj.com - [MKUHAR](http://www.spoj.com/problems/MKUHAR)
    - spoj.com - [SVADA](http://www.spoj.com/problems/SVADA)
    - spoj.com - [SUBS](http://www.spoj.com/problems/SUBS)