Question Paper

Exam Date & Time: 01-Dec-2018 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
II SEMESTER B.S. ENGG. END SEMESTER EXAMINATION - NOV./ DEC. 2018
Data Structures [CS 123]

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

Answer 5 out of 8 questions.
Missing data, if any, may be suitably assumed

1) A) What is an algorithm? What are the characteristics of a good algorithm? (6)

B) How do you find the complexity of an algorithm? What is the relation between the time and space complexities of an algorithm? Justify your answer with an example. (8)

C) The factorial function n! has value 1 when n <=1 and value n*(n-1)! when n>1. Write recursive function to compute n! (6)

2) A) The Fibonacci numbers are defined as $f_0=0$, $f_1=1$, and $f_i=f_{i-1} + f_{i-2}$ for i>1. Write iterative function to compute f_i. (6)

B) What is a Stack? Write a function with all necessary operations on stack. (8)

C) Write an algorithm for evaluation of postfix expression using stack. (6)

3) A) Convert the infix expression ((a+b)*c-(d-e))^(f+g) to postfix expression using stack. Show the symbol scanned, postfix string and operStack contents in each scan in the form of table. (6)

B) What are circular queues? Write down routines for inserting and deleting elements from a circular queue implemented using arrays. (8)

C) Write the following algorithm/function for singly linked list. Use the following declarations only. The functions should (6)

print appropriate message(s).
i) void InsertFront(int info)
ii) int Search(int item)

4) A) Write the algorithm/function for doubly linked list (DLL) 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). (6)
i) void InsertRear(int x)
ii) void Delete(int x)

B) Write a recursive function for binary search. Compare the time complexities of linear and binary search techniques. (8)

C) Define a Tree? Prove the following by considering the tree shown in Figure 1: (6)

i) The maximum number of nodes on level i of a binary tree is 2^i-1, i $\geq$ 1.

ii) The maximum number of nodes in a binary tree of depth k is 2^k-1, k $\geq$ 1

Justify your answer?

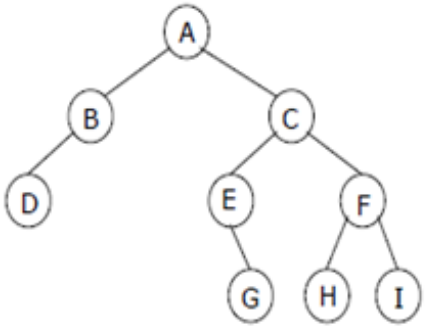

Figure 1: Binary tree

5) A) What is a Binary Search Tree (BST)? Make a BST for the following sequence of numbers. (12)
45, 36, 76, 23, 89, 115, 98, 39, 41, 56, 69, 48
Traverse the tree in Pre-order, In-order and post-order.

B) What are expression trees? Represent the given expression (a-b)/((c*d)+e)) using a tree. Comment on the result that you get when this tree is traversed in Pre-order, In-order and post-order. (8)

6) A) Define a graph. What are the different ways of representing a graph? Represent the following graph (refer Fig. 2) using those ways. (8)

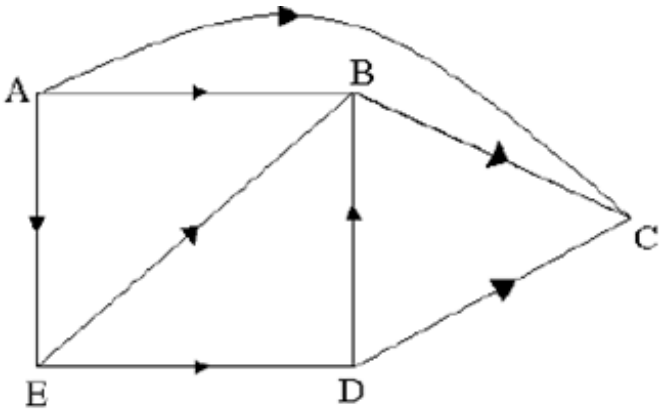

Figure 2

B) Show the result of running Breadth First Search and Depth First Search on the directed graph given below (refer Fig. 3) using vertex 3 as source. Show the status of the data structure used at each stage. (12)

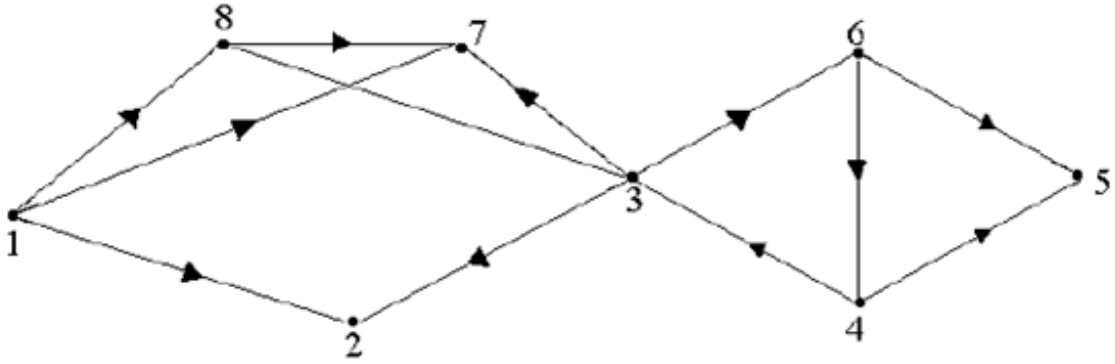

Figure 3

7) Sort the following sequence of keys using merge sort. (10)

A) 66, 77, 11, 88, 99, 22, 33, 44, 55

B) What is quick sort? Sort the following array using quick sort method. (10)

24 56 47 35 10 90 82 31

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

A) 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. Use chaining as the method of collision resolution.

B) What is a height balanced tree (AVL)? Explain how the height is balanced after addition/deletion of nodes in it? (6)

C) Write short notes on Time Complexity, Big O notation and Insertion Sort. (6)

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