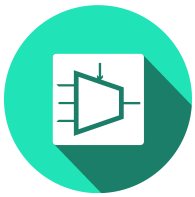

DAT Batch - Last Bytes

Program Name: Demux Autumn (DAT) batch - last bytes

Duration: 4 months, 3 days/week, 2 hours a day

Course: Algorithms, Data-structures, Web-development and System Design

Topics (in the order in which they'll be covered):

Binary Search

1. The Predicate framework
2. Intuitive Search spaces
3. Non-intuitive search spaces
4. Optimization problems on Binary Search

Bit-manipulation

1. Useful techniques of bit manipulation
2. Medium/hard questions

Recursion

1. General framework for solving recursive problems
2. Different types of decisions encountered generally
3. A view of sub-problems
4. Introduction to back-tracking

Backtracking

1. Differences with Recursion
2. Classical questions and patterns involving Backtracking

Sorting

1. Components of Sorting
2. Problems on custom comparator for sorting
3. Comparison based sorting algorithms - Insertion Sort, Bubble Sort and Selection sort
4. Applications of sorting - Handling intervals, duplicate identification, etc.
5. Non-comparison based sorting algorithms - Radix Sort, Count Sort
6. Idea of bucketing and bucket sort
7. Divide and Conquer - basic idea
8. Recursive sorting - Merge Sort, Quick Sort

9. Tweaking Merge Sort to solve problems
10. Idea of pivoting in Quick Sort and applications

Dynamic Programming

1. General Framework for DP
2. 1D DP in O(n)
3. 1D DP in O(n^2)
4. 2D DP in O(n^2)
5. 2D DP in O(n^3)
6. Matrix DP
7. Other types of decisions
8. DP on trees and graphs
9. DP and bitmasking
10. Digit DP

Ordered Search Structures

1. BST as an ordered search structure
2. Introduction to trees, representation and traversal
3. General Patterns involving hard recursive questions on trees

Graphs

1. Representation
2. Traversals
3. Connectivity
4. Cyclicity
5. DAGs
6. Topological Sorting
7. Disjoint Data-structures: Union-find algorithm
8. Tarjan's Algorithm
9. Shortest paths
10. Spanning trees

Unordered Search Structures

1. Concept of Hashing
2. General Patterns in questions involving Hashing
3. An alternate view of subarrays

Ordered Search Structures

1. Need for ordering
2. BSTs - Applications involving ordered search
3. BSTs - Applications involving lower and upper bounds
4. Other applications of BSTs
5. Heaps - Applications involving dynamic priorities
6. Order statistics using Priority Queues
7. General Patterns in questions involving ordered SS

Linked-lists

1. Concept of slow-fast pointers and cycle detection
2. Recursion on Linked lists
3. Intermediate problems on Linked lists

Stacks

1. Uses of stacks - converting a recursive function to iteration
2. Expression evaluation - Infix, Postfix
3. Monotonic stacks and intermediate problems on Stacks

Queues

1. Intermediate problems on Queues
2. Sliding window applications

Data-structure Design

1. Sessions on designing complex data-structures using these fundamental data-structures as building blocks such as LRU Cache, Median from running stream, Min Stack, etc.

Strings

1. Strings in STL
2. Pattern matching - KMP
3. Manacher's algorithm
4. Tries and general patterns involving strings

2 Pointers

1. Index based
2. Window based
3. Slow-fast pointers
4. Other patterns involving 2 pointers

General topics:

1. Algorithmic ideas - Preprocessing
2. Algorithmic ideas - Peeking to the other side
3. Algorithmic ideas - Idea of cumulative statistics like sum, product, max, etc.
4. Handling overflows
5. Introduction to STL
6. Memory layout of C/C++ programs

System Design

1. Web 101 - Network Protocols, Caching, Cookies, Client-Server Architecture
2. Elements of Systems - CAP theorem, load balancing, sharding, etc.
3. Framework Definitions - MVC, Apache, Virtual servers etc.
4. Case studies of frequently encountered systems like Instagram, Netflix, etc.

