

1.6. Why Study Algorithms?

Computer scientists learn by experience. We learn by seeing others solve problems and by solving problems by ourselves. Being exposed to different problem-solving techniques and seeing how different algorithms are designed helps us to take on the next challenging problem that we are given. By considering a number of different algorithms, we can begin to develop pattern recognition so that the next time a similar problem arises, we are better able to solve it.

Algorithms are often quite different from one another. Consider the example of `sqrt` seen earlier. It is entirely possible that there are many different ways to implement the details to compute the square root function. One algorithm may use many fewer resources than another. One algorithm might take 10 times as long to return the result as the other. We would like to have some way to compare these two solutions. Even though they both work, one is perhaps “better” than the other. We might suggest that one is more efficient or that one simply works faster or uses less memory. As we study algorithms, we can learn analysis techniques that allow us to compare and contrast solutions based solely on their own characteristics, not the characteristics of the program or computer used to implement them.

In the worst case scenario, we may have a problem that is intractable, meaning that there is no algorithm that can solve the problem in a realistic amount of time. It is important to be able to distinguish between those problems that have solutions, those that do not, and those where solutions exist but require too much time or other resources to work reasonably.

There will often be trade-offs that we will need to identify and decide upon. As computer scientists, in addition to our ability to solve problems, we will also need to know and understand solution evaluation techniques. In the end, there are often many ways to solve a problem. Finding a solution and then deciding whether it is a good one are tasks that we will do over and over again.

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