CLRS Chapter 1 Edition 4 Solutions

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Updated June 13, 2023

Section 1.1

- An ***algorithm*** is any well-defined computational procedure that takes some value, or a set of values, as **input** and produces some value, or set of values, as **output** in a finite amount of time.
- An algorithm is **correct** if, for every problem instance provided as input, it **halts** – finishes its computing in finite time – and outputs the correct solution to the problem instance.
- An incorrect algorithm might not halt at all on some input instances, or it might halt with an incorrect answer. However, incorrect algorithms can sometimes be useful if we can control their error rates.

Exercise 1.1-1

A real-world example that requires...

- Sorting: organizing files in a file system (for example, by name, date created, etc).
- Shortest distance: DoorDash figuring out which restaurants are closest to my house and then routing the driver.

Exercise 1.1-2

Another measure of efficiency might be the amount of resources something takes to complete. It could be space (memory), available workers, or anything of the sort.

Exercise 1.1-3

Arrays: very good when you know you want to iterate over the entire collection or only need to access things by index. Good for insertions towards the end, although really frequent insertions are bad due to the need for resizing. Less good for insertions towards the beginning, or for when you need to access particular entries of the array based on something other than index.

Exercise 1.1-4

One major similarity between the two the idea of minimizing some quantity (distance). However, in the travelling salesperson problem, we are forced to consider many distances between nodes in a graph – and end where we started, whereas the shortest-path problem only requires us to consider the distance between two nodes.

Exercise 1.1-5

A real-world problem where our requirements are satisfied by...

- Only the best solution: an algorithm controlling space shuttle movements.
- An "approximately" best solution: A google search where the result of the query can be good enough for what we need, even if it's not perfect.

Exercise 1.1-6

A real-world example that applies to both of these categories is audio data.

- In some contexts, you may have access to the entire audio file before you need to worry about analyzing it, such as with a YouTube video.
- However, you may also deal with audio data in the context of a live stream, where you may not be able to wait to have the entire file before doing your processing.

Section 1.2

Exercise 1.2-1

Exercise 1.2-2

Exercise 1.2-3