

B.TECH / ECE / 3RD SEM/ ECEN 2102/2017
DATA STRUCTURE
(ECEN 2102)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group - A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which of the given options provides the increasing order of asymptotic complexity of functions f_1, f_2, f_3 and f_4 ?
 $f_1(n) = 2^n, f_2(n) = n^{3/2}, f_3(n) = n \log n, f_4(n) = n^{(\log n)}$
(a) f_3, f_2, f_4, f_1 (b) f_3, f_2, f_1, f_4
(c) f_2, f_3, f_1, f_4 (d) f_2, f_3, f_4, f_1 .
- (ii) A program P reads in 500 integers in the range [0, 1, 2, ..., 100] expressing the scores of 500 students. It then prints the frequency of each score above 50. What would be the best way for P to store the frequencies?
(a) An array of 100 numbers
(b) An array of 500 numbers
(c) An array of 50 numbers
(d) A dynamically allocated array of 550 numbers.
- (iii) Evaluate the following postfix expression: $5\ 7\ +\ 6\ /$
(a) 4 (b) 2 (c) 1 (d) none of the above.
- (iv) Find the most appropriate matching for the following pairs
X: depth first search 1: heap
Y: breadth-first search 2: queue
Z: sorting 3: stack
(a) X-1 Y-2 Z-3 (b) X-3 Y-1 Z-2
(c) X-3 Y-2 Z-1 (d) X-2 Y-3 Z-1.
- (v) Which of the following data structures is best suited for efficient implementation of priority queue?
(a) Array (b) Linked List (c) Heap (d) Stack.

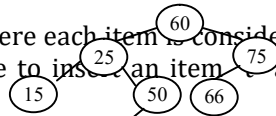
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- (vi) While inserting the elements 71, 65, 84, 69, 67, 83 in an empty binary search tree (BST) in the sequence shown, the element(s) in the lowest level is
(a) 65 (b) 69 (c) 67 (d) 69 and 67.
- (vii) Which of the following statement(s) is/are TRUE for an undirected graph?
P: Number of odd degree vertices is even
Q: Sum of degrees of all vertices is even
(a) P Only (b) Both P and Q
(c) Neither P nor Q (d) Q only.
- (viii) What will be the output of the following program?
- ```
#include <stdio.h>
void print(int n, int j)
{
 if (j >= n)
 return;
 if (n-j > 0 && n-j >= j)
 printf("%d \t%d,\t", j, n-j);
 print(n, j+1);
}
int main()
{
 int n = 8;
 print(n, 1);
}
```
- (a) 1 7, 2 6, 3 5, 4 4 (b) 1 7, 2 6, 3 5  
(c) 1 2, 3 4, 5 6 (d) 1 7, 2 6.
- (ix) What is the Average case time for quick sort to sort an array of  $n$  elements?  
(a)  $O(\log n)$  (b)  $O(n)$  (c)  $O(n \log n)$  (d)  $O(n^2)$ .
- (x) A circular linked list is used to represent a Queue. A single variable  $p$  is used to access the Queue. To which node should  $p$  point such that both the operations  $enQueue$  and  $deQueue$  can be performed in constant time?  
(a) not possible with a single pointer (b) rear node  
(c) node next to front (d) front node.

5. (a) What are the relative merits of Recursion and Iteration?
2. (a) How are the factorial function can be evaluated by recursive and iterative efficiency? Explain with an example as factorial (5).
- (c) Assume 5 × 5 2D array M. Now consider the starting address of M is 4000. Each data item is of size 4 bytes. Calculate the location for the index (3, 4). Starting index is (0, 0).

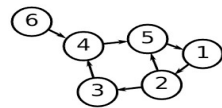
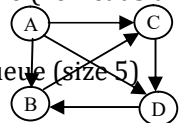
**Group - D**

- (c) What is ADT? Critically comment on the statement “Queue is a data structure”.
6. (a) What is the worst case time complexity of searching an element in the ordinary binary search tree and in an AVL tree?
3. (a) Write the given Binary Search Trees perform the following sequence of operations and draw the resultant binary tree in each case.
- (b) i. Delete 44. ii. Delete 75. iii. Delete 25
- (b) Suppose L is a Linked list with n items where each item is considered as an integer. Write a function/pseudo code to insert an item after a specified integer present in L.
- (c) Suppose there are n number of students. There is 'obtained\_mark' field for each student. Write a program that will take 'obtained\_mark' for each student as input and will round off the mark to the next multiple of 10.
- (c) Differentiate between Depth First Search (DFS) and Breadth First Search (BFS).
- (d) Instead of doing binary search in an array, when do we prefer to do a binary search in a Tree data structure?



**Group - C**

47. (a) Using available operations of stack, 0, 2, 1, 3, function 7 push to 25 data that will determine whether a given word is palindrome (i.e. reads the same backward and forward, example “level”) or not.
- (b) Draw the Adjacency Matrix of the following graph.
- (b) Consider the following operations in a Circular Queue (size 5)
- i. Insert the following values : 10, 20, 30, 40, 50
- ii. Delete 10, 20, 30
- iii. Insert 60, 70, 80
- (c) Consider the following Graph. What will be the Front and Rear operations?



Now start from '2' and figure out the traversal sequence using BFS.

**Group - E**

8. (a) Instead of using a Binary search algorithm of the order of  $O(\lg n)$ , why should we consider Hashing technique?
- (b) What are the essential properties of a good hash function?
- (c) Consider the following sequence of values: 10, 45, 20, 14, 57, 100, 200, 40, 35, 66, 27, 85, 52, 70, and 18.
- (i) Suppose we have an array of size 50. Consider a simple hash function with Division method and allocate the values accordingly. Identify the collisions, if any.
- (ii) For the same data set, apply the concept of chaining (open hashing) with table size 10.

$$2 + 2 + (4 + 4) = 12$$

9. (a) What is the time complexity of finding second largest element in a random array of elements?
- (b) Compare relative merits and demerits of Quick sort and Merge Sort.
- (c) Given an array of 6 elements: 15, 19, 10, 7, 17 and 16. Construct Max\_Heap showing intermediate steps.
- (d) What is the best known time complexity of constructing a heap with n elements.

$$2 + 4 + 4 + 2 = 12$$