| | Utech |
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| Name: | (4) |
| Roll No.: | A dynamic (y' Exercising 2nd Explana) |
| Invigilator's Signature : | |

$\begin{array}{c} \text{CS/B.TECH (CSE,IT,ECE,EE(N),EEE,ICE)/SEM-3/CS-302/2010-11} \\ \textbf{2010-11} \end{array}$

DATA STRUCTURE AND ALGORITHMS

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

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

GROUP – A (Multiple Choice Type Questions)

1. Choose the correct alternatives for the following:

 $10 \propto 1 = 10$

- i) Which of the following is the best time for an algorithm?
 - a) O(n)
 - b) $O(\log_2 n)$
 - c) $O(2^n)$
 - d) $O(n \log_2 n)$.

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The Ackerman function, for all non-negative values ii) and n is recursively defined as

$$A\left(m,n\right) =$$

i)
$$n + 1$$

if
$$m = 0$$

ii)
$$A(m-1, 1)$$

if
$$m! = 0$$
 and $n = 0$

iii)
$$A(m-1), A(m, n-1)$$
 if $m! = 0, n! = 0$

if
$$m! = 0$$
, $n! = 0$

Therefore the value of A(1, 2) is

a) 4

3 b)

5 c)

- d) 2.
- iii) The best case time complexity of Bubble sort technique is
 - O(n)a)

- b) $O(n^2)$
- $O(n \log n)$ c)
- $O(\log n)$. d)
- A linear list in which elements can be added or removed at either end but not in the middle, is known as
 - a) queue

b) dequeue

c) stack

- d) tree.
- Which of the following sorting procedures is the v) slowest?
 - Quick sort a)
- Heap sort b)
- c) Merge sort
- d) Bubble sort.

- vi) In array representation of Binary tree, if the index number of a child node is 6 then the index number of its parent node is
 - a) 2

b) 3

c) 4

- d) 5.
- vii) Maximum number of edges in a n-node undirected graph without self loop is
 - a) n^2

b) $\frac{n(n-1)}{2}$

c) n-2

- d) $\frac{(n+1)(n)}{2}$.
- viii) Four algos do the same task. Which algo should execute the slowest for large values of n?
 - a) $O(n^2)$
- b) O(n)
- c) $O(\log_2 n)$
- d) $O(2^n)$.
- ix) The adjacency matrix of an undirected graph is
 - a) unit matrix
- b) asymmetric matrix
- c) symmetric matrix
- d) none of these.
- x) BFS constructs
 - a) a minimal cost spanning tree of a graph
 - b) a depth first spanning tree of a graph
 - c) a breadth first spanning tree of a graph
 - d) none of these.



(Short Answer Type Questions)

Answer any three of the following.



2. a) Convert the following infix expression into equivalent postfix expression using stack.

$$(A + B)^* C - (D - E) / (F + G).$$

b) What is dequeue?

4 + 1

- 3. a) How a polynomial such as $6x^6 + 4x^3 2x + 10$ can be represented by a linked list?
 - b) What are the advantages and disadvantages of linked list over an array? 2 + 3
- 4. Define Big O notation. Show that the function f(n) defined by

$$F(1) = 1$$

$$F(n) = f(n-1) + 1/n \text{ for } n > 1$$

has the complexity $O(\log n)$.

2 + 3

- 5. a) Write down the recursive definition for generation of the Fibonacci sequence.
 - b) Assuming Fib (n) is a recursive function, draw a recursive tree for Fib (6). 2+3
- 6. What is the precondition of performing binary search in an array? Write the Binary Search algorithm.

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GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. 3



- 7. a) What is Circular queue ? Write Q-insert algorithm for the circular queue. 1+4
 - b) Construct the expression tree for the following expression:

$$E = (2a + 5b)(x - 7y)^4$$
.

- c) Write the recursive function for the problem of Tower of Hanoi problem.3
- d) Write a C function for selection sort and also calculate the time complexity for selection sort. 3+2
- 8. a) Show the stages in growth of an order -4 *B*-tree when the following keys are inserted in the order given: 5

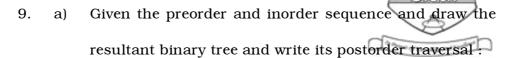
74 72 19 87 51 10 35 18 39 60 76 58 19 45

b) How do AVL trees differ from binary search tree?

Insert the following keys in the order given below to build them into an AVL tree:

Clearly mention different rotations used and balance factor of each node. 5

c) Explain with suitable example the principle of operationof Quick sort.



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Pre-order: A B D G H E I C F J K

In-order: G D H B E I A C J F K

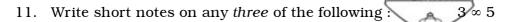
- b) Write non-recursive algorithm for inorder traversal of a binary tree.5
- c) Write an algoritm to search a node in a binary search tree. 5
- 10. a) Define 'Hashing'.

2

- b) Explain with a suitable example the collision resolutionscheme using linear probing with open addressing.5
- c) What is index? What are the various types of indexing?State the advantages of using indexing over a sequential file. 5
- d) Discuss the differences between command file and executable file.

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- a) Radix sort
- b) Index sequential file ordering
- c) Tail recursion
- d) Threaded binary tree
- e) BFS vs DFS.

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