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B.Tech. DEGREE EXAMINATION, JULY 2022

Fourth Semester

18CSC201J – DATA STRUCTURES AND ALGORITHMS

(For the candidates admitted during the academic year 2020 - 2021 & 2021 - 2022)

Note: Part - A should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) Part - B should be answered in answer booklet.

Time: 2½ Hours

Max. Marks: 75

Marks BL CO PO

PART – A (25 × 1 = 25 Marks)

Answer ALL Questions

1 1 1 1

1. Choose the correct statement about array?

(A) Objects of mixed data type can be stored	(B) Elements in an array connate be sorted
(C) Index of first element of an array is 1	(D) Easier to store elements of same data type
2. Which case indicate the minimum time required for program execution?

(A) Best case	(B) Average case
(C) Worst case	(D) Average case and worst case
3. Which of the following is a stable sorting algorithm?

(A) Merge sort	(B) Typical in-place quick sort
(C) Heap sort	(D) Selection sort
4. What is the best case runtime of linear search algorithm on an ordered set of elements?

(A) $O(1)$	(B) $O(n)$
(C) $O(\log n)$	(D) $O(nx)$
5. The concatenation of two lists can be performed in $O(1)$ time. Which of the following variation of the linked list can be used?

(A) Singly linked list	(B) Doubly linked list
(C) Circular doubly linked list	(D) Array implementation of list
6. Using asymptotic analysis, we can very well conclude the _____ scenario of an algorithm.

(A) Best case	(B) Average case
(C) Worst case	(D) Best case, worst case and average case
7. In linked list implementation, a node carries information regarding _____.

(A) Data	(B) Link
(C) Data and link	(D) Node

8. Linked list is considered as an example of _____ type of memory 1 1 2 1
- (A) Dynamic (B) Static
 (C) Compile time (D) Heap
9. Linked list data structure offers considerable saving in _____. 1 1 2 1
- (A) Computational time (B) Space utilization
 (C) Space utilization and (D) Speed utilization computational time
10. _____ form of access is used to add and remove nodes from a queue. 1 1 3 1
- (A) LIFO (Last In First Out) (B) FIFO (First In First Out)
 (C) Both LIFO and FIFO (D) Dequeue
11. What is the term for inserting into a full queue known as _____. 1 1 3 1
- (A) Overflow (B) Underflow
 (C) Null pointer exception (D) Program won't be compiled
12. A parentheses checker program would be best implemented using _____. 1 2 3 2
- (A) List (B) Queue
 (C) Stack (D) Graph
13. What is the need for a circular queue? 1 2 3 1
- (A) Effective usage of memory (B) Easier computations
 (C) To delete elements based on (D) Implement LIFO principle in priority queues
14. What is a dequeue? 1 1 3 1
- (A) A queue with insert/delete (B) A queue implemented with a defined for both front and rear doubly linked list ends of the queue
 (C) A queue implemented with both (D) A queue with insert / delete singly and doubly linked lists define for front side of the queue
15. A linear list of elements in which deletion can be done from one end and insertion at the other end is known as _____. 1 2 3 1
- (A) Queue (B) Stack
 (C) Tree (D) Linked list
16. Which of the following traversing algorithm is not used to traverse in a tree? 1 2 4 1
- (A) Post-order (B) Pre-order
 (C) In-order (D) Randomized
17. The post-order traversal of a binary tree is O P Q R S T. Then 1 2 4 2
 possible pre-order traversal will be _____.
 (A) T Q R S O P (B) T O Q R S P
 (C) T Q O P S R (D) T Q O S P R
18. The maximum number of nodes in a tree for which post-order and pre-order traversals may be equal is _____. 1 2 4 2
 (A) 3 (B) 1
 (C) 2 (D) Any number

19. A self-balancing binary search tree can be used to implement _____. 1 1 4 1
 (A) Priority queue (B) Hash table
 (C) Heap sort (D) Priority queues and heap sort
20. The number of edges from the root to the node is called _____ of the tree. 1 2 4 1
 (A) Height (B) Depth
 (C) Length (D) Width
21. What is a hash table? 1 1 5 1
 (A) A structure that maps values to keys (B) A structure that maps keys to values
 (C) A structure used for storage (D) A structure used to implement stack and queue
22. The topological sorting of any directed acyclic graph can be done in _____ time. 1 1 5 1
 (A) Cubic (B) Quadratic
 (C) Linear (D) Logarithmic
23. What is simple uniform hashing? 1 1 5 1
 (A) Every element has equal probability of hashing into any of the slots
 (B) A weights probabilistic method is used to hash elements into the slots
 (C) Elements has random probability of hashing into array slots
 (D) Elements are hashed based on priority
24. Which of the following properties does a simple graph not hold? 1 2 5 1
 (A) Must be connected (B) Must be unweighted
 (C) Must have no loops or multiple edges (D) Must have no multiple edges
25. Which of the following is true? 1 2 5 1
 (A) A graph may contain no edges and many vertices (B) A graph may contain many edges and no vertices
 (C) A graph may contain no edges and no vertices (D) A graph may contain no vertices and many edges

