Notes of the Introduction To Algorithms

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Foundations

Chapter 1

The Role of Algorithms in Computing

1.1 Algorithms

Exercies

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 meausres 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

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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 $\boldsymbol{V} - 1$.

7.2 Growing a minimum spanning tree

7.2.1 Definition

A

A is a subset of some minimum spanning tree.

Safe edge

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

7.2.2 Generic-MST

GENERIC-MST(G, ω)
1 A = ∅
2 **while** A does not form a spanning tree
3 find an edge(μ, υ) that is **safe edge** for A
4 A = A ∪ (μ, υ)
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.

7.2.3 Theorem

Let $G = (V, E)$ be a connected, undirected graph with a real-valued weight function ω defined on E. Let A be a subset of E that is inclued in some minimum spanning tree for G, let $(S, V - S)$ be any cut of G that respects A, and let (u, v) be a light edge crossing $(S, V - S)$. Then, edge (u, v) is **safe** for A.

Part VII

Selected Topics

Part VIII

Appendix: Mathematical Background