

MODEL QUESTION ON DATA STRUCTURES

1. Choose the correct alternatives of the following:
- i) The time complexity of Merge Sort is
 - a) $O(n^2)$
 - b) $O(n)$
 - c) $O(n \log n)$
 - d) $O(\log n)$
 - ii) The fastest sorting algorithm for an almost already sorted array is
 - a) Insertion Sort
 - b) Selection Sort
 - c) Merge sort
 - d) Quick sort
 - iii) To implement recursion, we require
 - a) Stack
 - b) Queue
 - c) Both (a) & (b)
 - d) None of these
 - iv) Sparse matrix is
 - a) All 0 element matrix
 - b) A unit matrix
 - c) Mostly 0 element matrix
 - d) A few 0 element matrix
 - v) The vertex of degree 1 is called
 - a) isolated vertex
 - b) pendent vertex
 - c) null vertex
 - d) none of these
 - vi) The Postfix expression for the Infix expression $a * (b + c) / e - f$ is
 - a) $a b c + * e / f -$
 - b) $a b c + e / f - *$
 - c) $a b c + e / * f -$
 - d) None of these
 - vii) Queue can be used to implement
 - a) Radix sort
 - b) Quicksort
 - c) Recursion
 - d) Depth First Search
 - viii) Linked lists are not suitable for implementing
 - a) Insertion sort
 - b) Binary search
 - c) Radix sort
 - d) Polynomial manipulation
 - ix) Number of nodes in a complete binary tree of depth k is
 - a) 2^k
 - b) $2k$
 - c) $2k-1$
 - d) None of these
 - x) Which of the following need not be a binary tree.
 - a) Search tree
 - b) Heap
 - c) AVL tree
 - d) B-tree

- xi) Quick sort uses
- Divide and Conquer strategy
 - Backtracking approach
 - Heuristic Search
 - Greedy approach
- xii) A binary tree T has n leaf nodes. The no. of nodes of degree 2 in T is
- $\log_2 n$
 - n-1
 - n
 - 2^n
- xiii) Which of the following is the best time for an algorithm?
- $O(n)$
 - $O(\log_2 n)$
 - $O(2^n)$
 - $O(n \log_2 n)$
- xiv) Any connected graph with x vertices must have at least
- x+1 edges
 - x-1 edges
 - x edges
 - x/2 edges
- xv) A full binary tree with n leaves contains
- n nodes
 - $\log n$ nodes
 - $2n-1$ nodes
 - 2^n node
- xvi)traversal of binary search tree gives the sorted list in ascending order.
- In-order
 - Post-order
 - Pre-order
 - All of these
- xvii) Reverse polish notation is also called
- Postfix
 - Prefix
 - Infix
 - Undefined
- xviii) The evaluation of the postfix expression 23 5 7 * - 12 + is
- 12
 - 0
 - 12
 - 35
- xix) The following sequence of operations is performed on a stack: push(1), push(2), pop, push(1), push(2), pop, pop, pop, push(2), pop.
The sequence of popped out values are
- 2, 2, 1, 1, 2
 - 2, 2, 1, 2, 2
 - 2, 1, 2, 2, 1
 - 2, 1, 2, 2, 2
- xx) The number of nodes in a complete binary tree of level 5 is
- 15
 - 25
 - 63
 - 71
- xxi) Which of the following statements is false?
- Every tree is a bipartite graph.
 - A tree contains a cycle
 - A tree with n nodes contains n-1 edges.
 - A tree is a connected graph.
- xxii) The goal of hashing is to produce a search that takes
- $O(1)$ time
 - $O(n)$ time
 - $O(\log n)$ time
 - $O(n \log n)$ time
- xxiii) Which of the following is useful in implementing Quick sort?
- Stack
 - Set
 - List
 - Queue

- xxiv) A graph in which all nodes are equal degree is known as
- | | |
|------------------|----------------------|
| a) Multi graph | b) Non regular graph |
| c) Regular graph | d) Complete graph |