Object Oriented Programming

1. Basics of OOPS - Classes, Object, Instances, Constructors etc.

2. Abstraction - Abstract Class, Interfaces | Access Modifiers
3. Polymorphism - Data overloading, Data overriding etc
4. Encapsulation, Inheritance, Virtual Functions | Aggregation and Composition etc.

Web-Development (Application)

1. Building a website using a front-end and a back-end framework
2. Front end frameworks involve Angular, Bootstrap, HTML, CSS, JS etc.
3. Backend Frameworks involve Node, MYSQL, PHP etc.

Cloud-Development (Project Deployment)

1. Making your application live over the internet.
2. Version Control - Git/BitBucket
3. AWS - EC2 Server, Security Groups, Load Balancer etc
4. Deploying on AWS - Full functional Website
5. LAMP Configuration, Virtual hosts, Confd config etc.
6. Integration - DNS Config, Domain Name Config

Advanced DS (if needed):

1. Segment Trees
2. Fenwick trees

Assignments and doubt classes
Resume and CV building sessions
Interview experience sessions from Alumni
Weekly hackathons

**** Demux also provides free access to Leetcode Premium and full Educative access accounts to all it's students.**

Frequently Asked Questions (FAQs)

- **Who should ideally join this course?**

This course is ideally for students who wish to pursue a career in the Software Industry and have a basic understanding of the common Data-structures and Algorithms. Students who have zero to low familiarity with Algorithms and data-structures should not take this course but instead opt for the basic course.

- **What are the prerequisites?**

You should have familiarity with one high-level programming language such as C/C++/Java/ Python, etc. Experience with Algorithms and Data-Structures (ideally a formal course in the university) is needed. Also, dedication, coffee and internet!

- **Total program duration and timings?**

Total duration of the program is roughly 16 weeks - 3 days/week, 2 hours a day

Sessions generally take place in the evenings from 8.30 pm to 10.30 although we do take into account the schedule of our students.

- **I have my college going on. Will that cause an issue?**

We are glad that you asked. Not at all. This timeline is designed keeping in mind the above factor. Classes will be strictly restricted to 2 hours on 3 days of the week. They will take place in the evenings roughly from 8.30 pm onwards. We will also have long breaks when students have other commitments (like exams, etc.)

- **What is the mode of classes?**

Classes are live, remote and interactive. We use a virtual whiteboard for explaining concepts and code live on popular editors such as Leetcode, interviewbit, etc. Instructors are provided suitable hardware for facilitating these classes smoothly. The focus of the classes is on solving problems - tonnes of them together with a solid foundation of the theoretical concepts.

- **Do you provide recordings if I miss any class?**

Yes! After every class, recording, reading materials, codes done in the class, homework, etc. are uploaded onto the Slack channel.

- **Do you have doubt solving sessions as well?**

Yes, we have practice problems that we give to students as assignments and have periodic doubt solving sessions on them as well as on the concepts covered in the class. Apart from doubt sessions, we also have weekly hackathons for developing the skill of solving problems in a time-constrained environment.

- **What programming language is used?**

We use C++ in the classes. The concepts discussed are language agnostic, so you are welcome to use any other language of your choice.

- **What is the language of instruction?**

English. Depending on your comfort, we use Hinglish also.

- **Will I get a certificate at the end of the course?**

Yes!. In Fact we offer various certificates like Certificate of Internship, Appreciation and training on the basis of your profile requirement.

- **How much is the fees of this program?**

Since it’s an initiative run by working professionals, we don’t have any specific monetary inclination from students. We just need enough to keep this alive and sustainable.
The first week is FREE. After the first week, we will circulate a transparent form wherein you fill how much you can afford and then we take a call.

- **Does Demux provide placement assistance/Referrals to companies?**

Because of this ongoing pandemic, most of our partner companies have stopped hiring. So we cannot promise anything.

However, we'll be having sessions on LinkedIn and profile building as well as sessions from people who got off-campus success so that you can apply off-campus. Apart from that, Demux Alums have already made it to almost every big company in India and they will keep sharing their company specific experiences intermittently with you.

For more information, you can mail us at info@demux.in or ping your session quality manager once your onboarding starts.

Hope to see you soon,
Team Demux