BRAINWARE UNIVERSITY

Course – MCA

Data Structure with Python (MCA202)

(Semester – 2)

Time allotted: 3 Hours   **Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Questions)   10 x 1 = 10

1. *Choose the correct alternative from the following*

(i)   Which of the following is not a property of an algorithm?

    a. Input   b. Output

    c. Definiteness   d. Timeliness

(ii) Which of the following data structure is used to perform infix expression to postfix expression conversion?

    a. Stack   b. Queue

    c. List   d. Heap

(iii) The worst case occurs in linear search algorithm when

    a. item is somewhere in the array   b.   item is not in the array

    c. item is the first element in the array   d.   item is the last element in array or not there at all

(iv) 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

(v)   Which of the following data structure is following FIFO (First In First Out)nature?

    a. Stack   b. Queue

    c. Graph   d. Binary search tree

(vi) A full binary tree with n leaves contain

    a. n nodes   b. log n nodes

    c. (2n-1) nodes   d. 2^n nodes

(vii)   The searching technique that take O(1) time to find a data is
        a.   Linear search   b.   Binary search
        c.   Hashing   d.   Tree search

(viii)   Which of the following sorting method would be most suitable for sorting a list which is almost sorted?
        a.   Bubble sort   b.   Merge sort
        c.   Quick sort   d.   Selection sort

(ix)   In a circular linked list
        a.   Components are linked together in some sequential manners   b.   There is no beginning and no end
        c.   Components are arranged hierarchically   d.   None of these

(x)   The number of interchanges require to sort 5, 1, 6, 2, 4 in ascending order by bubble sort
        a.   6   b.   5
        c.   7   d.   8

Group – B

(Short Answer Type Questions)   3 x 5 = 15

Answer any *three* from the following

2.   Define Big-Oh? Prove that $p(x) = a_n x^n + a_{n-1} x^{n-1} + ... + a_2 x^2 + a_1 x + a_0$ is $O(x^n)$.   [2+3]

3.   Write an algorithm to perform PUSH and POP operation of STACK data structure   [5]

4.   What is the advantage of the circular Queue over linear Queue? What is the overflow and underflow conditions of Circular Queue?   [2+3]

5.   Compare the performance and operations between Bubble sort and Insertion sort.   [5]

6.   What is the precondition of the Interpolation search? Write a searching procedure of Interpolation search.   [2+3]

Group – C

(Long Answer Type Questions)   3 x 15 = 45

Answer any *three* from the following

7.   (a)   What is tree? What is binary tree? Describe the difference between two.   [2+1+2]

     (b)   Construct a binary tree whose nodes in two traversal orders are given below: [5]
          Pre-order: A B D E G H C F
          In-order : D B G E H A C F

(c) What is a max-heap data structure? Explain with example. [5]

8. (a) Write down the algorithm or python function of physically reverse to a linked list. [5]

(b) Explain the improvement of performance of binary search tree by the use of height-balanced tree. [3]

(c) Construct a height-balance tree by inserting the following elements in the given order: [7]
1, 2, 3, 4, 5, 6, 8, 9, 10, 7, 11
Explain all the necessary steps.

9. (a) Explain how divide and conquer technique is applied to the Quick sort algorithm. [2]

(b) Sort the following numbers by using Quick Sort algorithm: [5]
51, 71, 31, 61, 41, 11, 21, 81, 91, 11
Explain all the necessary steps.

(c) Write down the Quick sort algorithm. [5]

(d) Analyze the complexity of the Quick sort algorithm. [3]

10. (a) Define the Fibonacci binary tree as follows: If n=0 or n=1 tree consists a single node. If $n > 1$, tree consists of a root with Fibonacci tree of order n-1 as a left sub-tree and Fibonacci tree of order n-2 as right sub-tree. [2+2+2+4]
    i) In such tree a strictly binary tree?
    ii) What is the number of leaves in such tree for any value n?
    iii) What is the depth of the tree?
    iv) Write a recurrence relation to calculate the total number of nodes in the tree with proper initial condition.

(b) Prove that for any binary tree T, if N_0 is the number of terminal nodes and N_2 is the nodes of degree 2 then $N_0 = N_2 + 1$. [5]

11. (a) Define hashing. Explain collision resolution technique with suitable example. [2+5]

(b) Show the hash table structure when the given input values are 4371, 1423, 6273, 9149, 3494, 8679, 1989, and stored in the given order using the linear probe collision resolution method. Assume a hash table of size 10 and use the hash function H(K)=K MOD 10 [8]