Data Structures

Question Bank for FA-1 (Unit 1 and Unit 2)

1. Explain how you would detect a cycle in a singly linked list. Write the algorithm for cycle detection.
2. Describe how you would remove duplicate elements from a singly linked list.
3. Write a function to partition a singly linked list around a value x, such that all nodes less than x come before nodes greater than or equal to x.
4. You are given an integer array score of size n, where score[i] is the score of the ith athlete in a competition. All the scores are guaranteed to be unique. The athletes are placed based on their scores, where the 1st place athlete has the highest score, the 2nd place athlete has the 2nd highest score, and so on. The placement of each athlete determines their rank: The 1st place athlete's rank is "Gold Medal". The 2nd place athlete's rank is "Silver Medal". The 3rd place athlete's rank is "Bronze Medal". For the 4th place to the nth place athlete, their rank is their placement number (i.e., the xth place athlete's rank is "x").
5. Given the array [22, 7, 2, 19, 10,18,15,13] and using the gap sequence [3, 1], show the sorting process with Shell Sort.
6. Write a function for a given array of integers nums, sort the array in increasing order based on the frequency of the values. If multiple values have the same frequency, sort them in decreasing order. Return the sorted array.
    a. Eg. Input: [25,7,1,1,5,7,1,10,7]
    b. Output:[5,10,25,7,1]
7. Given two strings a and b consisting of lowercase characters. The task is to check whether two given strings are an anagram of each other or not. An anagram of a string is another string that contains the same characters, only the order of characters can be different. For example, act and tac are an anagram of each other. Strings a and b can only contain lower case alphabets.
8. Given an array of integers nums, sort the array in increasing order based on the frequency of the values. If multiple values have the same frequency, sort them in decreasing order. Return the sorted array.
9. Given an integer array nums, return the third distinct maximum number in this array. If the third maximum does not exist, return the maximum number.
10. A professor went to a party. Being an erudite person, he classified the party into two categories. He proposed that if all the persons in the party are wearing different colored robes, then that is a girl's only party. If we even get one duplicate color, it must be a boy's party. The colors of the robes are represented by positive integers. InputThe first line of each test case contains an integer T, denoting the no of test cases. Then T test cases

follow. The first line of each test case contains an integer N denoting the number of people in the party. In the next line are N space separated values of Ai denoting the color of the robes.Write the function for the above test case. OutputFor each test case, print "BOYS" without quotes if it's a boy's party, else print "GIRLS"

11. Write a function to merge two sorted doubly linked lists.
12. Imagine a scenario of a lucky draw event and have a list of participants represented as a singly linked list. Write a function that retrieves the N-th participant from the end of the linked list, where N is a 1-based index. If N is greater than the number of participants or if the list is empty, the function should return None. ('N' will be taken from user)
13. Suppose, you are developing a contact management system that stores contacts in a linked list. Each contact entry in the list includes details such as name, phone number, and email address, and each contact node points to the next contact in the list. Find the total number of contacts in your list using a recursive method.
14. Write a function to search & remove duplicate entries from singly circular LL.
15. Write a function to detect loop or cycle in a singly linked list
16. You have a music playlist represented as a singly linked list. Each node in the linked list represents a song (title, artist, duration). Write a recursive function to find out whether a particular song is present in the playlist.
17. You are given a singly linked list where each node contains the following information: `data` (an integer representing the value of the node) `next` (a reference to the next node in the list) Your task is to write a function that retrieves the value of the N-th node in the linked list. If N is greater than the length of the list or if the list is empty, the function should handle these cases appropriately.
18. You are organizing a lucky draw event and have a list of participants represented as a singly linked list. Each node in the linked list contains: `name` (a string representing the participant's name) `next` (a reference to the next node in the list) Your task is to write a function that retrieves the N-th participant from the linked list, where N is a 1-based index. If N is greater than the number of participants or if the list is empty, the function should return None.
19. Given a singly linked list, write a function to find the middle element of the list.
20. Write a function to swap nodes in a doubly linked list ***without swapping data.***
21. Print the middle of a given linked list without counting the total number of nodes
22. Write a function that counts the number of times a given int occurs in a Linked List
23. Detect loop in a linked list
24. Find length of loop in linked list
25. Function to check if a singly linked list is palindrome
26. Remove duplicates from a sorted linked list
27. Given a doubly linked list, write a function to detect if the list is a palindrome.
28. Write a function to organize a music playlist using a linked list structure, where each song is categorized based on its play count. Create **two separate lists**: one for songs with an

even number of plays and another for songs with an **odd** number of plays. Ensure that the system preserves the original order of songs within each list.

