Questions- Group 1

Arrays:

1. Find the element that appears once in a sorted array where all other elements appear twice one after another. Find that element in 0(logn) complexity.

```
Input:   arr[] = {1, 1, 3, 3, 4, 5, 5, 7, 7, 8, 8}
Output:  4
```

2. A magic index in an array A[0...n-1] is defined to be an index such that A[i] = i. Given a sorted array of distinct integers, write a method to find a magic index if one exists, in an array A. FOLLOW UP: What if the values are not distinct?
3. Given a sorted array of n integers that has been rotated an unknown number of times, write code to find an element in the array. You may assume that the array was originally sorted in increasing order.
4. Given an array that contains numbers from 1 to n-1 and exactly 1 duplicate, find that duplicate.
5. Search an element in an array where difference between adjacent elements is 1.
   For example: arr[] = {8, 7, 6, 7, 6, 5, 4, 3, 2, 3, 4, 3}
   Search for 3 and Output: Found at index 7
6. Given an array of numbers, split the array into two where one array contains the sum of n-1 numbers and the other array with all the n-1 elements.

Stack:

7. Find missing parenthesis in a given expression – 2 * (3 + 5(sasdfasdfasd)
8. Evaluate an expression given only single digits and only 2 operators * and +.
9. Reverse a stack and put the reversed value back in the same stack. You can use only one other stack and a temp variable.

Strings:

1. Implement an algorithm to determine if a string has all unique characters. What if you cannot use additional data structures?
2. Given two strings, write a method to decide if one is a permutation of the other?
3. Write a method to replace all spaces in a string with '%20'.
4. Implement a method to perform a basic string compression using the counts of repeated characters. For example, the string aabccccaaa would become a2b1c4a3. If the compressed string would not become smaller than the original string, your method should return the original string.
5. Write an algorithm such that if an element in an MxN matrix is 0, its entire row and column are set to 0.

6. Given two sequences, print longest common subsequence
   LCS for input Sequences "ABCDGH" and "AEDFHR" is "ADH" of length 3.
   LCS for input Sequences "AGGTAB" and "GXTXAYB" is "GTAB" of length 4.

7. Given two string str1 and str2, find the shortest string that has both str1 and str2 as subsequences.
   Examples:
   Input: str1 = "geek", str2="eke"
   Output: "geeke"

   Input: str1 = "AGGTAB", str2="GXTXAYB"
   Output: "AGXGTXAYB"

8. Remove spaces from a given string in O(n) running time and only one traversal of a string.
   Input: "I   love   ice   cream"
   Output: "Iloveicecream"

9. Find all distinct palindromic sub-strings of a given string

```
Input: str = "abaaa"

Output:  Below are 5 palindrome sub-strings

a

aa

aaa

aba

b
```

10. Given a string "This is a string" reverse its characters "gnirts a si siht"
11. Given a string "This is a string" reverse the characters in every word "siht si a gnirts"

Linked lists:

12. Write an algorithm to determine if a linkedlist is a palindrome
13. Write an algorithm to determine if a linkedlist is circular. FOLLOW UP: Determine where the circle meets.
14. Clone a linked list with a random pointer.
15. Write code to remove duplicates from an unsorted linked list. Follow up: How would you solve it if temporary buffer is not allowed?
16. Implement an algorithm to find the kth to the last element of a singly linked list
17. Implement an algorithm to delete a node a singly linked list, given only access to that node.
18. Write code to partition a linkedlist around a value x, such that all nodes less than x come before all nodes great than or equal to x.
19. Reverse a linked list – iteratively and recursively
20. Given a singly linked list which has data sorted in ascending order, construct a balanced BST.

