

Placement Course (Java) | Alpha - Course Syllabus

1. Welcome to Alpha!

- Curriculum
- Alpha Community Update
- Telegram Channel Link

2. Course Introduction

- Path to Placement
- What will you learn?
- Prerequisites

3. Prerequisites - Installation Resources

- What to Install? (on your laptop/computer)
- Installation Resources

4. Flowcharts & Pseudocodes

- What are Flowcharts?
- Flowchart Components
- Sum of 2 Numbers
- Calculate Simple Interest
- Max of 3 Numbers
- Find if a Number is Prime or not
- Sum of first N natural numbers

6. Variables & Data Types

- Creating a Java File
- Boilerplate Code
- Output in Java
- Print a Pattern
- Variables in Java
- Data Types in Java
- Sum of a & b
- Comments in Java
- Input in Java
- Sum of a & b (Input from User)
- Product of a & b

- Area of a Circle
- Type Conversion
- Type Casting
- Type Promotion in Expression
- How does Java code run?

7. Operators

- Types of Operators
- Arithmetic Operators
- Unary Operators
- Relational Operators
- Logical Operators
- Assignment Operators
- Operator Precedence

7. Conditional Statements

- if-else
- Print the largest of 2 numbers
- Print if number is Odd or Even
- else if
- Income Tax Calculator
- Print the largest of 3 numbers
- Ternary Operator
- Check if a student will Pass or Fail
- Switch statement
- Calculator

8. Loops (Flow Control)

- Loops Basics
- while Loop
- Print numbers from 1 to 10
- Print numbers from 1 to n
- Sum of first N natural numbers
- for Loop
- Print Square pattern
- Print reverse of a number
- Reverse the given number
- do-while Loop
- Break statement
- Continue statement
- Check if a number is Prime or not

9. Patterns (Part I)

- Intro to Nested Loops (Star Pattern)
- Inverted Star Pattern
- Half Pyramid Pattern
- Character Pattern
- Looking Forward - Advanced Patterns

10. Functions & Methods

- Introduction to Functions
- Syntax - Function Code Demo
- Syntax with Parameters
- Parameters v/s Arguments
- What happens in memory? (Call Stack)
- Call by Value (in Java)
- Product of a & b
- Find Factorial
- Find Binomial Coefficient
- Inbuilt v/s User defined Methods
- Function Overloading
- Overloading using Parameters
- Overloading using Data Types
- Check if a number is Prime or not
- Check Prime (Optimized)
- Primes in Range
- Binary to Decimal
- Decimal to Binary
- Method Scope
- Block Scope

11. Patterns (Part II) - Advanced

- Hollow Rectangle Pattern
- Inverted & Rotated Half Pyramid
- Inverted Half Pyramid Pattern with Numbers
- Floyd's Triangle Pattern
- 0-1 Triangle Pattern
- Butterfly Pattern
- Solid Rhombus Pattern
- Hollow Rhombus Pattern
- Diamond Pattern

12. Arrays

- Introduction
- Arrays - Creation
- Arrays - Input, Output & Update
- Arrays as Function Arguments
- Space & Time Complexity
- Linear Search
- Largest in Array
- Binary Search
- Reverse an Array
- Pairs in Array
- Print Subarrays
- Max Subarray Sum - I (Brute Force)
- Max Subarray Sum - II (Prefix Sum)
- Max Subarray Sum - III (Kadane's Algorithm)
- Trapping Rainwater
- Best Time to Buy & Sell Stock

13. Basic Sorting Algorithms

- What is sorting?
- Bubble Sort
- Selection Sort
- Insertion Sort
- Inbuilt Sort
- Counting Sort

15. 2D Arrays

- Introduction to 2D Arrays
- Real life examples
- Representation of 2D Arrays
- Creation of 2D Arrays
- 2D Arrays in Memory
- Spiral Matrix
- Diagonal Sum
- Search in Sorted Matrix

16. Strings

- What are Strings?
- Input/Output
- String Length

- String Concatenate
- String charAt Method
- Check if a String is Palindrome
- Shortest Path
- String Functions - compare
- String Functions - substring
- Print Largest String
- Why Strings are Immutable?
- StringBuilder
- Convert Letters to Uppercase
- String Compression

