# Data Structures and Algorithms

general algorithm algorithms data-structure datastructure

neo1tech9_7 1 Jul '14

Hi all,
I need your help to make a list of most used data structures and algorithms along with their tutorials, implementation and some problems on them. It will be helpful to everyone in many ways. I request everyone to contribute to this list by providing links to tutorials, problems, etc. I will keep updating this list regularly.

1. Binary Search :
   Tutorial, Problems 487, Tutorial, Implementation 115, Problem 115
2. Quicksort :
   Tutorial, Implementation 97, Tutorial 35
3. Merge Sort :
   Tutorial, Implementation 43, Tutorial 35
4. Suffix Array :
   Tutorial 81, Tutorial, Implementation, Tutorial, Implementation 23, Problem 19, Problem 8
5. Knuth-Morris-Pratt Algorithm (KMP) :
   Tutorial 54, Tutorial, Implementation 21, Tutorial 5, Problem 14

6. Rabin-Karp Algorithm :
   Tutorial, Implementation 34, Tutorial 8, Problem 6, Problem 4

7. Tries :
   Tutorial, Problems 49, Tutorial : I, 20 II, Tutorial 6, Problem 3, Problem, Problem 1

8. Depth First Traversal of a graph :
   Tutorial, Impelementation 34, Tutorial, Problems 19, Problem 6, Problem 6, Problem 2

9. Breadth First Traversal of a graph :
   Tutorial, Impelementation 18, Tutorial, Problems 19, Problem, Problem 1, Problem, Flood Fill 4

10. Dijkstra's Algorithm :
    Tutorial, Problems 30, Problem 7, Tutorial(greedy) 7, Tutorial (with heap) 4, Implementation 6, Problem 2, Problem 3

11. Binary Indexed Tree :
    Tutorial, Problems 21, Tutorial 5, Original Paper 2, Tutorial 1, Tutorial, Problem 1, Problem 1,
    Problem, Problem, Problem, Problem, Problem

12. Segment Tree (with lazy propagation) :
    Tutorial, Implementation 20, Tutorial, Tutorial, Problems, Implementation 6, Tutorial, Implementation and Various Uses 3, Persistent Segment Tree: *62 1, II, problems same as BIT, Problem 1, Problem/*HLD is used as well/*

13. Z algorithm :
    Tutorial, Problem 28, Tutorial 5, Tutorial 2, problems same as KMP.

14. Floyd Warshall Algorithm :
    Tutorial, Implementation 22, Problem 3, Problem

15. Sparse Table (LCP, RMQ) :
    Tutorial, Problems 14, Tutorial, Implementation(C++) 5, Java implementation 1

16. Heap / Priority Queue / Heapsort :
    Implementation, Explanation 12, Tutorial 8, Implementation 3, Problem 5, Chapter from CLRS

17. Modular Multiplicative Inverse 10

18. Binomial coefficients (nCr % M): Tutorial, Tutorial 3, Paper 1 (Link Not Working), Problem 3

19. Suffix Automaton :
    Detailed Paper 6, Tutorial, Implementation (I) 4, Tutorial, Implementation (II), Problem, Problem, Problem 6, Problem 8, Tutorial, Implementation

20. Lowest Common Ancestor :
    Tutorial, Problems 13, Paper 3, Paper 1, Problem 1, Problem, Problem 1

21. Counting Inversions :
    Divide and Conquer 7, Segment Tree 5, Fenwick Tree 3, Problem 2

22. Euclid's Extended Algorithm

23. Suffix Tree :
    Tutorial 4, Tutorial 3, Intro 1, Construction : *106, II, Implementation, Implementation 2, Problem 3, Problem 2, Problem 2, Problem 2

24. Dynamic Programming :
    Chapter from CLRS(essential), Tutorial, Problems 46, Problem 14, Problem 5, Problem 2, Problem, Tutorial 8, Problem 2, Problem 3, Problem 2, Longest Increasing Subsequence 4, Bitmask DP 2, Bitmask DP 1, Optimization 1, Problem, Problem, Problem, Problem 1, Problem, Problem, Problem, DP on Trees : *134 3, II

25. Basic Data Structures :
    Tutorial 19, Stack Implementation 13, Queue Implementation, Tutorial 6, Linked List

Implementation 10

26. Logarithmic Exponentiation

27. Graphs :
Definition, Representation, Definition, Representation 6, Problem 7, Problem 1

28. Minimum Spanning Tree :
Tutorial 4, Tutorial, Kruskal's Implementation 1, Prim's Implementation, Problem 1, Problem, Problem 1, Problem, Problem

