

Unique Paper Code : 32341301-OC
 Name of the Paper : Data Structures
 Name of the Course : B.Sc. (H) Computer Science
 Semester : Third (III)
 Duration of Examination : Three Hours
 Maximum Marks : 75 marks

Instructions for candidates:
 Attempt any 4 questions out of 6 questions.

Q1	<p>Write a recursive function 'reverse()' to input a line and print in reverse order. State whether the function is using Tail recursion or non-tail recursion? Show the status of run time stack when 'abcd\n' is given as input in the reverse() function. Convert the reverse() function into non-recursive function using Stack. State whether Stack is a LIFO or a FIFO structure.</p> <p>Following definition of a recursive function is given:</p> $ \begin{aligned} h(n) &= 0 \text{ if } n=0; \\ &= n \text{ if } n > 4 \\ &= h(2+h(2n)) \text{ if } n \leq 4 \end{aligned} $ <p>What is the value of h(n) if n = 1?</p>	
Q2	<p>The following list of numbers is given</p> <p>3, 28, 45, 23, 12, 26, 90, 56, 76</p> <p>To search a given number in the above list, which of the searching technique (linear/binary) is best suited. What is the time complexity of the suggested technique? Does hashing the above numbers improve the search efficiency. Draw a hash table with open addressing and a size of 11. Use the hash function "k%11" and linear probing for collision resolution. Insert the above keys into your table (in that order). Show the status of table after each insertion.</p> <p>Sort the above numbers using a divide and conquer algorithm. Specify the algorithm and show each step of the algorithm.</p>	
Q3	<p>If a triangular matrix of n x n dimension is stored as a 1D array, how many elements will be there in 1D array? Suppose the following triangular matrix is given:</p> <pre> 2 0 0 0 3 8 0 0 </pre>	

	<p>4 0 6 0 0 5 2 0</p> <p>Show the elements of the 1D array if the matrix is stored by i) rows ii) columns iii) diagonals (lowest diagonal first) iv) diagonals (highest diagonal first). Write the code of <code>get(int i, int j)</code> function which returns the element stored at <code>i</code>th row and <code>j</code>th column of the given matrix. Give the necessary class definitions. If the matrix is sparse, is it a better idea to use linked lists? Justify.</p>	
Q4	<p>Draw a binary search tree for the following sequence:</p> <p>55, 45, 89, 35, 99, 23, 78, 12, 0, 25, 69, 49</p> <p>Show each step separately. Is it a complete binary tree? Justify. Next, delete the node having value 55. Use delete by merging method. What is the effect on the height of the resulting tree? Write a function to perform the following operations on a binary search tree i) Count the number of leaves ii) Calculate the height of the tree Give the necessary class definitions.</p>	
Q5	<p>Draw the binary search tree corresponding to the following traversals</p> <p>Preorder traversal: JCAEGFMR Inorder traversal: ACEFGJMR</p> <p>Give the post order traversal of the constructed tree. What are the advantages of B-tree over binary search tree? Construct a B tree of order 5 by inserting the following keys:</p> <p>9, 14, 3, 16, 4, 1, 17, 6, 5, 28</p> <p>Show the B tree diagrammatically after each key insertion</p>	
Q6.	<p>Write a template function to insert a new node <code>p</code> into a single linked list before the node <code>q</code> where <code>p</code> and <code>q</code> are the node pointers. The function takes <code>p</code> and <code>q</code> as input. Give the necessary class definitions. Describe the situation in which double linked list has an advantage over single linked list. Does self-organising the list helps in searching? What are the different ways of self-organizing lists? For a given linked list having A, B, C, D as nodes, show the list after each step using Move to Front method. Steps are: i) search D, ii) search D iii) search B iv) search A v) search B vi) search D vii) search A viii) search B</p>	