PART – B (5 × 10 = 50 Marks)

Answer ALL Questions

Marks BL CO PO

26. a. Sort the given list of elements using insertion sort technique. 10 3 1 2,4
 30 52, 29, 87, 63, 27
 Write the pseudo code and mention its worst case time complexity.
- (OR)
- b. You have an array of 10 numbers, and the element ‘56’ needs to be found. 10 3 1 2,4
 Use binary search and solve the following example.
 2, 5, 8, 12, 16, 23, 38, 56, 72, 91
 Write the pseudo code and mention its worst case time complexity.

27. a. Write an algorithm to insert a node '90' at the beginning at given position and at the end of the circular linked list. Give a pictorial representation of circular linked list before and after insertion.

10 3 2 3

10, 75, 30, 45, 20, 65, 50

(OR)

- b. Write the pseudo code for inserting an element in the middle of an array and for traversing an array with example.

10 3 2 3

28. a. Convert the following expression from infix ID postfix.

10 3 3 3,4

$$\begin{array}{ll} \text{(i)} & (a + b) / (c + d) - (d * e) \\ \text{(ii)} & a - (b / c + (d \% e * f) / g) * h \end{array}$$

(OR)

- b. Write the pseudo code to insert and delete an element in a circular queue with example.

10 3 3 3,4

29. a. Create a binary search tree using the following data elements.

10 3 4 3,4

46, 40, 57, 13, 35, 79, 11, 90, 68

Delete the node 79 and 40 after constructing the tree.

(OR)

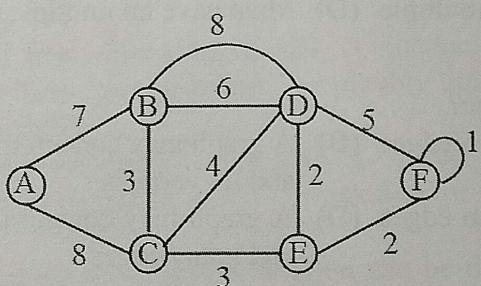
- b. Create a red black tree using the following data elements.

10 3 4 3,4

12, 20, 10, 17, 33, 28, 42, 63

30. a. Find the minimum spanning tree for the graph given below using both prim's and kruskal's algorithms.

10 3 5 3,4



(OR)

- b. What is hashing? Explain in detail mid-square method and modulo-division method with example.

10 3 5 3,4

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B.Tech. DEGREE EXAMINATION, MAY 2018

Fourth Semester

CS1004 – DATA STRUCTURES AND ALGORITHM DESIGN

(For the candidates admitted during the academic year 2013 – 2014 and 2014 – 2015)

Note:

- (i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
- (ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours

Max. Marks: 100

PART – A ($20 \times 1 = 20$ Marks)
Answer ALL Questions

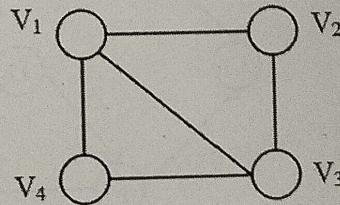
1. Two main measures for the efficiency of an algorithm are
 - (A) Processor and memory
 - (B) Complexity and capacity
 - (C) Time and space
 - (D) Data and space
2. $O(n^2)$ is the complexity of which searching and sorting algorithm?
 - (A) Binary search
 - (B) Linear search
 - (C) Merge sort
 - (D) Bubble sort
3. The _____ notation is used when the function $g(n)$ defines a lower bound for the function $f(n)$
 - (A) Omega
 - (B) Big O
 - (C) Theta
 - (D) Little Oh
4. The number of elements 'n' is called the length or _____ of the array.
 - (A) Upper bound
 - (B) Lower bound
 - (C) Size
 - (D) Variable
5. Which function places an element on the stack?
 - (A) Pop()
 - (B) Push()
 - (C) Peek()
 - (D) Isempty()
6. Disks piled up one above the other represent a _____.
 - (A) Stack
 - (B) Queue
 - (C) Linked list
 - (D) Array
7. A line in a grocery store represents a _____.
 - (A) Stack
 - (B) Queue
 - (C) Linked list
 - (D) Array
8. 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

