

Notes of the Introduction To Algorithms

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August 2, 2016

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Part I

Foundations

Chapter 1

The Role of Algorithms in Computing

1.1 Algorithms

Exercises

1.1-1 Give a real-world example that requires sorting or a real-world example that requires computing a convex hull.

Answer: One example that requires sorting is that teachers will sort our scores after the exam.

1.1-2 Other than speed, what other measures of efficiency might one use in a real-world setting ?

Answer: cost, space, manpower, material resources. In different cases, each can be the key of measures of efficiency.

Reference: <https://www.quora.com/Other-than-speed-what-other-measures-of-efficiency-might-one-use-in-a-real-world-setting>

1.1-3 Select a data structure that you have seen previously, and discuss its strengths and limitations.

Answer: Array
strengths: access directly
limitations: costs lot when insert or delete

1.1-4 How are the [shortest-path](#) and [traveling-salesman](#) problems given [similar](#)? How they are [different](#)?

Answer:

1.1-5 Come up with a real-world problem in which only the best solution will do. Then come up with one in which a solution that is "approximately" the best is good enough.

Answer:

1.2 Algorithms as a technology

Chapter 2

Getting Started

Chapter 3

Growth of Functions

Chapter 4

Divide-and-conquer

Chapter 5

Probabilistic Analysis and Randomized Algorithms

Part II

Sorting and Order Statistics

Chapter 6

Heapsort

Part III

Data Structures

Part IV

Advanced Design and Analysis Techniques

Part V

Advanced Data Structures

Part VI

Graph Algorithms

Chapter 7

Minimum Spanning Tree

7.1 Notes

- (i) There maybe more than one MST in a forest.
- (ii) The number of all the edges in the MST is equal to $V - 1$.

7.2 Growing a minimum spanning tree

7.2.1 A

A is a subset of some minimum spanning tree.

7.2.2 Safe edge

Safe edge is a edge that add to A and A is also a subset of some minimum spanning tree.

7.2.3 Generic-MST

GENERIC-MST(G, ω)

```
1  $A = \emptyset$ 
2 while A does not form a spanning tree
3   find an edge( $\mu, v$ ) that is safe edge for A
4    $A = A \cup (\mu, v)$ 
5 return A
```

Initialization: After line 1, the set A trivially satisfies the loop invariant.

Maintenance: The loop in lines 2-4 maintains the invariant by adding only safe edges.

Termination: All edges added to A are in a minimum spanning tree, and so the set A returned in line 5 must be a minimum spanning tree.

Part VII

Selected Topics

Part VIII

Appendix: Mathematical Background

