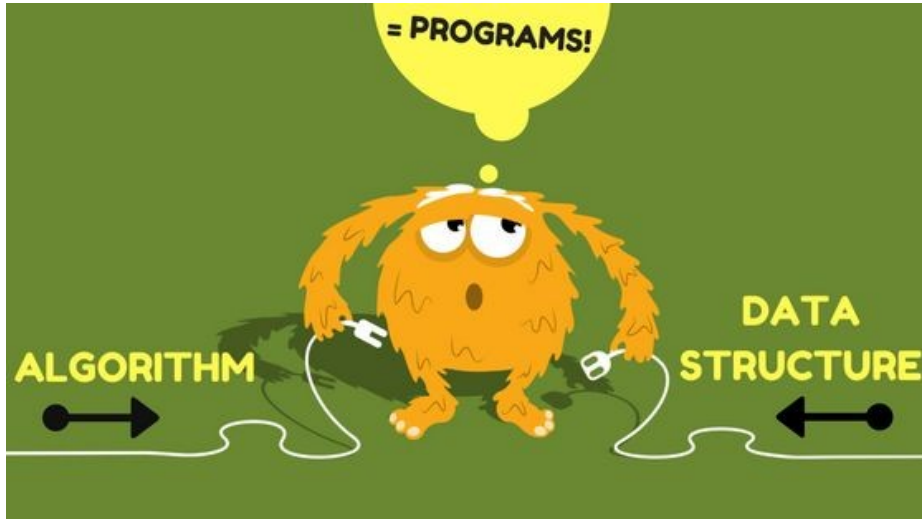


# Data Structures and Algorithms Interview Guide



## Pre-requisite

- (i) Familiarity with College Level DSA and Mathematics.
- (ii) C++ Basics

This Quick book is more about “Understanding Why?”

Author : Yash Pratap

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## **Data Structures and Algorithms from Perspective of Academia, Industry and Competitive Programming.**

(i) In Academia: It is more tilted towards "P vs NP".

People are primarily trying to understand:

a. If we can reduce any given algorithm into P/NP.

b. P/NP classification helps us understand whether we can solve the problem by throwing more computing resources at it with increasing value of input.

If we can't solve the problem, whether we can use some kind of "heuristics" to get things done for all practical purposes or not.

(ii) In Industry: It is more tilted towards "debugging the algorithm."

Companies using DSA as a primary criterion wish to understand:

a. If the candidate can actually understand popular algorithms and debug issues in large codebase.

A bigger company means a bigger codebase, people already know what they are doing, and the market is already identified. So, the primary challenge of a bigger company is maintaining big infrastructure and understanding the leakages, not developing new products or solving new problems.

b. If the candidate can properly communicate the issue to other team members or not.

That's why interviewers focus primarily on the "candidate's ability to explain the algorithm" more than the "candidate's ability to solve very complex algorithms (competitive coding) within a given time."

(iii) In Competitive Programming: It is more tilted towards "optimization of algorithms."

a. Optimization of algorithms beyond a point can't be done in the majority of simple data structures and algorithms.

Usually, these optimizations make more sense in advanced topics like Graphs and Dynamic Programming, and most of the problems in academia and industry don't require solving these problems within a given time period on a frequent basis.

If you can solve difficult recursion and loop problems then solving all important Graph and Dynamic Programming problem isn't a big deal, they are basically recursion on steroids.

b. Doing too much competitive coding mindlessly can be counterproductive because you might develop a habit of skipping the basics, and sometimes the problem lies in the basic algorithm implementations themselves.

## **DSA, Industry and Psychometrics of Algorithm Test.**

Engineers generally avoid writing custom algorithms on frequent basis, they prefer using algorithms implementations done by trusted libraries even in Big Tech Jobs. Algorithms aren't necessarily implemented by libraries in conventional ways, they might be modified according to hardware and language. Testing these algorithms isn't easy.

### **Is DSA good criteria to test competence of an engineer ?**

The answer varies according to the scale of company,

1. Large Scale : Engineers are primarily hired to sustain the infrastructure.

They need people who can understand complex algorithms because the payback of optimization is huge. If Google hire 100 engineers via DSA then at any particular instance of time, they will always get 30 competent engineers who can understand and sustain important things. This is basically a good financial strategy to keep a big tech functioning. Acquisition of a company always makes more sense then development of new products. If you like to build libraries, analyze code and design large scale distributed systems then you'll be a good fit.

Role : Individual Contributor Route (Staff/Principle Engineer) .

2. Mid Scale : Engineers are primarily hired to fulfill business requirements.

They need people who can understand business requirements and convert it into a software. Even in Large Scale companies, almost 80% part of the software (internal tools) doesn't need much optimization. The jobs are similar to jobs in Mid Scale Organization so it might be possible that someone with average understanding of DSA could be found in Leadership/Management Roles due to proficiency in their niche.

Role : Engineering Manager Route (Tech Lead/Engineering Manager)

3. Small Scale : Engineers are primarily hired to develop prototypes and iterate till Product Market Fit. People with Product Skills are better fit. Basic understanding of DSA which doesn't become obstacle in learning is always helpful.

Role (Product) : Product Managers Route ( Product Manager )

Note : If you are looking for bringing concept to reality then you should pursue academia or entrepreneurship not regular software jobs.

### **Psychometrics of Algorithm Test**

IQ Tests are used as a "proxy" for intelligence measurement. IQ tries to measure your ability to learn diverse subjects and ability to use working memory.

IQ test predicts your ability to learn but not the ability to perform.

We can classify candidates based on IQ into 4 ranges

- (i) 80 - 100 => Below Average (40% people)
- (ii) 100 - 120 => Average (40% people)
- (iii) 120 - 140 => Above Average (8% people)
- (iv) 140+ => Higher (0.3% people)

Approximate time ratio to learn totally new abstraction for different IQ people,

Below Average : Average : Above Average : Higher = 8 : 4 : 2 : 1

Candidate's lack of fluency in language of Test can reduce IQ scores of above average person (say 120) into average (say 100). Lack of familiarity with culture / society which conducts the exam might reduce the IQ score further into below average (say 80).

Universities curriculum are designed according to average IQ people.

Lack of good educational resources in native language with similar cultural context can reduce learning speed 2 times for most average students.

It means loss of interest of average IQ students in the subject who are weak with english comprehension and doesn't belong to similar social background as majority of students.

DSA Questions has two major abstractions (i) loops (ii) recursion

It is the place where IQ will hamper your learning abilities the most.

If you have average IQ and you are decent in english then you don't have to worry.

You can even do competitive coding so cracking most algorithm interviews won't be big deal if you practice enough and use the right educational resources.

That's why, we will start with loops and recursion and drill down on it by dry run them with our hands before doing any other thing.

For below average IQ people, you should ask yourself the following question,

Can you give 2X time to DSA than most people ? Is DSA important for your career goal ?

People who are good at DSA get chance to work at Google but only 10% of them reach the position of staff engineer where they actually do algorithms and optimizations.

No one can thrive in the market for long term without identifying their real strengths.

DSA can be very complex but it is less diverse which means role of IQ decrease as you practice. DSA Tests aren't IQ test due to lack of diversity in question, they are skill tests.

School exams can be a reflection of IQ due to the diversity of subjects more than DSA tests or University exams but both are generally inaccurate and biased. That's why psychologists develop separate IQ measurements tests with less bias like WAIS-4.