17. Bit Manipulation

- Introduction to Bit Manipulation
- Binary Number System
- Bitwise Operators
- Binary AND, OR, XOR
- Binary 1's Complement
- Binary Left Shift, Right Shift
- Check if Odd or Even
- Get, Set, Clear, Update ith Bit
- Clear last i bits
- Clear range of bits
- Check if a number is power of 2 or not
- Count set bits in a number
- Fast Exponentiation

18. Object Oriented Programming (OOPs)

- Classes & Objects
- Access Modifiers
- Getters & Setters
- Encapsulation
- Constructors (Types of Constructors, Copy Constructor)
- Shallow & Deep Copy
- Destructors
- Inheritance (Single level, Multi level, Hierarchical, Hybrid)
- Polymorphism
- Method Overloading
- Method Overriding
- Packages in Java
- Abstraction
- Abstract Classes

- Interfaces
- Static keyword
- Super keyword

19. Recursion Basics

- What is Recursion?
- Print numbers in decreasing order
- Stack overflow
- Print numbers in increasing order
- Find Factorial of N
- Print sum of N natural numbers
- Print Nth Fibonacci number
- Check if array is sorted or not
- First Occurrence / Last Occurrence
- Print x to the power n
- Tiling Problem
- Remove Duplicates in a String
- Friends Pairing Problem
- Binary Strings Problem

20. Divide & Conquer

- What is Divide & Conquer?
- Merge Sort (Basic + Space Optimized)
- Quick Sort
- Worst Case in Quick Sort
- Sorted & Rotated Array Search

21. Time & Space Complexity

- Introduction
- What is Time Complexity?
- Constant Time Complexity
- Big O Notation
- Big Omega & Theta Notation
- Common Complexities
- Space Complexity
- Simple Loop Analysis
- Nested Loop Analysis (1, 2, 3)
- Bubble Sort Analysis
- Binary Search Analysis
- Recursive Complexity Analysis (Factorial)
- Sum of N numbers Analysis

- Fibonacci Analysis
- Merge Sort Analysis
- Power Function Analysis (I, II, III)

22. Backtracking

- Introduction
- Types of Backtracking
- Backtracking on Arrays
- Find Subsets
- Find Permutations
- N Queens - all ways, count ways, print one solution
- Grid Ways
- Sudoku

23. ArrayLists

- Introduction to ArrayList
- Operations on ArrayList
- Size of ArrayList
- Print Reverse
- Find Maximum
- Swap 2 Numbers
- Sorting an ArrayList
- Multi-dimensional ArrayLists
- Container with Most Water (Brute Force & 2 Pointer Approach)
- Pair Sum - 1 & 2

24. Linked Lists (Part 1)

- Introduction to Linked List
- Head & Tail in LL
- Add First / Add Last / Add in the Middle
- Print a LL / Size of a LL
- Remove First / Remove Last
- Iterative Search / Recursive Search
- Reverse a Linked List
- Find and Remove Nth Node from End
- Check if LL is Palindrome

25. Linked Lists (Part 2)

- Detecting Cycle in LL
- Removing Cycle in LL
- Java Collections Framework

- LL in Collections Framework
- Merge Sort on LL
- Zig Zag Linked List
- Doubly LL
- Reverse a Doubly LL
- Circular LL

26. Stacks

- Stack Introduction
- Stack using ArrayList
- Stack using Linked List
- Stack using Collections Framework
- Push at Bottom of Stack
- Reverse a String using a Stack
- Reverse a Stack
- Stock Span Problem
- Next greater element
- Valid Parentheses
- Duplicate Parentheses
- Maximum Rectangular Area in Histogram

27. Queues

- Introduction to Queues
- Queues using Arrays
- Circular Queue using Arrays
- Queue using LL
- Queue using JCF
- Queue using Two Stacks
- Stack using 2 Queues
- First Non-Repeating Letter
- Interleave two halves of a Queue
- Queue Reversal
- Deque (Double Ended Queue)
- Deque in JCF
- Implement Stack using Deque
- Implement Queue using Deque

28. Greedy Algorithms

- Introduction to Greedy
- Activity Selection
- Fractional Knapsack

- Minimum Sum absolute difference pairs
- Maximum length chain of pairs
- Indian Coins
- Job Sequencing Problem
- Chocola Problem

29. Binary Trees (Part 1)

- Introduction to Binary Trees
- Levels & Sub-trees in a Tree
- Build Tree Preorder
- Preorder, Inorder, Postorder Traversal
- Level order Traversal
- Height of a Tree
- Count Nodes of a Tree
- Sum of Nodes
- Diameter of a Tree (Approaches 1 & 2)

