Q.4	i.	State the steps and convert the following expression from infix to postfix notation: R/D-Y*(G/C*(D-E)+B/Z)+S*A	**4**
	ii.	Explain towers of hanoi problem with three discs? Also write an algorithm to solve the tower of Hanoi problem.	**6**
OR	iii.	What is the advantage of circular queue over ordinary queue? Also Write an algorithm to implement insertion operation in circular queue?	**6**
Q.5	i.	Explain binary search with example? What are the advantages of binary search over linear search?	**4**
	ii.	Rearrange following numbers using Quick sort: 10, 6, 3, 7, 17, 26, 56, 32, 72	**6**
OR	iii.	Define hashing, hash function and hash table with example?	**6**
Q.6	i.	The inorder and preorder traversal of a tree are given below: Inorder: DBMINEAFCJGK Preorder: ABDEIMNCFGJK (a) Construct the corresponding binary tree (b) Determine the post order traversal of the tree drawn	**3**
	ii.	Show the result of inserting H, I, J, B, A, E, C, F, D, G, K, L into an initially empty AVL Tree. Specify the type of rotation after each insertion.	**7**
OR	iii.	Explain graph traversals with illustrative example.	**7**

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Total No. of Questions: 6 *Total No. of Printed Pages:4*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2019

CS3CO21 / IT3CO02 Data Structures

Programme: B.Tech. Branch/Specialisation: CS/IT

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.

Q.1	i.	If row-major order is used, how is the following matrix stored in memory? a b c d e f g h i (a) ihgfedcba (b) abcdefghi (c) cfibehadg (d) adgbehcfi	**1**
	ii.	In recursion,the condition for which the function will stop calling itself is? (a) Best case (b) Worst case (c) Base case (d) There is no such condition	**1**

	iii.	What is the output of following function for start pointing to first node of following linked list?
		1->2->3->4->5->6
		void fun(struct node* start)
		{ if(start == NULL)
		return;
		printf("%d ", start->data);
		if(start->next != NULL)
		fun(start->next->next);
		printf("%d ", start->data); }
		(a) 1 4 6 6 4 1 (b) 1 3 5 1 3 5
		(c) 1 2 3 5 (d) 1 3 5 5 3 1
			1

P.T.O.

iv. Is it possible to create doubly linked list using only one pointer with every node? **1**

(a) Not possible

(b) Yes, possible by storing XOR of addresses of previous and next nodes.

(c) Yes, possible by storing XOR of current and next nodes.

(d) Yes, possible by storing XOR of current and previous nodes.

v. The following postfix expression with single digit operands is evaluated using a stack: **1**

8 2 3 ^ / 2 3 * + 5 1 * -

Note that ^ is the exponentiation operator. The top two elements of the stack after the first * is evaluated are:

(a) 6,1 (b) 5,7 (c) 3,2 (d) 1,5

vi. How many stacks are needed to implement a queue? Consider the situation where no other data structure like arrays, linked list is available to you. **1**

(a) 1 (b) 2 (c) 3 (d) 4

vii. Which of the following sorting algorithm is of priority queue sorting type? **1**

(a) Bubble sort (b) Insertion sort

(c) Merge sort (d) Selection sort

viii. A hash table of length 10 uses open addressing with hash function h(k)=k mod 10, and linear probing. After inserting 6 values into an empty hash table, the table is as shown below. **1**

0	
1	
2	42
3	23
4	34
5	52
6	46
7	33
8	
9	

Which one of the following choices gives a possible order in which

the key values could have been inserted in the table?

(a) 46, 42, 34, 52, 23, 33 (b) 34, 42, 23, 52, 33, 46

(c) 46, 34, 42, 23, 52, 33 (d) 42, 46, 33, 23, 34, 52

ix. Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the in-order traversal sequence of the resultant tree? **1**

(a) 7 5 1 0 3 2 4 6 8 9 (b) 0 2 4 3 1 6 5 9 8 7

(c) 0 1 2 3 4 5 6 7 8 9 (d) 9 8 6 4 2 3 0 1 5 7

x. In the …….. traversal we process all of a vertex's descendants before we move to an adjacent vertex. **1**

(a) Depth-First (b) Breadth-First

(c) With-First (d) Depth Limited

Q.2 i. Write down limitations of the array data structure? **2**

ii. Consider a two dimensional array A[20][10]. Assume 4 words per memory cell, the base address of array A is 100, elements are stored in row-major order and first element is A[0][0]. What is the address of A[11][5] ? **3**

iii. Explain pointer with example? Also write a program to implement pointer. **5**

OR iv. Explain: **5**

(a) Static and Dynamic Memory allocation

(b) Recursion with suitable example

Q.3 i. How can a polynomial such as $6x^6+4x^3-2x+10$ be represented by a linked list? **2**

ii. (a) Write an algorithm to delete a node from the beginning of the linked list. **8**

(b) Write an algorithm to add two polynomials.

