Data Structures Algorithms Computer Programming

Why are data structures and algorithms so important in computer science?

11 Answers

Pratik Singhal, Software Development Engineer at Amazon (2017-present)

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Short Answer :- They are important because, they are what you do after you've become a computer scientist. Without,data structures and algorithms, you will be only a monkey coder.

Long Answer :- As computer scientist, our job is to perform operations on data, we basically perform the following three steps :-

1) Take some input
2) Process it
3) Give back the output.

The input can be in any form, for eg while searching for directions on google maps, you give the starting point and the destination as input to google maps, while logging in to facebook, you give your email and password as input and so on.

Similarly, in the third step, the computer application gives us output in some form or the other.

To make this process efficient, we need to optimize all the three steps. As you can guess, the most we can optimize is the 2nd step, which is where we have Data structures and algorithms.

Data structures refers to the way we organize information on our computer. With a slight thinking , you can guess that the way we organize information can have a lot of impact on the performance. Take for example, a library. Suppose, you want to have a book on Set Theory from a public library, to do that you have to first go to the maths section, then to set theory section. If these books are not organized in this manner and just distributed randomly then it will be really a cumbersome process to find a book on set theory.

This is the way a librarian organizes his books(data) into a particular form (data structure) to efficiently perform a task(find a book on set theory).

In this manner we computer scientist process and look for the best way we can

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Jaimin Patel, Junior Software Developer at Advanced (2017-present)
Answered Jul 28, 2017

It is axiom that data structures and algorithms are base of computer science. It is actual computer science.

Any developer or cs student must have to write code which provides a required output. Algorithms are methods to implement certain task. Algorithm is general word which suggest a process to perform task in sequential manner. Algorithms are developed to perform task more efficiently. If you write code as per your perception and judgement without applying any predefined algorithm, your code will be botched up after certain time. It is because you haven't applied any predefined approach or methodology.

Same thing happens with data structures. Data structures are like hands for algorithms to make recipe. Using combination of data structure and algorithms, we can improve performance of program drastically. For example, you are using any searching algorithm like binary search, then set data structure would be perfect rather than array. The reason is, set is much better for checking whether element is present in specified place or not. This is actually not a quite good example but it can tell you the actual need of data structure in algorithms.

Do you think that what difference would it make if we do not use any algorithm or suitable data structure? The ans is - Assume your task is to perform sorting on array of N elements. First you apply normal selection sort which is pretty easy to perform using two nested for loop. Second you apply Quick sort or merge sort which uses recursion and code is like around 50 lines with to many variables and Hodge podge. Now if the value of N is 100 or 1000, your both algorithm implementation would work perfectly without error or lag. Selection sort is O(N^2) and Merge sort is O(NlogN) so at max number of comparison will be 1M. They will not lag on i5 at all.

important?

What is the importance of data structures?

What are data structures and why do we use them? What is their relationship with algorithms?

What are the best books on algorithms and data structures?

How do I start learning or strengthen my knowledge of data structures and algorithms?

Why do interviewers care so much about algorithm and data structures?

What algorithms and data structures should any software engineer know?

Why should I learn data structures and algorithms?

What are data structures and algorithms?

Is there a book that teaches algorithms, data structures, and other computer science basics in a fun way?

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take few hours to complete. On the other hand, merge sort would require only 10^7 moves which will take around minute (roughly) at max. So this is actual power of algorithms. Array data structure is also perfect for sorting and so that combination of both will make us happy.

We can say that algorithms and data structures are swords for computer science students. As much and efficiently you use them, your future will be bright for sure. I hope you understand why they are such important for us. Keep practicing and never loose hope. Enjoy coding..:)

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Sanket Dialani, Co-founder at GeekyPrep.com,Ex-SDE at Amazon.com, BITS-Pilani CSE 08-12
Answered Dec 19

I will answer this in terms of the importance in computer science as well as in terms of hiring of big tech companies.

The top tech companies are mostly into asking questions based on DSA instead of language/framework/tools specific questions.

Now, you need to first understand the difference between very good tech companies such as Google, Microsoft, Amazon, Facebook etc and other software companies.

How are their engineers different?

What extra thing does it take to get into these for engineering positions?

Why do engineers in these companies get paid higher (and much higher in some countries) as compared to other companies ?

Yes, engineers in these companies and other companies write code as well. The main difference comes in terms of day to day responsibilities and ownership.

In these companies, you own your module completely and you have to come up with the design of the piece of software you will be writing to solve a problem. Coding part is just the implementation and roughly takes 20-30% of the time allotted to a project. Most of the time goes into designing things with the best

focused on algorithms as they want people who can think out of the box to design algorithms which can save the company thousands of dollars.

For example, if you are working at facebook and if you are able to arrive at an optimal solution of a problem(like sorting a list of users from USA) with a time complexity of O(nLogn) instead of O(n^2) and assume that n for the problem here for the company in real life scenario is 100 million(very fair assumption considering the number of users registered on facebook exceeds 1 billion). nLogn would be 800 million, while n^2 would be 10^7 billion. In cost terms, you can see that the efficiency has been improved more than 10^7 times, which could be a humongous savings in terms of server cost and time. You might not realise the efficiency while working on small datasets as a student, but for big data sets in real life scenarios it can create a lot of difference(and savings).

So this is why DSA is so important in computer science as well as in hiring processes of big tech companies.

Paritosh Kulkarni, knows little programming

Answered Jan 5, 2017

Computers are basically tool to solve problems.Problems generally has data to process on to make some decisions. In any real life problem this data would be very large.

So we saw what computers are used for now let's look at computer itself. It has CPU which is brain and it had RAM which is memory or place where temporarily data on which CPU is processing will reside.

Now let's see what kind of problems we have.We have records stored in file and we want to compute next months salary for employee and so on. Now if you compile such problems and try to come up with intersection of this problems we generally come to simple intersection problem how to access this data fast.

Now you remember this data is residing in RAM and you want to access it faster. Please see you are here limited by the power of CPU , Size of RAM , bus bandwidth so you are now left with option to organise your data in RAM such that access to it will be great due to the way you are arranging and organising data in RAM.

Now you start thinking how to organise data optimally so, answer you get is depending on what operations we do frequently. Looking at intersection of operations you generally perform you come to know searching something in data is more frequent operation also you notice that searching could be faster if you again pre organise data in some forms hence you came up with sorting.

Now you define some structures so that this operations of searching and sorting is fast and thus you came up with linked list , stacks and so on....

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