29. Remove duplicates from an unsorted linked list
30. Swap nodes in a linked list without swapping data
31. Pairwise swap elements of a given linked list
32. Move last element to front of a given Linked List
33. Intersection of two Sorted Linked Lists
34. Intersection point of two Linked Lists.
35. Segregate even and odd nodes in a Linked List
36. For the given array [22, 7, 2, 19, 10,18,15,13] and using the middle element as the pivot, show the sorting process with Quick Sort.
37. For the given array [22, 7, 2, 19, 10,18,15,13] and using the Last element as the pivot, show the sorting process with Quick Sort.
38. Given an integer array nums, move all the even integers at the beginning of the array followed by all the odd integers. Input: nums = [3,1,2,4] Output: [2,4,3,1] or [4,2,3,1], [2,4,1,3], and [4,2,1,3]
39. Given an array nums with n objects colored red, white, or blue, sort them in-place so that objects of the same color are adjacent, with the colors in the order red, white, and blue. We will use the integers 0, 1, and 2 to represent the color red, white, and blue, respectively. Write the function for the above test case.
40. Given an array of 10,000 integers, which sorting algorithm would you choose among Insertion Sort, Shell Sort, Radix Sort, Quick Sort, and Merge Sort to achieve the best performance and why?
41. Sort the following array using Quick Sort and describe the partitioning process:
    Array: [9, 7, 5, 11, 12, 2, 14, 3, 10, 6]
42. Given the array [3, 6, 8, 10, 1, 2, 1], sort it using Quick Sort with the last element as the pivot.
43. Given the array nums, for each nums[i] find out how many numbers in the array are smaller than it. If the Input is: nums = [8,1,2,2,3] then the Output will be: [4,0,1,1,3].
44. Given an integer array nums, move all the even integers at the beginning of the array followed by all the odd integers.
45. Given an array of 2n integers, your task is to group these integers into n pairs of integer, say (a1, b1), (a2, b2), ..., (an, bn) which makes sum of min(ai, bi) for all i from 1 to n as large as possible.
46. Given an integer array nums, return true if any value appears at least twice in the array, and return false if every element is distinct.
47. Given an array nums containing n distinct numbers in the range [0, n], return the only number in the range that is missing from the array.

48. You are given an integer array score of size n, where score[i] is the score of the ith athlete in a competition. All the scores are guaranteed to be unique. The athletes are placed based on their scores, where the 1st place athlete has the highest score, the 2nd place athlete has the 2nd highest score, and so on. The placement of each athlete determines their rank: The 1st place athlete's rank is "Gold Medal". The 2nd place athlete's rank is "Silver Medal". The 3rd place athlete's rank is "Bronze Medal". For the 4th place to the nth place athlete, their rank is their placement number (i.e., the xth place athlete's rank is "x").Return an array answer of size n where answer[i] is the rank of the ith athlete.
49. A library needs to manage its book catalog efficiently. Books should be sorted by their titles in alphabetical order to make it easier for librarians and patrons to locate them.
50. An e-commerce website needs to display products in various sorted orders, such as by price, customer ratings, or newest arrivals. The sorting feature must be fast and responsive to user selections.
51. A company has a list of job tasks that need to be scheduled based on their deadlines. Each task has a start time, end time, and priority. The goal is to sort tasks in such a way that the most urgent and high-priority tasks are handled first.
52. A school needs to sort students' grades to determine rankings for awards and honor rolls. The system should sort students by their average grades and, in case of ties, by their names.
53. An event management system needs to sort a list of scheduled events by their start times to create a daily agenda. The system must ensure that events are ordered correctly and efficiently.
54. A contact management app needs to sort contacts by names, phone numbers, or email addresses. Users should be able to quickly locate contacts based on these fields.
55. A hospital's patient management system needs to sort patient records by various criteria, such as appointment date, urgency level, and patient names.
56. A supply chain system needs to sort inventory items based on various attributes, such as stock levels, reorder dates, and item categories.
57. A sports tournament needs to rank teams based on their performance metrics, such as win-loss records, points scored, and point differentials
58. A flight booking system needs to sort available flights by departure times, arrival times, and prices for users searching for flights.