(Pages : 4) 9720

Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, January 2016
(2013 Scheme)
13.306 : DATA STRUCTURES AND ALGORITHMS (FR)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** Questions.

1. Explain the meaning of O Notation. Illustrate with an example.
2. Deduce the expression for worst-case running time of selection sort.
3. What is the effect of the following code snippets on matrix A of size n × n ? Write the expression representing the running time for the snippet.

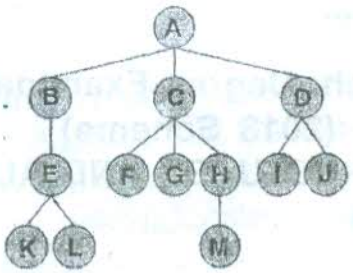
```
for(i=0; i<n; i++)
for(j=0; j<n; j++)
{
    temp=A[n – i – 1] [j];
    A[n – i – 1] [j] = A[i] [j];
    A[i] [j]=temp;
}
```

4. Show the post-fix and pre-fix forms of the expression P – Q * R – (S – T^U^V*W)+Z. Assume that ^ is the exponentiation operator and has right-to-left associativity.
5. Show the final expression tree for the following arithmetic expression :

   A – B * (C – D – E) * (F – (G / F – I)) – K.

P.T.O.

6. For the following tree, show the left-most-child-right-sibling representation.



7. Write the algorithm for best-fit allocation.
8. Distinguish between internal and external fragmentations.
9. Illustrate how chaining is used for collision resolution in hashing.
10. Give example of a data structure where the largest element can be read in constant time and a new element can be inserted in $O(\log_2 n)$ where n is the number elements. Justify your answer. **(2×10 = 20 Marks)**

PART – B

Answer **any one full** question from **each** Module.

MODULE – 1

11. a) Briefly outline the concept of step-wise refinement. 5

    b) Write an algorithm that finds the smallest digit in a positive integer. Estimate the worst and best case running times of this algorithm in terms of number of digits. 7

    c) Assume that a character string is represented as a circular double linked list, where each character is stored in a node. Write a C function that checks if the string is a palindrome (i.e., read the same way in both directions like MALAYALAM). Assume the following structure for nodes : Struct node {int val; struct node* next; struct node*prev;}; 6

    d) Draw a circular double linked list with the header node and one data node. 2

OR

12. a) Distinguish between top-down and bottom-up styles of program design. 3

    b) List out any four factors that affect the running time of an algorithm. 4

    c) Write a C function that accepts an array and reverses it efficiently. 7

    d) Write an algorithm/C function that checks if a square matrix is upper triangular. What is the running time of your algorithm ? 6

MODULE – 2

13. a) Show contents of the stack after each token while evaluating the expression 2 – 7 * 8 / 2 + 9. 5

b) Explain how insertion and deletion can be efficiently done in a queue implemented using two stacks. You don't have to write the algorithm/code. 6

c) Write a C function that counts the number of nodes in a binary tree. Assume that the tree node has the following structure : struct node{int val; struct node * left; struct node * right;}; 4

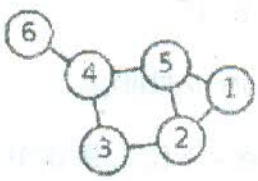
d) Distinguish between input-restricted and output-restricted DEQUEUEs. 5

OR

14. a) Show that a full binary tree with k internal nodes will have k + 1 leaf nodes. 4

b) Assume that a binary search tree of n integers, which is also a complete binary tree, is represented using an array. Formulate and write an algorithm/ C function to produce sorted output from this tree without using any sorting algorithm. (Hint: - if the values are stored from indices 1 to n in the array, the values from indices floor (n/2) + 1 to n represent leaf nodes of the tree; floor(x) represents the largest integer smaller than x). 10

c) Show the adjacency matrix and adjacency list representations of the following un-directed graph. 6



MODULE – 3

15. a) Write an explanatory note on the boundary-tag method. Illustrate with an example. 10

b) Assume that memory partitions of the following sizes are available (in that order): 10K, 4K, 20K, 18K, 7K, 9K, 12K, 15K. Assume that three memory requests A, B and C of sizes 12K, 10K and 9K arrive in that order. Show the memory map (free and occupied regions of memory) when each of best-fit, worst-fit, first-fit and next-fit schemes is used for allocation. 10

OR

16. a) Write a brief note on garbage collection and compaction. **10**

b) Four jobs A, B, C and D make memory allocation requests for 240K, 120K, 60K and 130 K respectively. Assume that the initial pool of memory available is 1024K and that memory is allocated when job starts and de-allocated when job ends. Show the memory map (allocated and free areas) after each allocation and de-allocation if buddy system is used. Assume that the jobs start and end in the following order :

A starts, B starts, C starts, B ends, A ends, D starts, D ends, C ends. **10**

MODULE – 4

17. a) Show the final position of pivot elements after each partition step when quick sort is used to sort the list of numbers 5, 2, 3, 9, 0, 2, 1, 10, 12. Assume that the first element in each sub-list is chosen as the pivot. **8**

b) Estimate the running times of insertion sort in the worst and best-cases and deduce the expression, in terms of size of the list, for each case. **8**

c) Illustrate mid-square and folding techniques in hashing. **4**

OR

18. a) Show, pictorially or otherwise, the splitting and merging phases of merge sort when applied to the following list: 12, 0, 7, 2, 8, 3, 9, 1, 6, 10. **7**

b) Explain the linear probing method for collision handling in hashing. **6**

c) Show the steps in forming a max-heap for the list of numbers 3, 5, 1, 9, 0, 10, 4. **7**

(20×4 = 80 Marks)