Enrollment No.......................................

Faculty of Engineering / Science

End Sem Examination Dec-2023

CS3CO31 / IT3CO38 / BC3CO36 Data Structures

Programme: B.Tech./B.Sc.   Branch/Specialisation: CSE All / IT / Computer Science

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1   i.   If the address of Arr[1,1] and [2,1] are 1000 and 1010 respectively in a **1** array Arr[5][5],and each element occupies 2 bytes, the array is stored in-
        (a) Random   (b) Column major
        (c) Compiler dependent   (d) Row major

   ii.   If a, b and c are pointer variables of type char, int and float respectively **1** in 'C' language, then which of the following statement is true?
        (a) Size of a, b and c are same
        (b) Size of c is greater than the size of a
        (c) Size of b is greater than the size of a
        (d) Size of c is greater than the size of b

  iii.   In a linked list each pointer points to _____.   **1**
        (a) Integer field of a node   (b) A node
        (c) Pointer field of a node   (d) None of these

  iv.   A variant of the linked list in which none of the node contains NULL **1** pointer is-
        (a) Singly linked list   (b) Doubly linked list
        (c) Circular linked list   (d) None of these

   v.   What will be the correct output for the following sequence of operations: **1** push (1), push (2), pop, push (2), push (3), pop, pop, pop, push (4), pop-
        (a) 4 1 2 3 2   (b) 2 1 3 2 4   (c) 2 3 2 1 4   (d) 4 3 2 2 1

  vi.   In linked list implementation of a queue, where does a new element be **1** inserted?
        (a) At the beginning of linked list
        (b) At the last of the linked list
        (c) At the center position in the linked list
        (d) None of these

vii. Which of the following algorithm design technique is used in the quick sort algorithm? **1**
(a) Dynamic programming   (b) Backtracking
(c) Divide-and-conquer   (d) Greedy method

viii. Which of the following is not true for binary search algorithm? **1**
(a) It divides the array in subarrays
(b) It compares each element
(c) Array must be sorted
(d) It has time complexity O (log n)

ix. What is a full binary tree? **1**
(a) Each node has exactly zero or two children
(b) Each node has exactly two children
(c) All the leaves are at the same level
(d) Each node has exactly one or two children

x. In a max-heap, element with the greatest key is always in the which node? **1**
(a) Leaf node   (b) First node of left sub tree
(c) Root node   (d) First node of right sub tree

Q.2   Attempt any two:
i. What is data structure? Explain its types. **5**
ii. Given an array arr[1………10][1………15] with a base value of 100 and the size of each element is 1 Byte in memory find the address of arr[8][6] with the help of column-major order & row major order. **5**
iii. Explain pointer with example. Write a program to swap two numbers using pointers. **5**

Q.3   i. Write advantages of linked list data structure over array. **2**
ii. What is doubly linked list? Write an algorithm for insertion of a node at beginning in a doubly linked list. **8**
OR   iii. Explain circular linked list. Write an algorithm for deletion of a node after an element in a circular linked list. **8**

Q.4   i. Explain circular queue and its advantage over liner queue. **4**
ii. Convert the given infix expression (using Stack table)- **6**
(A+B) * (C^D) / E-F
(a) Infix to Postfix   (b) Infix to Prefix
OR   iii. Write an algorithm for push, pop and display operation in stack. **6**

Q.5   i. Explain binary search with example. What are the advantages of binary search over linear search? **4**
ii. Write an algorithm for bubble sort. Also sort the following array with bubble sort- **6**
25 13 18 2 7 10
OR   iii. What is Hashing? Consider the hash table of size 11(indexing 0 to 10) with hash function h(k) = (2*k+1) mod 10, insert the following keys 12,23,45,65,32,57,66,10 into empty hash table using open addressing linear probing technique. **6**
(a) Show the resultant hash table after inserting keys
(b) Calculate total number of hash collision

Q.6   i. Explain graph and its traversal techniques. **4**
ii. Construct AVL tree for the following data- **6**
9,27,50,15,2,21, and 36
OR   iii. Write short note on- **6**
(a) Heap
(b) Tree traversal technique
(c) Threaded binary tree

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Marking Scheme

Data Structures (T) - IT3CO38 (T)

Q.1	i)	d) Row major		1
	ii)	a) Size of a, b and c are same		1
	iii)	b) A node		1
	iv)	c) Circular linked list		1
	v)	c) 2 3 2 1 4		1
	vi)	b) At the last of the linked list		1
	vii)	c) Divide-and-conquer		1
	viii)	b) It compares each element		1
	ix)	a) Each node has exactly zero or two children		1
	x)	c) root node		1

Q.2	i.	Data Structure definition	2 marks	5
		Types	3 marks	
	ii.	Address of arr[8][6] in column-major order 157	2.5 marks	5
		Address of arr[8][6] in row-major order 210	2.5 marks	
OR	iii.	Pointer definition with example	2 marks	5
		Program	3 marks	

Q.3	i.	4 Advantages	2 marks	2
	ii.	Doubly linked list explanation	2 marks	8
		Algorithm	6 marks	
OR	iii.	Circular linked list explanation	2 marks	8
		Algorithm	6 marks	

Q.4	i.	Circular queue	2 marks	4
		Advantage	2 marks	
	ii.	Infix to Postfix	3 marks	6
		Infix to Prefix	3 marks	
OR	iii.	Algorithm for push, pop and display	(2 marks *3)	6

Q.5	i.	Binary search	2 marks	4
		Advantages	2 marks	
	ii.	Programming	3 marks	6
		Algorithm	3 marks	
OR	iii.	a. resultant hash table after inserting keys	(2+2) marks	6
		b. total number of hash collision	2 marks	

Q.6	i.	Graph	2 mark	4
		Traversal techniques	2 mark	
	ii.	Definition or Step Marking	6 marks	6
	iii.	a. Heap	2 marks	6
		b. Tree traversal technique	2 marks	
		c. Threaded binary tree	2 marks	

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