JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY
End Semester Examination, December 2024
B.Tech, Semester III, 2024-25

Roll No... 2023BTECH039

CS1131: Data Structure and Algorithms   Time: 2 hours   Max. Marks: 30

Instructions to students:
1. Do not write anything other than your roll number on question paper.
2. Mention all the assumptions for your answers clearly.

Q.1			
	A.	Write a **function** to exchange kth node from start and kth node from end of a singly linked list. The function should take the linked list as the argument and return the same linked list after the exchange has been done.	3 (LO2,3)

OR

struct BST{int data; struct BST * left; struct BST * right, int frequency;};

Given a BST of integer values and suppose you are asked to insert few new values into an existing binary search tree. You have to insert the value if the value is not found else you increment the frequency count of the node. Write a function to support this.

B. Consider an abstract data type of a queue containing integer data elements with the following specifications of the interface functions:

```
void enqueue (QUEUE *q, int element);
/* Insert an element in the queue */

int dequeue (QUEUE *q);
/* Remove an element from the queue */

queue * create();
/* Create a new queue */

int isempty (QUEUE *q);
/* Check if queue is empty */

int size (QUEUE *q);
/* Return the no. of elements in queue */
```

3 (LO2,3)

Given a Queue Q, write a **function** that **will find the maximum element in the queue**. You may only use queue operations such as enqueue, dequeue, size etc.. No other data structure can be used other than queues. Queue must remain intact after finding the maximum.

C. Write the functions required to build a maximum heap from an array.

OR

Suppose a priority queue is implemented using a Binary Heap data structure. Write the dequeue function.

3

(LO2,3)

Q.2.1	Consider the following sequence <23, 1, 6, 19, 14, 18>. Sort using **Quick sort.** _Show every step._	(2) (LO5)
Q.2.2	**Construct a** binary search tree for the scenario given below: In-order: 1,2,3,4,5,6,7,8,9,10,11 Post-order: 1,3,2,5,7,6,4,9,11,10,8	(2) (LO1,2)
Q.2.3	Using the concept of an **AVL tree**, insert the following elements <5, 2, 1, 6, 8, 3>. **Show the tree after every insertion. Mention the rotation performed if any.**	(3) : (LO1,2)

Q 2.4	Using the concept of a **B Tree**, answer the following:
	  A. Define a B Tree
	  B. Insert the elements <23, 1, 6, 19, 14, 18, 8, 24, 15 > to form a B Tree of order 5
		(3)
		(LO1,2)

Q.3.1 | Let G be a graph whose vertices are the integers 1 through 8, and let the adjacent vertices of each vertex be given by the table below:

vertex	adjacent vertices
1	(2,3,4)
2	(1,3,4)
3	(1,2,4)
4	(1,2,3,6)
5	(6)
6	(4,5)

A. Order the vertices as they are visited in a DFS traversal starting at vertex 1. Show the changes it the data structure that you choose.

(1.5+1.5 = 3)

B. Order the vertices as they are visited in a BFS traversal starting at vertex 1. Show the changes it the data structure that you choose. *(LO1,2)*

3.2.

A. Would you use the adjacency list structure or the adjacency matrix for a graph, G, that has 5000 vertices and 10,000 edges, and it is important to use as little space as possible.

B. Maya loves computer science and wants to plan her course schedule to take the following six CS courses. The course prerequisites shown.

Prerequisites:
CS 111: (none)
CS 112: CS111
CS 114: (none)
CS 115: CS 111
CS 110: CS 112, CS 115
CS 113: CS 114

1 + 1 = 2

(LO 3)

Find a sequence of courses that allows Maya to satisfy all the prerequisites. What is the sort that you would use? What is the schedule of courses that you would recommend?

Q.4	**A.** Draw the 10-item hash table resulting from hashing the keys 12, 44, 13, 88, 23, 94,11, 39, 20, and 14, using the hash function $h(i) = i \bmod 10$	
	1. Assuming collisions are handled by **linear probing**	2+2=4
	2. Assuming collisions are handled by **chaining**	(LO 3)
	B. What is/are the number of comparison/s that we have to perform to search for the key 39 in the data given in 4(A) if:	
	1. The data is stored as an unsorted array	1+1 =2
	2. Data is stored in a binary search tree	(LO4)