OR iii. What are the advantages of linked list over array? Also write an algorithm to implement insertion operation in all position of linked list. **8**

Marking Scheme
CS3CO21 / IT3CO02 Data Structures

Q.1 i. If row-major order is used, how is the following matrix stored in memory? **1**

a b c
d e f
g h i

(b) abcdefghi

ii. In recursion,the condition for which the function will stop calling itself is? **1**

(c) Base case

iii. What is the output of following function for start pointing to first node of following linked list? **1**

1->2->3->4->5->6

```
void fun(struct node* start)
{     if(start == NULL)
       return;
      printf("%d ", start->data);
       if(start->next != NULL )
        fun(start->next->next);
      printf("%d  ", start->data);       }
```

(d) 1 3 5 5 3 1

iv. Is it possible to create doubly linked list using only one pointer with every node? **1**

(b) Yes, possible by storing XOR of addresses of previous and next nodes.

v. The following postfix expression with single digit operands is evaluated using a stack: **1**

8 2 3 ^ / 2 3 * + 5 1 * -

Note that ^ is the exponentiation operator. The top two elements of the stack after the first * is evaluated are:

(a) 6,1

vi. How many stacks are needed to implement a queue? Consider the situation where no other data structure like arrays, linked list is available to you. **1**

(b) 2

vii. Which of the following sorting algorithm is of priority queue sorting type? **1**

(d) Selection sort

viii. A hash table of length 10 uses open addressing with hash function h(k)=k mod 10, and linear probing. After inserting 6 values into an empty hash table, the table is as shown below. **1**

0	
1	
2	42
3	23
4	34
5	52
6	46
7	33
8	
9	

Which one of the following choices gives a possible order in which the key values could have been inserted in the table?

(c) 46, 34, 42, 23, 52, 33

ix. Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the in-order traversal sequence of the resultant tree? **1**

(c) 0 1 2 3 4 5 6 7 8 9

x. In the …….. traversal we process all of a vertex's descendants before we move to an adjacent vertex. **1**

(a) Depth-First

Q.2 i. Limitations of the array data structure (0.5 mark*4) **2**

ii. What is the address of A[11][5] **3**

Ans- 560

iii. Definition 1 mark **5**
Example 1 mark
Program 3 marks

OR iv. Explain: **5**
(a) Static and Dynamic Memory allocation 2.5 marks
(b) Recursion with suitable example 2.5 marks

Q.3 i. Polynomial such as $6x^6+4x^3-2x+10$ be represented by a linked list **2**
(As per explanation) 2 marks

ii. (a) Algorithm to delete a node from the beginning of the linked list. **8**
4 marks
(b) Algorithm to add two polynomials. 4 marks

OR	iii.	Advantages of linked list over array	2 marks	**8**
		Algorithm to implement insertion operation in all position of linked list.	6 marks	
Q.4	i.	State the steps and convert the following expression from infix to postfix notation:		**4**
		R/D-Y*(G/C*(D-E)+B/Z)+S*A (As per answer)	4 marks	
	ii.	Towers of hanoi problem with three discs	3 marks	**6**
		An algorithm to solve the tower of Hanoi problem.	3 marks	
OR	iii.	Advantage of circular queue over ordinary queue	3 marks	**6**
		Also An algorithm to implement insertion operation in circular queue	3 marks	
Q.5	i.	Binary search with example	3 marks	**4**
		Advantages of binary search over linear search	1 mark	
	ii.	Rearrange following numbers using Quick sort:		**6**
		10, 6, 3, 7, 17, 26, 56, 32, 72 (As per answer)	6 marks	
OR	iii.	Define		**6**
		Hashing with example	2 marks	
		Hhash function with example	2 marks	
		Hash table with example	2 marks	
Q.6	i.	The inorder and preorder traversal of a tree are given below:		**3**
		Inorder: DBMINEAFCJGK		
		Preorder: ABDEIMNCFGJK		
		(a) Construct the corresponding binary tree	1.5 marks	
		(b) Determine the post order traversal of the tree drawn	1.5 marks	
	ii.	Show the result of inserting H, I, J, B, A, E, C, F, D, G, K, L into an initially empty AVL Tree. Specify the type of rotation after each insertion.(As per answer)	7 marks	**7**
OR	iii.	Graph traversals with illustrative example.		**7**
		BFS	3.5 marks	
		DFS	3.5 marks	

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