2015

DATA STRUCTURE & ALGORITHM

(ECEN 2102)

Time Alloted : 3 Hours   *Full Marks : 70*

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : **[10×1=10]**

   i) Maximum possible height of an AVL Tree with 7 nodes is

      (a) 3   (b) 4

      (c) 5   (d) 6

   ii) The best case complexity of insertion Sort is

      (a) $O(n^2)$ (b) $O(n \log n)$

      (c) $O(n)$ (d) $O(\log n)$

   iii) Which data structure is used for the breadth first traversal of a graph?

      (a) Stack   (b) Tree

      (c) Queue   (d) Linked List

   iv) Which data structure is used in Recursion?

      (a) Stack   (b) Tree

      (c) Queue   (d) Graph

   v) The postfix equivalent of the prefix expression * + a b − c d is

      (a) a b + c d −   (b) a b c d + − *

      (c) a b + c d * −   (d) a b + − c d *

   vi) In a circularly linked list organization, insertion of a record in the beginning involves the modification of

      (a) no pointer   (b) 1 pointer

      (c) 2 pointers   (d) 3 pointers

   vii) Among the following time complexities, which one is the best :

      (a) $O(n)$ (b) $O(2n)$

      (c) $O(n \log_2 n)$ (d) $O(n^2)$

   viii) There are 8, 15, 13 and 17 nodes in 4 different trees. Which one of them can form a full as well as complete binary tree?

      (a) Tree with 8 nodes   (b) Tree with 15 nodes

      (c) Tree with 13 nodes   (d) Tree with 17 nodes

   ix) If a node having two children is deleted from a binary tree, it is replaced by its

      (a) Inorder predecessor   (b) Inorder successor

      (c) Preorder predecessor   (d) Preorder successor

   x) The time complexity of multiplying two matrices of order m×n and n×p is

      (a) mnp   (b) mn^2p

      (c) mp   (d) n^2

GROUP - B

2. (a) What is an algorithm? Describe the characteristics of an algorithm.

(b) For the function defined by $f(y) = 2y^3 + 3y^2 + 1$ show that $f(y) = O(y^3)$.

(c) DAT is a 25×4 array stored in row major order. The base address of DAT is 200. Calculate the address of DAT[12][3]. Width of the data stored in each cell of the array is 4.

(d) Write an algorithm or a pseudo-code to reach the middle node of a singly-linked list with odd number of nodes by traversing the list only once.

(1+5)+2+2 = 12

3. (a) A singly-linked list contains integer data. Write an algorithm or a pseudocode to delete the node containing maximum value.

(b) A circular linked list contains integer data. Write an algorithm or a pseudocode to find the sum of the values stored in the circular linked list.

(c) trip(S) represents the triplet representation of a sparse matrix S. Write an algorithm or a pseudo-code to find the transpose of the matrix S using trip(S).

5+4+3 = 12

GROUP - C

4. (a) Write down any four applications of a stack.

(b) Convert the following infix expression to postfix form using a stack :

$X + Y * Z + (P * Q + R) * S$, [Show all intermediate steps]

(c) Guess the output of the following function-call :

printme(0) ;

where printme() is a recursive function ;

void printme (int n)

```
{
    {
        if (n<10)
        {
            printme(n+1) ;
            printf(" %d ", n) ;
        }
    }
}
```

(d) Write down the advantages of circular queue over a simple queue.

2+6+2+2 = 12

5. (a) Write down any four applications of queues.

(b) Write an algorithm or pseudo-code to evaluate postfix expression using stack and use it to evaluate 2 3 1 * + 9 −. Write all intermediate steps.

(c) Write a recursive function to find the sum of first n natural numbers.

2+(3+4)+3 = 12

Group - D

6. (a) The in-order and pre-order traversal sequence of a binary tree is given below :

In-order : D B G A H E I C F

Pre-order : A B D G C E H I F

Draw the binary tree and explain the logic used to construct the tree.

(b) Write the result of running BFS and DFS on the directed graph given below using vertex 3 as the source. Show the status of the data structure used at each stage.
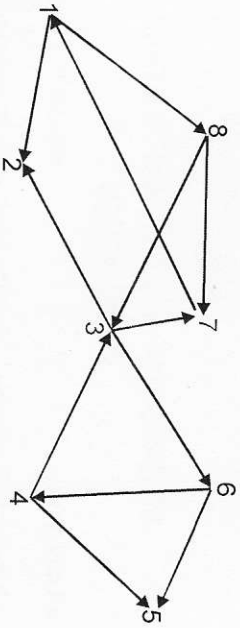
4+(4+4) = 12

7. (a) Explain with an example the various methods that can be used to represent a graph in the computer's memory.

(b) Set up an AVL tree while inserting the following nodes in the order specified.

3, 2, 1, 4, 5, 6, 7, 16, 15, 14. Indicate the balance factors and specify the rotations taking place.

6+6 = 12

GROUP - E

8. (a) The following values are to be stored in a hash table

25, 42, 96, 101, 102, 162, 197

Describe how the values are hashed by using division method of hashing with a table size of 7. In the case of collision, use chaining as the method of collision resolution.

(b) How bubble sort may be improved by reducing the time complexity? Explain.

(c) Differentiate sequential search and binary search. Which search method is more suitable for a singly linked list and why?

5+4+(2+1) = 12

9. (a) Make a BST for the following sequence of numbers.

45, 32, 90, 34, 68, 72, 15, 24, 30, 66, 11, 50. Show all intermediate trees.

(b) Explain any one of the following :

(i) Open hashing technique

(ii) Closed hashing technique

6+6 = 12

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