2. Explain the principle operation of quick sort with a suitable example. What is the best case complexity of insertion sort?
3. Explain the types of Deque with suitable example. What are the advantages and disadvantages of linked list over the array?
4. Write an algorithm for recursive binary search.
5. What is hashing? Why is it used? Explain the chaining method of collision resolution in hashing.
6. Convert the following:
 - i) $A + ((B - C) * (D - E) + F) / G) * (H - I)$ [POSTFIX]
 - ii) $A B C - / D E F + * +$ [PREFIX]
 - iii) $(a + b) * c - (d - e) / (f + g)$ [POSTFIX]
7. Construct a B-tree of order 3 with the following data.
50, 40, 60, 30, 70, 20, 80, 10, 90, 9, 99
8. Construct a B-Tree of order 5 with the following data:
Data: 10, 70, 60, 20, 110, 40, 80, 130, 100, 50, 190, 90, 180, 240, 30, 120, 140, 160.
9. Insert the following keys into a B-Tree of given order mentioned below.
a, f, b, k, h, m, e, s, r, c (Order 3)
a, g, f, b, k, d, h, m, j, e, s, i, r, x, c, l, n, t, u, p (Order 5)
10. Write an algorithm to delete a node at a given location from a doubly linked list.
11. Define circular queue. Write an algorithm to insert an item in circular queue.
12. What is complete graph? What is dequeue?
13. What is expression tree? Draw the expression tree for the given expression.
 $E = (2x + y)(5a - b)^3$
14. Let the size of the elements stored in an 8 x 3 matrix be 4 bytes each. If the base address of the matrix is 3500, then find the address of A [5, 2] for both row major & column major cases.
15. a) Explain with a suitable example the principle of operation of Merge Sort algorithm.
b) Construct a Binary Search Tree and Heap Tree from the following information
14 15 4 9 7 18 3 5 16 20 17

- c) What is a single linked list? What are the advantages and disadvantages of single linked list. What are the advantages of linked list over an array?
16. What is stack? Write the push and pop operations of stack.
17. Represent the following polynomial by a linked data structure

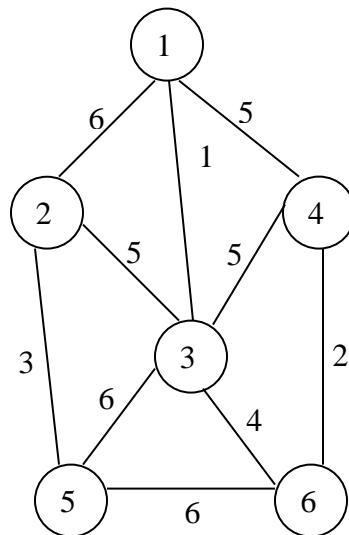
$$5x^5 + 4x^4 - 25x^3 + 10$$
18. a) Write a C program to insert new nodes to a binary search tree
 b) Write a C program to implement circular queue using array.
 c) Why we use circular queue instead of linear queue.
19. a) Write an algorithm to add two polynomials using linked list.
 b) Write an algorithm to reverse a single linked list.
 c) Write an algorithm to delete a node from the middle of a double link list.
 d) Write an algorithm to insert a node at a specific position in a single linked list.
20. What is recursion tree? Draw the recursion tree for computing nth Fibonacci numbers, where n may be any number & Tower of Hanoi having 4/3 disks.
21. What is complete binary tree? Show that the sum of degree of all the vertices in a graph is always even.
22. a) Construct a binary tree from the following information

Preorder	:A B D G H E I C F J K
Inorder	:G D H B E I A C J F K

 b) Inorder: D G B A H E I C F
 Preorder: A B D G C E H I F
 c) In-order: E A C K F H D B G
 Pre-order: F A E K C D H G B

 d) What is tail recursion? Explain with a suitable example.
 e) What is hash function? Discuss different types of hash functions.
23. a) Construct an AVL tree or height balanced binary tree with the following elements in the order of their occurrence.
 I J K C B D G E R W
 b) How does the AVL tree differ from a binary search tree?
 Construct an AVL tree by using following keys:
 8 , 12 , 9 , 11 , 7 , 6 , 14 , 10
 c) Write an algorithm for DFS.

24. If E and I denote the external and internal path length of a binary tree and n denoted the number of internal nodes then show that $E = I + 2 * n$.
25. What is a Complete graph? Show that the sum of degree of all the vertices in a graph is always even.
26. Prove that , for any non-empty binary tree, T , if n_0 be the number of leaves and n_1 be the number of nodes of degree 2, then $n_0 = n_1 + 1$.
27. Explain with suitable example the principle of operation of Quick sort.
28. Write an algorithm of Merge Sort and explain with example.
29. Find the minimum spanning tree of the following graph using Kruskal's algorithm and Prim's algorithm.



30. Write short notes on any three of the following:
 - a) BFS vs DFS
 - b) AVL Tree
 - c) Threaded binary tree
 - d) B-tree
 - e) Tail recursion
 - f) Priority queue
31. Perform DFS/BFS of the following graph.

