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Code No. : 14128 (B)

VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD

B.E. (CBCS) IV-Semester Main Examinations, January-2021

Introduction to Data Structures

(Open Elective-II)

Time: 2 hours

Max. Marks: 60

Note: Answer any NINE questions from Part-A and any THREE from Part-B

Part-A (9 × 2 = 18 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	How a singly linked list can be changed to circular linked list? Suggest some real time examples, where you can make use of circular linked list.	2	2	1	2
2.	How can you explain array as an Abstract Data Type? What are the advantages and disadvantages of arrays when compared with linked list?	2	2	1	1
3.	Illustrate the result of each operation in the sequence PUSH(S,4), PUSH(S,1), PUSH(S,3), POP(S), PUSH(S,8) and POP(S) on an initially empty stack S	2	3	2	2
4.	What is a queue? Why it is known as FIFO data structure? Write any one application for queue.	2	2	2	2
5.	What is a tree? What is a binary tree? How it is different from a Binary search tree?	2	2	3	1
6.	Given the in order and pre order traversal, Construct the Binary Tree . Inorder Traversal : {4, 2, 1, 7, 5, 8, 3, 6} Preorder Traversal : {1, 2, 4, 3, 5, 7, 8, 6}	2	3	3	2
7.	How can you define a Graph? What are the constraints imposed on graph?	2	2	4	1
8.	Define spanning tree. Give one example. What are the two different types of spanning tree?	2	2	4	2
9.	Define the best case, worst case and average case complexity using an example.	2	2	5	1
10.	Consider the following code fragment and analyze the time complexity. int a = 0, b = 0; for (i = 0; i < N; i++) { a = a + rand(); } for (j = 0; j < M; j++) { b = b + rand(); }	2	3	5	2
11.	What is a self-referential structure? Give an example.	2	2	1	1
12.	What is the importance of array doubling in the implementation of stacks?	2	2	2	2

Part-B (3 × 14 = 42 Marks)

13. a) What is sparse matrix. How can you define sparse matrix as ADT? Assume that you are given with the following matrix. How can you represent sparse matrix efficiently?

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 9 & 0 \\ 0 & 8 & 0 & 0 & 0 & 0 \\ 4 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 5 \\ 0 & 0 & 2 & 0 & 0 & 0 \end{bmatrix}$$

b) Let *LIST* be a circular linked list. Design a code snippet

- i) To find the number of items in the *LIST*
- ii) To search the data item called *ITEM* in the *LIST*

14. a) Design C functions to perform the following operations on stack using array

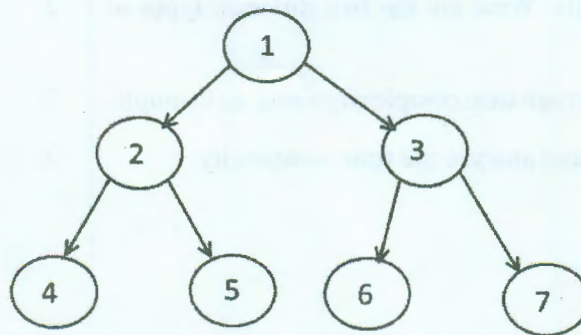
- i) insertion and deletion operations
- ii) stack full and stack empty operations

b) What are the steps performed to convert infix expression to postfix expression using stacks? Trace the infix to postfix algorithm (clearly showing the status of stack) to find the equivalent postfix expression for the following infix expression $A*(B+C)*D$

15. a) Construct a binary search tree from the given data {20,15,12,10,25,22}. Draw the corresponding trees after applying the following modifications

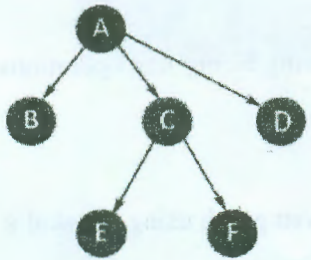
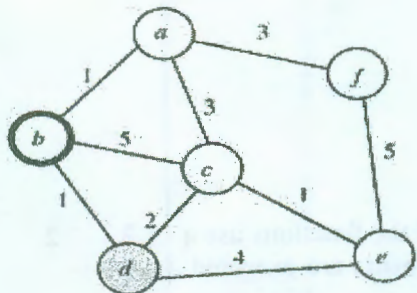
- i) Insert the data 14 into the obtained binary search tree
- ii) Delete the node 15

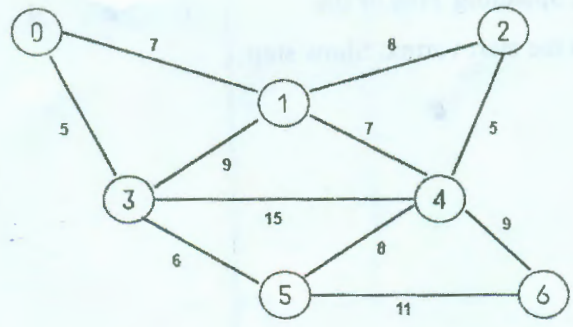
b)



Consider the above binary tree.

- i. Write the In order, Preorder and Post order traversal
- ii. Write C function to perform the recursive in order and preorder and post order traversal

<p>16. a)</p>	<p>Explain DFS algorithm. Traverse the following graph using DFS algorithm showing stack contents at each step.</p> 	<p>7 2 4 2</p>
<p>b)</p>	<p>Explain Prim's algorithm. Find the Minimum Cost Spanning Tree of the given graph using Prim's Algorithm by taking 'b' as the start vertex. Show step by step procedure.</p> 	<p>7 2 4 2</p>
<p>17. a)</p>	<p>What is the importance of asymptotic notation in data structure? What are the different types of asymptotic notation?</p>	<p>7 2 5 1</p>
<p>b)</p>	<p>What is time complexity and space complexity? Find the step count of the given code fragment using tabular method</p> <pre data-bbox="251 1400 1112 1680"> void add(int a[][MAX_SIZE],int b[][MAX_SIZE], int c[][MAX_SIZE],int rows,int cols) { int i,j; for(i=0;i<rows;i++) for(j=0;j<cols;j++) c[i][j]=a[i][j]+b[i][j]; } </pre>	<p>7 2 5 2</p>
<p>18. a)</p>	<p>Consider two sorted arrays A and B of size n each. Write an algorithm to find the median of the array obtained after merging both arrays.</p> <p>Note: <i>Median of a sorted array of size n is defined as the middle element when n is odd and average of middle two elements when n is even</i></p>	<p>7 2 1 2</p>

19.	<p>b) How can you reverse a string using stack? Illustrate with an example using step by step process.</p>	7	2	2	2
	<p>Answer any <i>two</i> of the following:</p>				
	<p>a) Implement C functions for performing the following binary tree operations.</p> <p>i. Copying binary tree</p> <p>ii. Testing for equality</p>	7	3	3	2
	<p>b) Find the Minimum Cost Spanning Tree of the given graph using Kruskal's Algorithm. Show step by step procedure.</p>	7	2	4	2
					
	<p>c) In a competition, four different functions are observed. All the functions use a single for loop and within the for loop, same set of statements are executed. Consider the following for loops:</p> <p>A) for(i = 0; i < n; i++)</p> <p>B) for(i = 0; i < n; i += 2)</p> <p>C) for(i = 1; i < n; i *= 2)</p> <p>D) for(i = n; i > -1; i /= 2)</p> <p>If n is the size of input(positive), which function is most efficient (if the task to be performed is not an issue)?</p> <p>Justify the reasons</p>	7	2	5	2

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	60
2	Knowledge on application and analysis (Level-3 & 4)	40
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	
