

Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech. / M. Tech. / Ph.D.

Branch :CSE

Semester :III

Title of the Course : Data Structures & Algorithms

Course Code :CS202

Time: 3 Hours

Maximum Marks: 50

Section A: Carry only one (01) question paper of 10 parts of 01 mark each and all parts are compulsory.

1. What is Garbage Collection? How is it different from Garbage Compaction?
2. Consider the linear arrays AAA(5:50), Find the number of elements in each array.
3. What is the complexity of Bubble sort algorithm.
4. Explain what $g(n) = O(f(n))$ means.
5. Write down the tree which is created by putting the following data into an empty tree in order. The key of left child is less than or equal to the key of parent, while the key of right child is more than or equal to the key of parent. Include all intermediate stages.
L D F A S H I O N
6. Write the following function that generates a tree from the input data by using recursion.
void treeinsert_r(char c, NodePointer p);
c means a input data. p means a current node. And display the traversed result by inorder.
7. Describe how a {stack,queue} can be represented using a linked list?
8. Define the ordered list ADT.
9. Draw a picture of a {linked list,circular linked list,doubly linked list} with nodes containing the integer values 1, 16, 27, 92. Do not use any dummy nodes.
10. Differentiate {DFS,BFS} of a graph.

Section B: Contains Five (05) questions of 5 marks each and any four (04) are to be attempted.

1. Rewrite the solution to the towers of Hanoi problem so that it uses only one recursive call instead of two.
2. Solve the following expression Q using stacks:
 $Q: ((A + B) * D) ^ (E - F)$
3. Suppose STACK is allocated N = 6 memory cells and initially STACK is empty i.e. TOP = 0. Find the output of the following module:
Set AAA = 2 and BBB = 5
Call PUSH(STACK, AAA)
Call PUSH(STACK, 4)
Call PUSH(STACK, BBB+2)
Call PUSH(STACK, 9)
Call PUSK(STACK, AAA + BBB)
Repeat while TOP != 0
 call POP(STACK, ITEM)
 Write ITEM
4. Suppose POLY1 and POLY2 are polynomials (in one variable) which are stored as header circular lists using the same parallel arrays COEFF, EXP and LINK. Write a procedure which finds sum SUMPOLY of POLY1 and POLY2.

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5. Design a method for keeping two stacks within a single linear array so that neither stack overflows until all of memory is used and an entire stack is never shifted to different location within the array. Write algorithm PUSH1 & PUSH2, POP1 and POP2 to manipulate the two stacks.

Section C: Contains Three (03) questions of ten (10) marks each and any two (02) are to be attempted.

1. Show the content of a hash array with B buckets with S slots, after insertion of the following strings FDNIFHFJOVEYPHWDBJMG , using hash function and {linear probing, quadratic probing, rehashing, chaining} to deal with overflow.
2. Explain why the time complexity of searching for elements in a hash table, where conflicts are resolved by chaining, decreases as its load factor α decreases. Recall that α is defined as the ratio between the total number of elements stored in the hash table and the number of slots in the table.
3. Consider the following max-heap $H = 37, 12, 30, 10, 3, 9, 20, 3, 7, 1, 1, 7, 5$
Write the exact output of the following Extract-All algorithm run on H