30. Binary Trees (Part 2)

- Subtree of another tree
- Top View of a Tree

31. Binary Trees (Part 3)

- Kth Level
- Lowest Common Ancestor (Approaches 1 & 2)
- Minimum Distance between 2 Nodes
- Kth ancestor of Node
- Transform to Sum Tree

32. Binary Search Trees (Part 1)

- Introduction
- Concept of Search in BST
- Build a BST
- Search in a BST
- Delete a Node
- Print in Range
- Root to Leaf Path
- Validate BST
- Mirror a BST

33. Binary Search Trees (Part 2)

- Sorted Array to Balanced BST
- Convert BST to Balanced BST
- Size of Largest BST in BT
- Merge 2 BSTs
- AVL Trees
- Red Black Trees

34. Heaps

- Introduction to Priority Queues
- PQ in JCF
- PQ for Objects
- Introduction to Heaps
- Heap Implementation (using CBT)
- Insert in Heap
- Peek / Remove from Heap
- Heap Sort
- Nearby Cars
- Connect N Ropes with Minimum Cost
- Weakest Soldier
- Sliding Window Maximum

35. Hashing

- Hashing Introduction
- HashMap (Operations, Iteration, Implementation)
- LinkedHashMap
- TreeMap
- Majority Element
- Valid Anagram
- HashSet (Iteration)
- LinkedHashSet
- TreeSet
- Count Distinct Elements
- Union & Intersection
- Find Itinerary for Tickets
- Largest Subarray with Sum 0
- Subarray Sum Equal to K

36. Tries

- Tries Introduction
- What is a Trie?
- Creating a Trie

- Insertion
- Searching
- Word Break Problem
- Prefix Problem

37. Graphs (Part 1)

- Introduction to Graphs
- Types of Graphs (Based on Edge)
- Graph Representations
- Graph Applications
- Creating a Graph (Adjacency List)
- BFS (Breadth First Search)
- DFS (Depth First Search)
- Has Path? (using DFS)

38. Graphs (Part 2)

- Connected Components
- Cycle in Graphs
- Cycle Detection (Undirected Graph) - DFS
- Bipartite Graph
- Cycle Detection (Directed graph) - DFS
- Topological Sorting (using DFS)

39. Graphs (Part 3)

- Topological Sort using BFS (Kahn's Algorithm)
- All Paths from Source to Target
- Dijkstra's Algorithm

40. Graphs (Part 4)

- Bellman Ford Algorithm
- What is MST?
- Prim's Algorithm

41. Graph (Part 5)

- Cheapest Flights within K Stops
- Connecting Cities
- Disjoint Set Union
- Kruskal's Algorithm
- Flood Fill Algorithm

42. Graphs - Supplemental

- Strongly Connected Components (Kosaraju's Algorithm)
- Bridge in Graph (Tarjan's Algorithm)
- Articulation Point (Tarjan's Algorithm)

42. DP (Part 1)

- Introduction to DP
- What is DP? (Definition)
- Ways of DP
- 7 Important Concepts
- Climbing Stairs (Recursion, Memoization DP, Tabulation DP)
- Climbing Stairs Variation

43. DP (Part 2)

- Types of Knapsack problems
- 0-1 Knapsack (Recursion, Memoization, Tabulation)
- Target Sum Subset (Tabulation)
- Unbounded Knapsack (Tabulation)

44. DP (Part 3)

- Coin Change
- Rod Cutting
- Longest Common Subsequence (Recursion, Memoization, Tabulation)

45. DP (Part 4)

- Longest Common Substring
- Longest Increasing Subsequence
- Edit Distance
- String Conversion

46. DP (Part 5)

- Wildcard Matching
- Catalan's Number (Recursion + Memoization, Tabulation)
- Count BSTs
- Mountain Ranges

47. DP (Part 6)

- Basics of Matrices (Math)
- Matrix Chain Multiplication (Recursion, Memoization, Tabulation)

- Minimum Partitioning
- Minimum Array Jumps

49. Segment Trees

- Segment Trees Introduction
- Count & Meaning of Nodes
- Creation of ST
- Queries on ST
- Update on ST
- Max/Min Segment Tree (Creation & Query/Update)