9. Pre-order traversal is also called as _____.
(A) Depth first (B) Breadth first
(C) Level order (D) In-order
10. Total number of nodes at the n^{th} level of a binary tree can be given as
(A) 2^n (B) $\log_2 n$
(C) 2^{n+1} (D) 2^{n-1}
11. 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
12. Which rotation is done when the new node is inserted in the right sub-tree of the right child of the critical node?
(A) Left Left (LL) (B) Left Right (LR)
(C) Right Left (RL) (D) Right Right (RR)
13. An edge that has identical end-points is called a _____.
(A) Multi-path (B) Loop
(C) Cycle (D) Multi-edge
14. A graph in which there exists a path between any two of its nodes is called _____.
(A) Complete graph (B) Connected graph
(C) Digraph (D) In-directed graph
15. How many articulation vertices does a biconnected graph contain?
(A) 0 (B) 1
(C) 2 (D) 3
16. The memory use of an adjacency matrix is _____.
(A) $O(n)$ (B) $O(n^2)$
(C) $O(n^3)$ (D) $O(\log n)$
17. Which design strategy stops the execution when it finds the solution, otherwise starts the problem from top?
(A) Backtracking (B) Divide and conquer
(C) Branch and bound (D) Dynamic programming
18. Which of the following is not a backtracking algorithm?
(A) Knight tour problem (B) N queen problem
(C) Tower of Hanoi (D) M coloring problem
19. A feasible tour for a travelling salesman problem with 45 cities (including the home city) has
(A) 27 arcs (B) 44 arcs
(C) 45 arcs (D) 990 arcs
20. The time complexity of sum of subsets using backtracking is _____.
(A) $O(n)$ (B) $O(\log n)$
(C) $O(n \log n)$ (D) $O(2^n)$

PART - B ($5 \times 4 = 20$ Marks)

Answer ANY FIVE Questions

21. What are the qualitative and quantitative aspects that an algorithm possesses to qualify as a good algorithm?
22. What do you understand by time-space trade-off and efficiency of an algorithm?
23. Evaluate the following postfix expressions
 (i) $ab + d / ab * -$ where $a = 12, b = 14$ and $d = 13$
 (ii) $EFG * H + -$ where $E = 1, F = 2, G = 3$ and $H = 4$
24. Define binary tree. Give the structure of a single node in a binary tree.
25. Draw binary expression trees for: $(p / q) - (r * s)$
26. What is breadth first search and depth first search in graphs? Where is it applied in graphs?
27. Color the following graph using graph coloring algorithm. what is the minimum number of colors required?



PART - C ($5 \times 12 = 60$ Marks)

Answer ALL Questions

28. a. Explain and compare the approaches for designing and algorithm.

(OR)

- b. Differentiate forward and backward substitution. Solve the following recurrence relation using back substitution method

$$T(n) = T(n-1) + n \quad ; n > 1 \\ = 1 \quad ; n = 1$$

29. a. Explain linked list and write an algorithm to create a circular doubly linked list and perform insertions and deletions at the beginning and end of the list.

(OR)

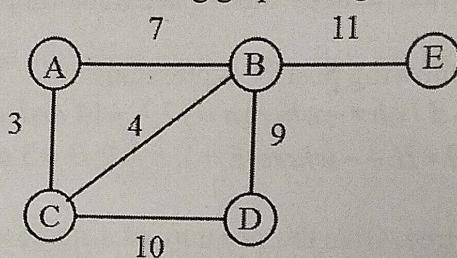
- b. Discuss the major drawback of a linear queue. Write an algorithm to insert and delete an element from a circular queue.