29. Efficient Prime Factorization 6

30. Combinatorics :
Tutorial, Problems 18, Problem 4, Tutorial 4

31. Union Find/Disjoint Set :
Tutorial 8, Tutorial, Problems 4, Problem 1, Problem 1, Problem 1

32. Knapsack problem :
Solution, Implementation 16

33. Aho-Corasick String Matching Algorithm :
Tutorial 4, Implementation 1, Problem, Problem, Problem, Problem

34. Strongly Connected Components :
Tutorial, Implementation 6, Tutorial, Problem 1, Problem, Problem

35. Bellman Ford algorithm :
Tutorial, Implementation 5, Tutorial, Implementation, Problem 1, Problem 2

36. Heavy-light Decomposition :
Tutorial, Problems 3, Tutorial, Implementation 3, Tutorial, Implementation, Implementation 1, Problem, Problem, Problem

37. Convex Hull :
    Tutorial, Jarvis Algorithm Implementation 4, Tutorial with Graham scan, Tutorial, Implementation, Problem, Problem, Problem, Problem, Problem

38. Line Intersection :
    Tutorial, Implementation 4, Tutorial, Problems

39. Sieve of Erastothenes 5

40. Interval Tree :
    Tutorial, Implementation 6, Problem, Problem, Problem, Problem, Problem, Problem, Tutorial

41. Counting Sort 7

42. Probabilities 7

43. Matrix Exponentiation :
    Tutorial, Tutorial 4

44. Network flow :
    (Max Flow)Tutorial : I, 3 II 1, Max Flow(Ford-Fulkerson) Tutorial, Implementation 3, (Min Cut) Tutorial, Implementation, (Min Cost Flow)Tutorial : I, 1 II, III, Dinic's Algorithm with Implementation 1, Max flow by Edmonds Karp with Implementation, Problem 1, Problem 1, Problem, Problem, Problem, Problem, Problem, Problem, Problem, Problem, Problem, Problem, Problem, Problem 1, Problem

45. K-d tree :
    Tutorial 5, Tutorial, Implementation 1, Problem

46. Deque 4

47. Binary Search Tree :
    Tutorial, Implementation 13, Searching and Insertion 5, Deletion 1

48. Quick Select :
    Implementation 2, Implementation 1

49. Treap/Cartesian Tree :
    Tutorial(detailed) 1, Tutorial, Implementation 1, Uses and Problems 2, Problem, Problem

50. Game Theory :
    Detailed Paper 10, Tutorial, Problems 2, Grundy Numbers 1, Tutorial with example problems - I, 1 II, III, IV, Tutorial, Problems, Problem 1, Problem, Problem, Problem, Problem, Problem, Problem, Problem, Problem, Problem, Problem, Nim

51. STL (C++) :
    I, 27 II 11, Crash Course 35

52. Maximum Bipartite Matching 5

53. Manacher's Algorithm :
    Implementation 2, Tutorial 2, Tutorial, Implementation 1, Tutorial, Implementation, Problem 1, Problem, Problem 1

54. Miller-Rabin Primality Test 2 : Code 2

55. Stable Marriage Problem 6

56. Hungarian Algorithm 4, Tutorial 2

57. Sweep line Algorithm : I 2, II

58. LCP :
    Tutorial, Implementation 4, Tutorial, Implementation

59. Gaussian Elimination 3

60. Pollard Rho Integer Factorization 4, problem

61. Topological Sorting 2

62. Detecting Cycles in a Graph : Directed - *293 1, II
    Undirected : *295

63. Geometry : Basics 5, Tutorial 1

64. Backtracking :
    N queens problem 7, Tug of War 4, Sudoku 4

65. Eulerian and Hamiltonian Paths :
    Tutorial 3, Tutorial, (Eulerian Path and Cycle)Implementation, (Hamiltonian Cycle)Implementation 2

