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Department of Computer Science & Engineering
End-Semester Exam Nov-2023

28/11/2023 (50)
(C)

Branch: B.Tech 5th Sem

Subject: Open Elective (Data Structures)

Code: CS-306

Max Marks: 50

Max Time: 03:00 hrs

Note: 1. All questions are compulsory.

2. Draw neat diagrams wherever necessary.

3. For the questions that are of one word or two words or one sentence answer, you also have to write the logic or procedure to get the answer.

Q1. What is the limitation of linear queue? Why circular queue is needed? Explain with proper example using insertion and deletion operation. [7 Marks]

Q2. Describe merge sort algorithm with suitable example (using input array 1, 15, 24, 26, 2, 13, 27, 38). Also, give the worst time complexity analysis of the algorithm. [7 Marks]

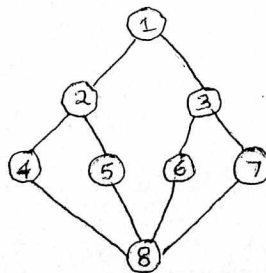
Q3. (a) What is hashing? What is collision? How collisions can be handled. Using the hash function 'key mod 7', insert the following sequence of keys in the hash table- [7 Marks]
50, 700, 76, 85, 92, 73 and 101

Use linear and quadric probing techniques for collision resolution.

(b) Insert the keys 79, 69, 98, 72, 14, 50 into the Hash Table of size 13. Resolve all collisions using Double Hashing where first hash-function is $h_1(k) = k \bmod 13$ and second hash-function is $h_2(k) = 1 + (k \bmod 11)$.

Q4. Explain heapsort algorithm with its time and space complexity. Apply heapsort for following input array $A = \{16, 14, 10, 8, 7, 9, 3, 2, 4, 1\}$. [7 Marks]

Q5. Explain Depth first search graph traversal technique with its algorithm, time complexity using following graph. [7 Marks]



Q6. What is the limitation of Binary Search Tree explain with example. Explain how AVL tree overcome this limitation. Construct AVL Tree for the following sequence of numbers- [7 Marks]
50, 20, 60, 10, 8, 15, 32, 46, 11, 48

Q7. (a) The postorder traversal of a binary tree is 8, 9, 6, 7, 4, 5, 2, 3, 1. The inorder traversal of the same tree is 8, 6, 9, 4, 7, 2, 5, 1, 3. Construct a binary tree from postorder and inorder traversal and calculate the height of the binary tree. [3+1+1+3=8 Marks]

(b) How many at least and at most number of elements is in a binary tree of height h , $h \geq 0$?

(c) What is the at least and at most height of a binary tree that contains n elements, $n \geq 0$?

(d) What is the time complexity of the following program? Explain your answer.

```

void fun (int n)
{
  if(n<1)
  return;
  else
  fun(n-1);
  printf("%d", n);
}
  
```