Question Paper

Exam Date & Time: 22-Nov-2018 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
THIRD SEMESTER B.SC. Applied Sciences in Engg.
END - SEMESTER THEORY EXAMINATIONS NOVEMBER - 2018
DATA STRUCTURES [ICS 231]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

1) A) Compare two functions n^2 and $2^n/4$ for various values of n, where $1 > n > 10$. Determine when second becomes larger than first. (6)

B) Given the following program segment, compute the time complexity of the program using tabular method. Also, express the time complexity of the program using Big-oh notation. (6)

```
int sumofnaturalnumbers (int a[ ],int n)
1 {
2       float s = 0;
3       for (int i = 1; i <= n; i++)
4               s += a[i];
5       return s;
6 }
```

C) There are three towers and four disks of different diameters placed on the first tower. The disks are in order of decreasing diameter as one scans up the tower. Monks were supposed to move the disks from tower 1 to tower 3 obeying the following rules. (8)
i) only one disk can be moved at any time and
ii) no disk can be placed on top of a disk with smaller diameter.
Write a recursive template function in C++ that prints the sequence of moves that accomplish this task.

2) A) What is System Stack? Briefly explain System stack after function call with neat sketch. (8)

B) (6)

How you are implementing abstract data type (ADT) stack. Write the data member declarations and constructor definition of stack using class template in C++.

C) What is Queue? Consider the elements A, B, C, D and E, and show the restrictions on a queue if we insert A, B, C, D and E in that order. Write the following sequence of events of queue using 1D array. (6)
a) Add(A) b) Add(B) c) Add(C) d) Delete(A) e) Add(D) f) Add(E) g) Delete(B) h) Delete(C)

3) A) Write an algorithm/ psedocode to evaluate a postfix expression. Execute your algorithm using the postfix expression as your input : ab+cd+*f^ . (8)

B) What is Circular Queue? Give the function (in C++) for inserting and removing an item into a Circular Queue. (8)

C) Write down any four applications of queues. (4)

4) A) What do you mean by hashing? Explain any five popular hash functions. (12)

B) Let X = (X1, X2, X3,....Xn) and Y= (Y1, Y2, Y3,....Xm) be two linked lists. Write a template function in C++ to merge the lists together to obtain the linked list Z such that Z = (X1, Y1, X2, Y2,....Xm, Ym,Xm+1....Xn) if m<=n or Z = (X1, Y1,X2,Y2....Xn,Yn,Yn+1....Ym) if m>n. (8)

5) A) Write the member functions in C++ [use class templates] for doubly linked list (DLL) to insert an item at front, to insert an item at the rear and to delete a given item. Use the following declarations only. The functions should print appropriate message(s). (12)

a) template <class T>
void DLL<T>::InsertFront(T x)

b) template <class T>
void DLL<T>::InsertRear(T x)

c) template <class T>
void DLL<T>::Delete(T x)

B) Given a set of input representing the nodes of a binary tree, write a an iterative algorithm that must be able to output the pre-order and in-order traversals. (8)

6) What is a Binary Search Tree (BST)? Make a BST for the (12)

A) sequence of numbers {45, 36, 76, 23, 89, 115, 98, 39, 41, 56, 69, 48}.Traverse the tree in Pre-order, In-order and post-order.

B) Draw the expression tree of the infix expression ((a + b)+ c * (d + e)+ f)* (g + h). Convert it in to Postfix expressions. (8)

7) A) What is quick sort? Sort the given list {24 56 47 35 10 90 82 31} using quick sort method. (8)

B) Differentiate between minheap and maxheap with an example. Sort the given list { 20, 12, 25 6, 10, 15, 13} using Heap Sort technique and displaying each step. (12)

8) A) Consider the following specification of a graph G (6)

V(G) = {1,2,3,4}
E(G) = {(1,2), (1,3), (3,3), (3,4), (4,1)}
(i) Draw an undirected graph.
(ii) Draw its adjacency matrix.

B) Show the result of running Breadth First Search and Depth First Search on a directed graph as shown in Fig. 1 using vertex 1 as source. Show the status of the data structure used at each stage. (8)

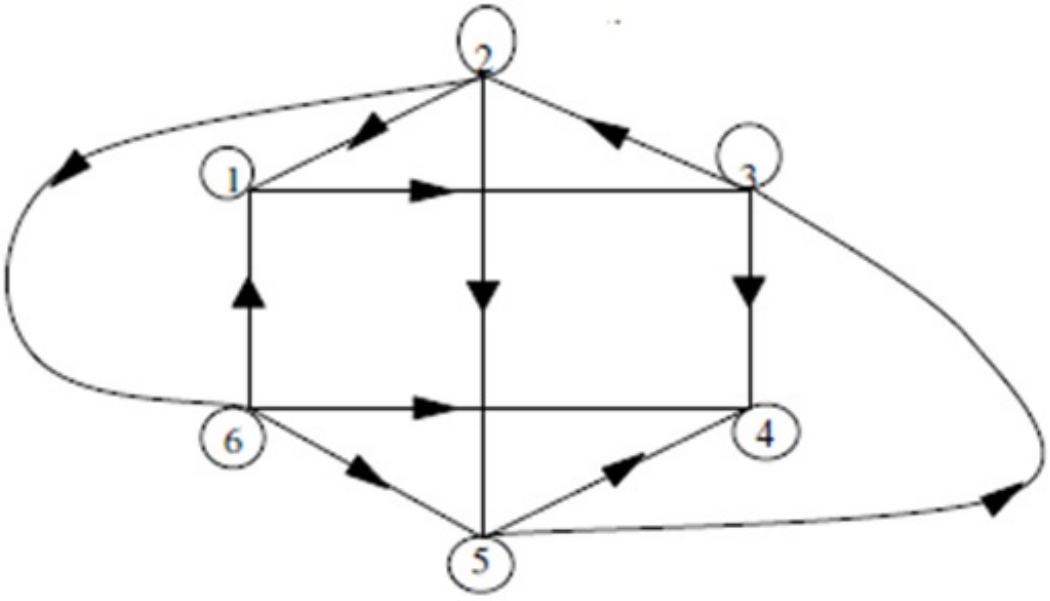

Fig. 1

C) Write the applications of graph data structure (at least 4) used in various engineering fields. (6)

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