66. Graph Coloring :
    Tutorial, Implementation 13

67. Meet in the Middle :
    Tutorial 9, Implementation 2

68. Arbitrary Precision Integer(BigInt) 1, II

69. Radix Sort 3, Bucket Sort

70. Johnson's Algorithm :
    Tutorial 6, Tutorial, Implementation 1

71. Maximal Matching in a General Graph :
    Blossom/Edmond's Algorithm, Implementation 4, Tutte Matrix, Problem

72. Recursion : I, 9 II 2, Towers of Hanoi 7 with explanation

73. Inclusion and Exclusion Principle : I 1, II

74. Co-ordinate Compression 1

75. Sqrt-Decomposition :
    Tutorial 3, Tutorial, Problem 1, Problem 2

76. Link-Cut Tree :
    Tutorial 5, Wiki, Tutorial, Implementation 3, Problem 1, Problem, Problem, Problem

77. Euler's Totient Function :
    Explanation, Implementation, Problems 5, Explanation, Problems

78. Burnside Lemma :
    Tutorial 6, Tutorial 1, Problem

79. Edit/Levenshtein Distance :
    Tutorial 2, Introduction 1, Tutorial 1, Problem 2, Problem

80. Branch and Bound 7

81. Math for Competitive Programming 66

82. Mo's Algorithm : Tutorial and Problems 20

692

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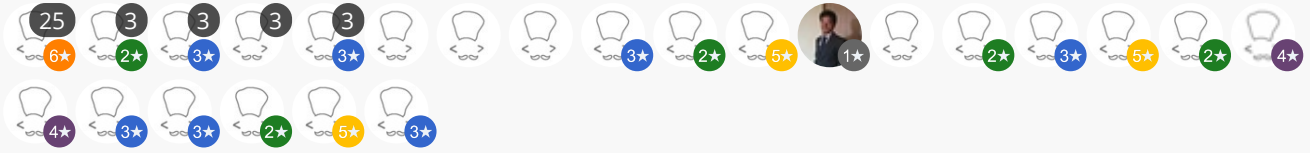

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487 Topcoder topcoder.com

136 http://discuss.codechef.com/questions/18752/what-are-the-must-known-algorithms-for-

on...

115 http://geeksquiz.com/binary-search/

115 http://www.spoj.com/problems/AGGRCOW

97 http://geeksquiz.com/quick-sort/

There are **192** replies with an estimated read time of **17 minutes**.

Summarize This Topic

**ravi0213** Aug '14

we already have a topic for list of imp algo

http://discuss.codechef.com/questions/18752/what-are-the-must-known-algorithms-for-online-programming-contests 136

12

**its_pheonix** Aug '14

A good initiative 🙂

2 Replies

32

utkarsh13 Aug '14

4★

add geeksforgeeks.org 13 for tutorials

1 Reply 4

grvana Aug '14

1★

I bookmarked this page... relating to the problem is best part... thanku...
want more...🙂

3

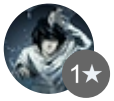
johri21 Aug '14

2★

Nice Initiative I would recommend http://e-maxx.ru/algo/ 26 for the implementation and theory. Make use of google translate. It also have a good set of questions in the end.

For DP I would recommend this 22 the topic is nicely explained by Mimino.(For starters)

8



vicky002 Aug '14

1★

Take a look of this website once...Explanation of all the algorithms from different sources can be found at one place!!!

http://algorithm.daqwest.com/ 47

12

codemaster1994 Aug '14

4★

link 16

The above link has lesser known but useful data structures.

31

ronakymca Aug '14

4★

I think stackoverflow can also be of immense help.

Really awesome effort.

7

rajat_dtc Aug '14

2★

For heavy-light decomposition - http://wcipeg.com/wiki/Heavy-light_decomposition 4

17

rishavz_sagar Aug '14

3★

I have found a nice implementation of Dijkstra's algorithm using c++. Please , have a look at the following link:

http://zobayer.blogspot.in/2009/12/dijkstras-algorithm-in-c.html 5

3 Replies 3

ravi0213 Aug '14

4★

Matrix exponentiation : http://zobayer.blogspot.in/2010/11/matrix-exponentiation.html 4

related problem : http://www.hackerearth.com/problem/algorithm/long-walks-from-office-to-home-sweet-home-1/ 2

17

gdisastery1 Aug '14

4★

One might try http://e-maxx.ru/ 3 🙂 It's in Russian though, but Google translator might help.

1 Reply 8

maheshd13 Aug '14

Quick Select

Deque

Binary Search Trees 2

1 Reply 2

tech_boy Aug '14

2★

Really good work.

God Bless you and you will win IOI 🙂

2 Replies 27

usaxena95 Aug '14

7★

GRUNDY NUMBERS-

letuskode.blogspot.com 9

**Grundy numbers for competitive programming**

Consider a simple game which two players can play. There are N coins in a pile. In each turn, a player can choose to remove one or two coi...

1 Reply 3

gaurav_vk Aug '14

1★

Superb initiative !! Keep it up

I hope i will help you

1 Reply 2

freeman92 Aug '14

3★

persistent segment tree: Explanation with basic code 3, tutorial with implementations of spoj and codechef problems by Anudeep Nekkanti 1

1 Reply 2

thechamp103 Aug '14

3★

Try this for classical problems of dp(interactive tutorial)

http://people.cs.clemson.edu/~bcdean/dp_practice/ 7

1 Reply 2

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This one is an awesome and very good crash course of STL here 6

Add this to list.

1 Reply 4