U.G. 3rd Semester Examination - 2020

COMPUTER SCIENCE

[HONOURS]

Course Code : COM.SC-H-CCL-T-305

(Data Structures)

Full Marks : 60 Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

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

1. Answer any **ten** questions: 2×10=20

   a) Define time complexity and space complexity.

   b) What are the major differences between linear data structure and non-linear data structure?

   c) What are the limitations of recursion?

   d) What is a queue? Give two applications of queue.

   e) Explain postfix expression.

   f) Define strictly binary tree and almost complete binary tree.

   g) Note that a queue can be implemented using a linear linked list or a circular linked list. Which implementation is algorithmically more efficient?

   h) What is linear probing? Explain with an example.

   i) Write down various applications of stack.

   j) What is divide and conquer approach? Give an example.

   k) What is threaded binary tree? What is its usefulness?

   l) Define hash table and hash function.

2. Answer any **four** questions: 5×4=20

   a) Design an algorithm/pseudocodes for searching a value from an integer array using binary search. Write down the best case time complexity of the binary search algorithm. 4+1

   b) Find the post-order traversal of the binary tree using the following information:

In order: 10, 15, 17, 18, 20, 25, 30, 35, 38, 40, 50

Pre order: 20, 15, 10, 18, 17, 30, 25, 40, 35, 38, 50 5

c) Suppose a two dimensional array A of size M×N is in memory. If the address of A[p][q] = B, find the address of A[i][j] considering each element of the array can be stored in 3 byte memory word. 5

d) Apply quick sort algorithm considering the first element to be the pivot on an Array A1 = {5, 2, 3, 8, 7, 12, 2, 1, 10, 4, 3}. 5

e) Design algorithms/pseudocodes for the insert and delete operations in a priority queue. $2\frac{1}{2}+2\frac{1}{2}$

f) How collision can be resolved in hashing? Draw an almost complete binary tree that is not a strictly binary tree. 4+1

3. Answer any **two** questions: 10×2=20

a) i) Construct an AVL search tree if the elements are in the following order:

60, 70, 30, 20, 55, 90, 95, 80, 55, 35, 45, 40, 50.

ii) How directed graph are represented using adjacency linked-list?

iii) How can we compute the in-degree and out-degree of the vertices of a graph when the graph is represented by an adjacency linked-list? 5+2+3

b) i) Convert the following infix expression to prefix notation: (A–B)/((C*D)+E).

ii) Construct the stack if the elements are in the following order and the size of the array is 5. Show all the steps.

PUSH(40);

PUSH(60);

PUSH(70);

PUSH(80);

PUSH(70);

POP() ;

POP();

PUSH(100);

PUSH(200);

POP();

POP();

POP();

POP();

PUSH(45);

PUSH(56). 5+5

c) i) Explain the working principle of insertion sort.

ii) Apply selection sort to the list of following elements:

92, 25, 86, 48, 57, 33, 12, 108, 10.

iii) What is the best case time complexity of quick sort algorithm? 3+6+1

d) i) Design algorithms to perform insert and delete operations on a stack when the stack is represented by a linked list.

ii) Design an algorithm/pseudocode to delete an item from a doubly linked list.

iii) Name a sorting algorithm that does not require any comparison. (3+3)+3+1

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