Trees:

21. Given a BST, create a linkedlist of all the nodes at each depth
22. Convert a BST into a doubly linkedlist.
23. Determine if a binary tree is balanced
24. Given a sorted array, create a binary search tree with minimal height
25. Implement a function to check if a binary tree is a BST
26. Write an algorithm to find the next node (i.e in-order successor) of a given node in a binary search tree. You may assume that each node has a link to its parent
27. Design an algorithm and write code to find the first common ancestor of two nodes in a binary tree. Avoid storing additional nodes in a data structure. NOTE: This is not necessarily a BST
28. You have 2 very large binary trees: T1 with millions of nodes, and T2 with hundreds of nodes. Create an algorithm to decide if T2 is a subtree of T1. A tree T2 is a subtree of T1 if there exists a node n in T1 such that the subtree of n is identical to T2. That is, if you cut off the tree at node n, the two trees would be identical.
29. You are given a binary tree in which each node contains a value. Design an algorithm to print all paths which sum to a given value. Note that a path can start or end anywhere in the tree.

Graph:

30. Determine if a path exists from a source node to a destination node
31. Print all paths from a given source to a destination

Recursion and Dynamic programming:

32. Write an algorithm to print all ways of arranging eight queens on an 8x8 chess board so that none of them share the same row, column or diagonal. In this case, "diagonal" means all diagonals, not just the two that bisect the board.

Bit manipulation:

1. Given an array that contains numbers from 1 to n-1 and exactly 1 duplicate, find that duplicate using bit operations.
2. Find the number of on(1) bits in a given number. For example, numbr 5 has 2 bits that are 1. Number 7 has 3 bits that are on.
3. Subtract two numbers without using arithmetic operators
4. How to turn off a particular bit in a number?
5. Swap two nibbles in a byte.
6. Swap all odd and even bits.
7. Binary representation of a given number
8. Given an array where every element occurs three times, except one element which occurs only once. Find the element that occurs once. Expected time complexity is O(n) and O(1) extra space. Examples:

   Input: arr[] = {12, 1, 12, 3, 12, 1, 1, 2, 3, 3}

   Output: 2

Other:

33. Given any integer, print an English phrase that describes the integer (e.g., "One Thousand, Two Hundred Thirty Four")
34. How to determine if a number is a power of 2.
35. Find a specific row and a column value in a Pascal's triangle.

Questions from students:

36. question about traversing a 2d array with recursion ?
37. replace a char in a string with another string. ?
38. Was asked how to delete a node in a binary search tree. He wanted an efficient algorithm to perform this.
39. Write a method which checks a string for unbalanced parenthesis (i.e. one too many opening or closing parenthesis) and returns a boolean value
40. Find the max sum of consecutive integers in an array.
41. Give program to count word frequency and take into account special characters
42. You are given an array of integers. If an index contains a positive number x, move forward x steps. If it contains a negative number y, move backward y steps. Determine if there is a loop in this array.
43. Given two sorted lists, write a function that merges them and then sorts them.
44. 3 baskets of fruits, mislabeled, you can only reach in to one and take a fruit, label all baskets
45. Write code that efficiently and thoroughly shuffles a deck of cards.
46. write a program that takes row and column numbers and return excel-formatted cell name
47. Open a file and read the first 1000 characters
48. Write the shunting yard algorithm without a stack
49. Give a array, depart negative and positive number.
50. Implement a function that insert a node into a doubly linked list
51. Turn a tree into a doubly linked list
52. Determine if a singly linked list is a palindrome.
53. Given a string, find the largest palindrome substring.
54. Given a char array, reverse each space delimited word in place using 3 pointers and a temporary character.
55. They asked me about one of my hackathons. Given two sorted arrays, merge them into one sorted array.
56. Find a pair of numbers from an array of number that sum of them equals to a given number.
57. Given a linked list, which has an extra pointer that points to a random node in the list
58. Your task is to copy the original linked list into a new one while preserving the list relation and the random pointer relations
59. consider a singly linked list, how to return the data stored at the last but fifth point
60. create a collection of permutations of   a list of integers.
61. How would you find the median in a sorted circularly linked list given a random node
62. An sorted array is shifted. How to detect how much it has been shifted