30. a. Draw an AVL tree for the following data

$$(i) \quad 30, 47, 86, 95, 115, 130, 138, 159, 166, 184 \\ (ii) \quad 5, 6, 8, 3, 2, 4, 7$$

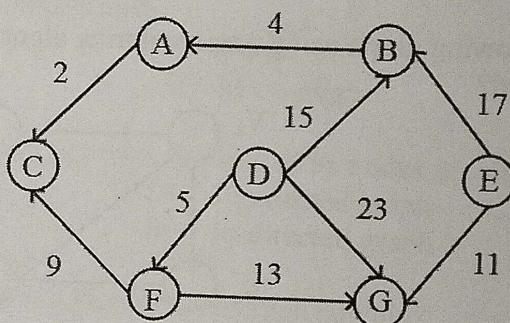
(OR)

- b. Construct a binary search tree with the following data. Write the preorder and postorder traversals for the tree
- 23, 46, 79, 21, 55, 33, 44, 57, 56
 - 14, 15, 4, 9, 7, 18, 3, 5, 16, 4, 20, 17, 9, 14, 5
31. a. Write the steps involved in constructing a minimum spanning tree using Prim's algorithm and find the minimum cost for the following graph using Prim's algorithm.



(OR)

- b. Consider the graph below, taking 'D' as the initial node, execute the Dijkstra's algorithm on it.

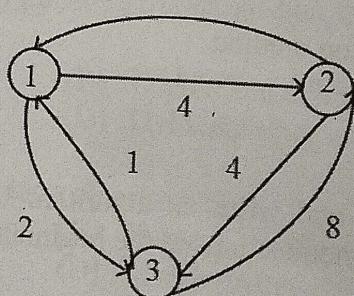


32. a. Write and analyze an algorithm for n-queen problem using backtracking technique. Also find the solution for 8-queens problem.

(OR)

- b. Solve the following travelling salesman problem using branch and bound technique.

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Reg. No. []

B.Tech. DEGREE EXAMINATION, NOVEMBER 2019
Third Semester

18CSC201J – DATA STRUCTURES AND ALGORITHMS
(For the candidates admitted during the academic year 2018-2019 onwards)

Note:

- (i) Part - A should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
- (ii) Part - B and Part - C should be answered in answer booklet.

Time: Three Hours

Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer ALL Questions

1. What is the advantage of bubble sort over other sorting techniques?
(A) It is faster (B) Consumes less memory
(C) Detects whether the input is already sorted (D) Consumes more memory
2. How many passes does an insertion sort algorithm consist of?
(A) N (B) N – 1
(C) N + 1 (D) N²
3. What is the worst case complexity of binary search using recursion?
(A) O (n log n) (B) O (log n)
(C) O (n) (D) O (n²)
4. Which of the following are themselves a collection of different data types?
(A) String (B) Structures
(C) Char (D) Arrays
5. Which of these best describes an array?
(A) A data structure that shows a hierarchical behaviour (B) Contains objects of similar types
(C) Contains objects of mixed types (D) Both similar and mixed types
6. A linear collection of data elements where the linear node is given by means of pointer is called
(A) Linked list (B) Node list
(C) Primitive list (D) Array list
7. What is the time complexity of searching for an element in a circular linked list?
(A) O (n) (B) O (n log n)
(C) O (1) (D) O (n²)
8. Which of the following is not a disadvantage to the usage of array?
(A) Fixed size (B) You know the size of the array prior to allocation
(C) Insertion based on position (D) Accessing elements at specified positions

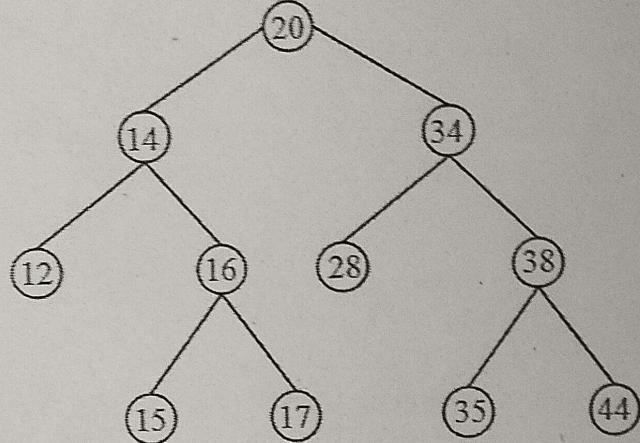
9. Process of inserting an element in a stack is called _____.
(A) Create (B) Push
(C) Evaluation (D) Pop
10. What is the time complexity of pop() operation when the stack is implemented using an array?
(A) O (1) (B) O (n)
(C) O (log n) (D) O (n log n)
11. What data structure would you most likely to see in a non-recursive implementation of a recursive algorithm?
(A) Linked list (B) Stack
(C) Queue (D) Tree
12. To implement a stack using queue with only enqueue and dequeue operations, how many queues will you need?
(A) 1 (B) 2
(C) 3 (D) 4
13. A node in a binary tree can have atmost _____ children.
(A) 2 (B) Any number of children
(C) 0 or 1 or 2 (D) 0 or 1
14. Given an empty AVL tree, how would you construct AVL tree when a set of numbers are given without performing any rotations?
(A) Just build the tree with the given input (B) Find the median of the set of elements given, make it as root and construct the tree
(C) Use trial and error (D) Use dynamic programming to build the tree
15. The tree traversal to obtain a prefix expression is _____.
(A) Level-order traversal (B) Pre-order traversal
(C) Post-order traversal (D) In-order traversal
16. What is the maximum height of an AVL tree with P nodes?
(A) P (B) $\log(P)$
(C) $\log(P)/2$ (D) $P/2$
17. What is direct addressing?
(A) Distinct array position for every possible key (B) Fewer array positions than keys
(C) Fewer keys than array positions (D) A structure used for storage
18. A graph with all vertices having equal degree is known as _____.
(A) Multi graph (B) Regular graph
(C) Simple graph (D) Complete graph
19. What kind of deletion is implemented by hashing using open addressing?
(A) Active deletion (B) Standard deletion
(C) Lazy deletion (D) Passive deletion

