JANUARY 2024

DATA STRUCTURES

Time Allowed: 2.5 Hours *Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 mark is allotted for right answer and 1 mark is allotted for correct explanation of the answer.

Answer any Five (05) Questions from Group-B.

GROUP - A

1. Choose the correct answer from the given alternatives and explain your answer (any ten): 2x10=20

i) Which data structure is defined as a collection of similar data elements? (a) Array (b) Tree (c) Linked Lists (d) Graph.
ii) Which among the following is a LIFO data structure? (a) Graph (b) Queue (c) Stack (d) Linked Lists.
iii) Which data structure is used to represent complex relationships between the nodes? (a) Graph (b) Tree (c) Array (d) Linked Lists.
iv) Typical time requirement for operation on queues is – (a) O(1) (b) O(n) (c) O(log n) (d) $O(n^2)$.
v) The depth of root node is – (a) 0 (b) 1 (c) 3 (d) 2.
vi) A binary tree of height h has at least h nodes and at most – (a) 2h nodes (b) 2^h nodes (c) 2^{h+1} nodes (d) $2^h - 1$ nodes.
vii) When the left sub-tree of the tree is one level higher than that of the right sub-tree, then the balance factor is – (a) 0 (b) 1 (c) -1 (d) 2.
viii) Total number of nodes at the nth level of a binary tree can be given as – (a) 2^n (b) 2n (c) 2^{n+1} (d) 2^{n-1}.
ix) Which type of linked list can have four pointers per node? (a) circular doubly linked list (b) multi-linked list (c) header linked list (d) doubly linked list.
x) A graph in which there exists a path between two of its nodes is called – (a) complete graph (b) connected graph (c) digraph (d) in-directed graph.
xi) The total number of edges containing the node u is called – (a) in-degree (b) out-degree (c) degree (d) none of these.
xii) Which type of linked list does not store NULL in the next field? (a) singly linked list (b) circular linked list (c) doubly linked list (d) all of these.
xiii) The circular queue will be full only when – (a) front = max -1 and rear = max -1 (b) front = 0 and rear = max – 1 (c) front = max – 1 and rear = 0 (d) front = 0 and rear = 0.
xiv) Reverse Polish Notation is the other name of – (a) infix expression (b) prefix expression (c) postfix expression (d) algebraic expression.
xv) Linked list is used to implement data structures like – (a) stack (b) tree (c) queue (d) all of these.

GROUP – B

Answer any Five (05) questions.

2. a) What do you understand by stack overflow and stack underflow?
   b) Differentiate between an array and a stack.
   c) Write algorithms for PUSH and POP. 2+2+(2+2)

3. a) What is a priority queue? Give its applications.
   b) Explain the concept of a circular queue. How is it better than a linear queue? (2+1)+(3+2)

4. a) Make a comparison between a linked list and a linear array.
   b) Which one will you prefer to use and when?
   c) Why is a doubly linked list more useful than a singly linked list?
   d) Give the advantages and uses of a circular linked list. 2+(1+1)+2+(1+1)

5. a) Differentiate between an iterative function and a recursive function. Which one will you prefer to use and in what circumstances?
   b) Convert the expression given below into its corresponding postfix expression and then evaluate it.
   10 + ((7 – 5) + 10) / 2 (2+1+1) + (2+2)

6. a) Specify the use of a header node in a header linked list.
   b) Give the linked representation of the following polynomial: $7x^3y^2 - 8x^2y + 3xy + 11x + 4$.
   c) Explain the difference between a circular linked list and a singly linked list. 2+4+2

7. a) What are the two ways of representing binary trees in the memory? Which one do you prefer and why?
   b) List all possible non-similar binary trees having four nodes. (2+1+2) + 3

8. a) Draw the queue structure in each case when the following operations are performed on an empty queue: i) Add A, B, C, D, E, F ii) Delete two letters iii) Add G iv) Add H v) Delete four letters vi) Add M 3+1+1+1+1+1

9. a) How are graphs represented inside a computer's memory? Which method do you prefer and why?
   b) Draw a complete undirected graph having five nodes. (2+1+2) + 3