63. Explain recursion to a 6 year old. Explain a project you've been working on. Brain Teaser: There are three baskets. In one basket there are oranges, in the other there are apples, and in the last there are both apples and oranges. However, all of these baskets are covered (can't see inside) and all of the baskets are labeled incorrectly. You can take one item out of one basket.
64. implementing stable array sorting algorithm. It was supposed to use O(n) time and constant space
65. Given a singly linked list, remove duplicates
66. Given a file system, how will you find and delete a duplicate file?
67. Parse string to int
68. Give you an array, find the two numbers that are closest to each other. Return the smallest pair if there are more than one solutions
69. Find the prime numbers in a given range?
70. Find the anagram meanings of a given string from a dictionary
71. Given two sorted lists, you had to find a solution that would merge the two in O(n) time.
72. Design the part of a (digital) product that will be released worldwide.
73. How to store huge number of strings.
74. How would you design an alarm clock for a blind person
75. Solution was is it possible to find if two strings anagrams by doing xor operation between them ?
76. Design a popup modal for people from different cultures
77. Given 9 marbles that look the same but one weights slightly more, and a scale you can only use twice, how can you find out which marble is the heavier one
78. Given an array of customer ids, find out if a costumer called more than once. No data structures, other than arrays
79. Explain recursion to a child.
80. Draw a S-R Latch and write truth table
81. Please implement an inquery and and outquery using an array using fifo.
82. You are given a linked list. They asked you to find a way to see if you have been over a certain node of the linked list.
83. Write a function to return words in a string.
84. Implement a queue
85. Given a string with characters and brackets, return true if the brackets are balanced
86. Design a remote control for Children
87. Given a string, say the most repeated letter in the string
88. What is a loop
89. Fill an integer matrix in a spiral fashion. Starting in the upper left corner and going clock-wise, the next element should be one more than the previous.
90. What process would you go through to debug a keyboard?
91. given a singly linked list, how to reverse direction
92. Given a number and a length, output to the console the "calculator" display of this number. i.e. display the number with _ and | characters
93. Given an arrays of length x and 2x, with the array of 2x containing only x integers, move the former array into the larger one and sort.
94. assign numbers to an nxn matrix (n is odd) in a clockwise manner

95. Write a function that returns the number of coins needed to make change for any given input value
96. Find the angle between the hour, minute, and second hand on a clock at any given time.
97. and implement two simple functions enqueue and dequeue
98. How does a rotary buffer work?
99. Given the two coordinates of opposite corners of two rectangles, are they intersecting
100. Write a function that find in an array the contiguous sequence of integers having the largest sum
101. How would you sort a 100Gb file with 1Gb of RAM?
102. How would you determine the temperature if you are locked in a room without windows.
103. 15 tile problem, 4*4 grid which has 15 tiles numbered 1 to 15 and given in shuffled order. I was asked to provide an algorithm to to arrange the tiles.
104. Having 5 columns of data in a flat file where an application would query on any of the five columns or in combination, the records are in millions, how would you design the structure to hold data and retrieve the data.
105. There's an m x n array. A block in the array is denoted by a 1 and a 0 indicates no block. You are supposed to find the number of objects in the array. A object is nothing but a set of blocks that are connected horizontally and/or vertically.
106. remove duplicates from single circular linked list
107. Design a parking meter.
108. Reverse individual words in a string
109. Name four ways in which you could improve Bing search results
110. Implement a simple compression algorithm where repeated letters in a string are represented by a count and the letter. Example: AAACBBD =
111. If you have two circles on a Cartesian plane and are given only their radii and the location of their center points on the plane, how can you tell if they overlap?
112. Write a program the determines if a word is a palindrome
113. design a calculator
114. How would you design/implement a hash table
115. Design a remote control as if they didn't exist yet
116. You are given an array with a null value on each end of the array. The array is populated with a random string (for instance "aabbca"). You must integrate through the array from each end and count the number of specific characters in the array
117. How do you quickly compute a knight's tour on a chessboard?
118. Given a string which can include special characters like phrase,sentence stoppers, reverse individual words in that sting.