SASTRA DEEMED UNIVERSITY

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

End Semester Examinations

JULY 2023

Course Code: **CSE209**

Course: **DATA STRUCTURES & ALGORITHMS**

QP No. :**UF016-2**

Duration: **3** hours

Max. Marks:**100**

PART- A

Answer all the questions **10 x 2 = 20 Marks**

1. Find the complexity of the following algorithm:

Algorithm DEC_TO_BIN(n)

//Converting a non-negative decimal integer 'n' into binary

1. $i = 0$
2. *repeat*
3. $i = i + 1$
4. $bin\_no[i] = n \% 2$
5. $n = \lfloor n / 2 \rfloor$
6. *until* $n = 0$
7. *for* $j = i$ *down to* 1
8. *write* $bin\_no[j]$
9. *end for*
10. *return*

2. Write a recursive algorithm for finding GCD of two positive integers m and n, which is defined as:

$$GCD(m.n) = \begin{cases} m & if\ n = 0 \\ GCD(n, m) & if\ n > m \\ GCD(n, m\ \%n) & otherwise \end{cases}$$

3. Define O-Notation.

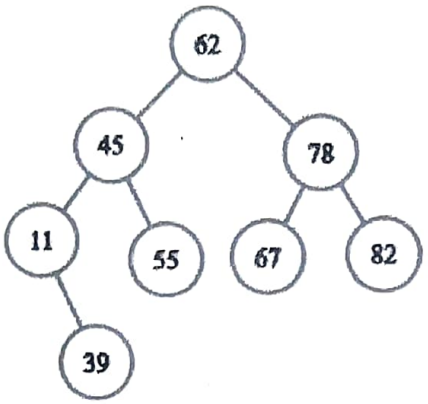
4. Represent the following polynomial using singly linked list:

$$P = 5x^{20} - x^{16} + 7x^{14} + 30x^{11} - 17x^5 + 20$$

5. Write the algorithm to delete an element from beginning of a singly linked list.

6. Draw the general tree whose parenthetical representation is given as: (A, (B, (C, D(E, F), G (H, I)), J (K, L(M), N(O, P(Q))), R(S, T)))

7. Find the postorder traversal of the following binary tree:

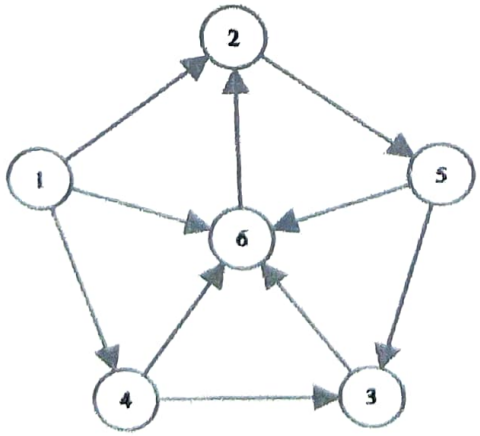


8. Write the algorithm for LeftRotate used in balancing AVL tree node.

9. Write the contents of the array after the first partition when applying quick sort. Consider last element as pivot element.

	1	2	3	4	5	6	7	8	9	10	11	12
A	60	22	43	71	30	29	11	8	20	54	75	41

10. Represent the following graph as adjacency matrix:



PART – B

Answer any FOUR questions **4 x 15 = 60 Marks**

11. (i) Trace the following recursive algorithm and find the return value when x=2 and y=9: (8)

```
Algorithm func(x, y)
1.  if x == 0
2.      return 0
3.  else if y == 1
4.      return x
5.  else
6.      term = func(x, ⌊y/2⌋)
7.      if  y%2 == 0
8.          return term * term
9.      else
10.         return term * term * x
11.   end if
12. end if
```

(ii) Find the complexity of the following algorithm: (7)

Algorithm TRANSFORM(A, B, n)

// A is a nxn matrix and B is a nx1 matrix

```
1.  for i = 1 to n − 1
2.      for j = i to n
3.          ratio = A[j, i]/A[i, i]
4.          for k = i to n
5.              A[j, k] = A[j, k] − ratio ∗ A[i, k]
6.              b[j] = b[j] − ratio ∗ b[i]
7.          end for k
8.      end for j
9.  end for i
10. return
```

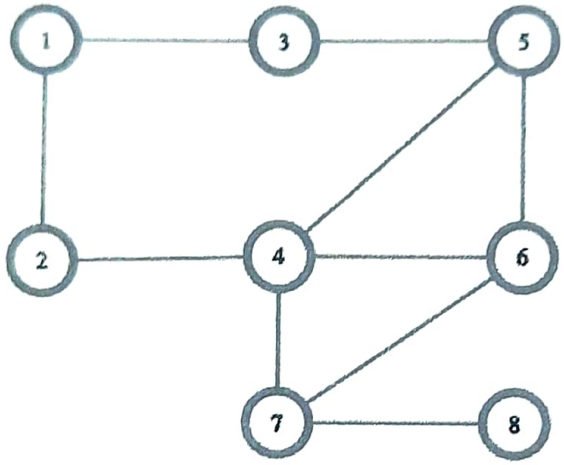
12. Write the algorithms to insert, delete and search for an element in an ordered doubly linked list. Explain with example.

13. Write the algorithm to add two polynomials represented as singly linked list. Explain with example.

14. Construct an AVL tree for the following input sequence: 4, 12, 7, 18, 27, 29, 65, 43, 78, 62, 58, 90, 69, 54, 59, 11.

15. Write the algorithm for Heapsort and sort the following numbers using it: 19, 20, 34, 41, 23, 90, 47, 69, 30.

16. Write the algorithm to find depth first traversal of a graph. Represent the following graph as adjacency list and perform depth first traversal:



PART – C

Answer the following **1 x 20 = 20 Marks**

17. (i) Convert the following infix expression into postfix expression using stack. Write the contents of the stack after each operation. (8)

$$(a + b * (c - d)/e * f - g + h\hat{}i)$$

(ii) Consturct a B-Tree of order 5 for the following input sequence: 29, 40, 11, 4, 39, 78, 26, 60, 54, 30, 55, 98, 112, 45, 27, 9, 5, 1. Then delete 78, 98 and 40. Draw the tree after each operation. (12)

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