

SASTRA DEEMED UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

End Semester Examinations

July 2022

Course Code: CSE209

Course: DATA STRUCTURES & ALGORITHMS

Question Paper No. :U0368

Duration: 3 hours

Max. Marks:100

PART – A

Answer all the questions

10 x 2 = 20 Marks

1. Define Ω -Notation.
2. Find the complexity of the following algorithm:
Algorithm EVAL_SERIES(x, n)
 1. $sum = 0$
 2. *for* $i = 1$ *to* $n - 1$
 3. *for* $j = i + 1$ *to* n
 4. $sum = sum + i * j * x$
 5. *return* sum
3. Find the contents of the stack after each of the following operations on an array stack of size 3: (a) PUSH (S, 'W') (b) PUSH (S, 'K') (c) POP (d) PUSH (S, 'O') (e) PUSH(S,'N') (f) POP (g) POP (h) POP.
4. Identify errors, if any, in the following pseudocode for inserting an element into a queue implemented as Linked list.

Algorithm ENQUEUE($Front, Rear, x$)

1. $T = GETNODE()$

2. $T \rightarrow data = x$
3. $T \rightarrow link = NULL$
4. $Rear = T$
5. $Rear \rightarrow link = T$
6. if $Front = NULL$
7. $Front = T$
8. Return

5. Let T be the address of the node to be deleted from a non-empty doubly linked list. Write the pseudocode to delete the node T .



6. Draw the general tree corresponding to the following parenthetical representation: $(a, (b, (d, e, f, (h, i)), c(g)))$.
7. Write the algorithm for traversing a binary tree in inorder.
8. What is the time complexity for traversing the vertices of a graph represented as adjacency matrix, having n vertices and e edges?
9. Write the advantages of dynamic hashing over static hashing.
10. What are the advantages and disadvantages of indexed sequential file organization method?

PART - B

Answer all the questions

4 x 15 = 60 Marks

11. Trace the following recursive algorithm stepwise and find the result where $n = 8$, and $A = \{21, 2, 40, 31, 75, 32, 54, 99\}$

Algorithm *EVAL* (A, n)

1. if $n = 0$
2. return 0
3. else
4. return $EVAL(A, n - 1) + A[n]$

(OR)

12. Derive the time complexity for the following two algorithms that calculate the sine value of x given in radians using Taylor Series approximation. Which algorithm is better and why?

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \dots$$

Algorithm SINE1(x, n)

// Computing the value of $\sin x$, where x is given in radians using // Taylor Series approximation with first n terms

1. $sum = x$
2. $term = x$
3. **for** $i = 1$ **to** $n - 1$
4. $term = -1 * term * x * x / ((2 * i) * (2 * i + 1))$
5. $sum = sum + term$
6. **return** sum

Algorithm SINE2(x, n)

// Computing the value of $\sin x$, where x is given in radians using // Taylor Series approximation with first n terms

1. $sum = 0$
2. $sgn = 1$
3. **for** $i = 1$ **to** $2 * n$ **step** 2
4. $fact = 1$
5. **for** $j = 1$ **to** i
6. $fact = fact * j$
7. $xp = 1$
8. **for** $k = 1$ **to** i
9. $xp = xp * x$
10. $sum = sum + sgn * xp / fact$
11. $sgn = sgn * -1$
12. **return** sum

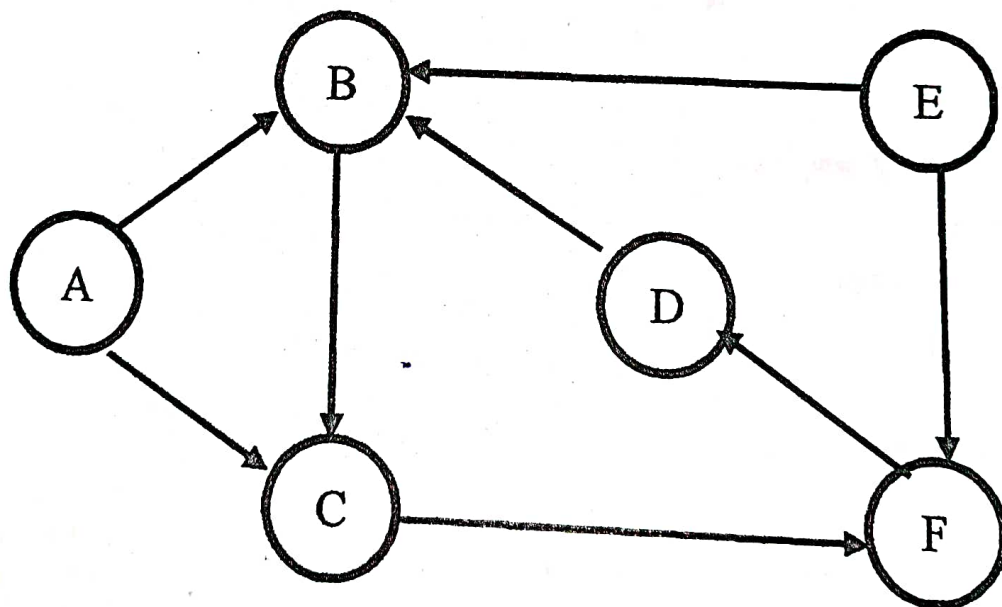
13. Write the algorithm for converting an infix expression into postfix using stack. Trace the algorithm for converting the following infix expression into postfix: $(a/b * (c - d) - e + f/g)$

(OR)

14. Write the algorithms for performing the following operations on an ordered doubly linked list.
- (a) Inserting an element
 - (b) Finding the position of a given element from the beginning
 - (c) Finding the position of a given element from the last
 - (d) Finding the minimum element
 - (e) Finding the maximum element
 - (f) Displaying all elements from first to last and last to first.
15. Construct an AVL tree for the following input sequence: 27, 78, 31, 44, 89, 62, 79, 50, 21, 38, 72, 66.

(OR)

16. What is the space complexity for representing a graph as adjacency matrix and adjacency list? Also, represent the following graph as adjacency matrix and adjacency list.



17. Write the algorithm for sorting a given array of numbers using quicksort and trace it for the following input sequence: 25, 11, 34, 55, 72, 30, 60, 43, 7, 20.

(OR)

18. Explain about various types of hashing techniques with examples.

PART – C

Answer the following

1 x 20 = 20 Marks

19. (a) Write the algorithm for PUSH, POP and PEEK operations on Linked stack.
- (b) Write the non-recursive algorithm using stack for finding the minimum number of movements required to move N discs of increasing diameter from source needle A to destination needle C using intermediate needle B with the following two constraints:
- (i) Only one disc can be moved at a time and placed in any one of the needles.
 - (ii) A larger diameter disc should not be placed on top of a lower diameter disc at any point of time during the movement.
- (c) Write the algorithm for traversing the vertices of a graph in depth first order and derive its time complexity.

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