20. A graph having an edge from each vertex to every other vertex is called _____.
 (A) Tightly connected (B) Strongly connected
 (C) Weakly connected (D) Loosely connected

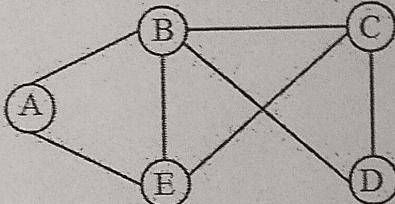
PART - B (5 × 4 = 20 Marks)

Answer ANY FIVE Questions

21. Mention the best case, worst case and average case of bubble sort algorithm.
 22. Write the pseudocode for linear search.
 23. List the difference between arrays and linked lists.
 24. Define Dequeue. How is it represented? What are the types of dequeue?
 25. List any four applications of stacks.
 26. Perform preorder and inorder traversal for the tree given below.



27. Consider the graph given below and find out the degree of each node.



PART - C (5 × 12 = 60 Marks)

Answer ALL Questions

28. a. Write the pseudo code for insertion sort and apply the same to the following elements.
 39, 9, 45, 63, 18, 81, 108, 54. Mention its best case, worst case and average case complexity.

(OR)

- b.i. Write the recursive pseudocode for binary search. (5 Marks)
 ii. Explain the various mathematical notations and functions used in analysis of algorithms with proper graphs. (7 Marks)

29. a. Draw the node structure of a doubly linked list. Write the pseudocode for the following operations on a doubly linked list.
- Delete the last node
 - Insertion after a given node
 - Insertion at the end

(OR)

- b. Describe the following operations of circular linked list with an example
- Insertion at the beginning
 - Insertion after a given node
 - Deletion at the end

30. a.i. Convert the given expression into postfix expression $9 - ((3 * 4) + 8) / 4$.

ii. Convert the given expression into prefix expression $(A - B / C) * (A / K - L)$.

(OR)

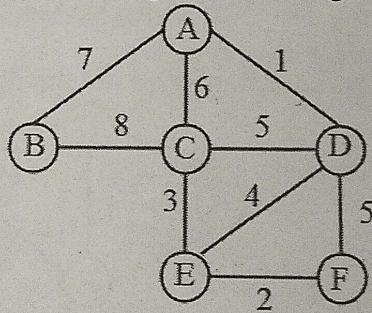
- b. Elaborate the enqueue and dequeue operations performed in queue using linked list representation with algorithms.

31. a. Construct binary search tree for the input list: 100, 90, 45, 80, 30, 35, 20, 60, 70. Trace the algorithm to delete the nodes 20 and 60 and show the steps.

(OR)

- b. Construct an AVL tree by inserting the following elements in order.
65, 3, 15, 28, 14, 100, 95, 85

32. a. Construct the minimum spanning tree using Kruskal's algorithm for the following graph.



(OR)

- b.i. Consider a hash table with size = 10, using linear probing and insert the keys 72, 27, 36, 24, 63, 81, 92 and 100 in the table. (8 Marks)
- ii. List the pros and cons of quadratic probing. (4 Marks)
