HALDIA INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION UNDER MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL)

Paper Code: PCC-CS 301

Paper Name: Data Structure & Algorithm

Time Allotted: 1 Hour 30 Minutes *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 from the followings: 30 x 1 = 30

(i) In the worst case, the number of comparisons needed to search a singly linked list of length n for a given element is?

a) $\log_2 n$ b) n/2 c) $\log_2 n-1$ d) n [CO2]

(ii) What is the time complexity for deleting a linked list

a) O(1) b)O(n) c) either O(1) or O(n) d) O(log n) [CO1,CO2]

(iii) What is the recurrence relation for the linear search recursive algorithm? [CO1,CO5]

a) T(n-2)+c b) 2T(n-1)+c c) T(n-1)+c d) T(n+1)+c

(iv) What is the worst case run-time complexity of binary search algorithm? [CO1, CO5]

a)O(n2) b)O(logn) c)O(n3) d)O(n)

(v) The data structure required to check whether an expression contains a balanced parenthesis is?

a)Stack b) Queue c) Array d) Tree [CO4]

(vi) Which of the following is not an inherent application of stack?

a) Reversing a string b) Evaluation of postfix expression [CO3]
c) Implementation of recursion d) Job scheduling

(vii) A data structure in which elements can be inserted or deleted at/from both ends but not in the middle is?

a) Queue b) Circular queue c)Dequeue d)Priority queue [CO3]

(viii) What would be the asymptotic time complexity to add a node at the end of singly linked list, if the pointer is initially pointing to the head of the list?

a) O(1) b) O(n2) c) O(n) d)O(n3) [CO1,CO2]

(ix) The concatenation of two lists can be performed in O(1) time. Which of the following variation of the linked list can be used?[CO1,CO2]

a) Singly linked list b) Doubly linked list c) Circular Doubly linked list d) None

(x) Which data structure is required to convert the infix to prefix notation? [CO3]

a) Stack b) Linked list c) Binary tree d) Queue

(xi) What is another name for the circular queue among the following options? [CO3]

a) Square buffer b) Rectangle buffer c) Ring buffer d) None of the above

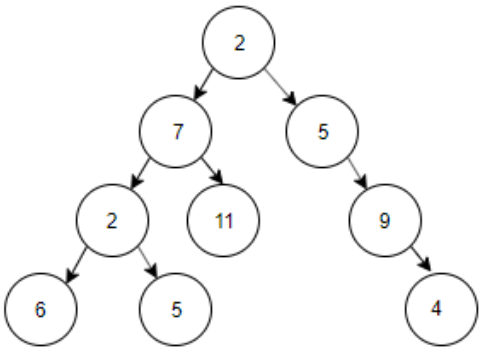
(xii) A vertex of in-degree zero in a directed graph is called a/an [CO5]

a) Root vertex b) Isolated vertex c) Sink vertex d) Pendent vertex

(xiii) Which of the following c code is used to create new node? [CO2]

a)ptr=(NODE*)malloc(sizeof(NODE)); b)ptr=(NODE*)malloc(NODE);
c)ptr=(NODE*)malloc(sizeof(NODE*)); d)ptr=(NODE)malloc(sizeof(NODE));

(xiv)For the tree below, write the in-order traversal. [CO4]



a) 6, 2, 5, 7, 11, 2, 5, 9, 4
b) 6, 5, 2, 11, 7, 4, 9, 5, 2
c) 2, 7, 2, 6, 5, 11, 5, 9, 4
d)2,7,6,511,2,9,5,4

(xv) Recursion is used to reduce the [CO3]

a) Coding complexity
b) Time complexity
c) Space complexity
d) None of these

(xvi) Which of the following is false about a binary search tree? [CO4]

a) The left child is always lesser than its parent
b) The right child is always greater than its parent
c) The left and right sub-trees should also be binary search trees
d) In order sequence gives decreasing order of elements

(xvii) The optimal data structure used to solve Tower of Hanoi is _____ [CO3]

a) Tree b) Heap c) Priority queue d) Stack

(xviii) Linked lists are not suitable to for the implementation of? [CO2]

a) Insertion sort b) Radix sort c) Polynomial Manipulation d) Binary search

(xix) A minimal connected graph is called ----------. [CO5]

a) Disconnected Graph
b) Unconnected graph
c) Tree
d) Null graph

(xx) Which of the following statements is/are TRUE for undirected graphs? [CO5]
P: Number of odd degree vertices is even
Q: Sum of degree of all vertices is even

a)P only b) Q only c) Both P and Q d) Neither P nor Q

(xxi) Breadth First Search is equivalent to which of the traversal in the Binary Trees? [CO4]

a) Pre-order Traversal b) Post-order Traversal
c) Level-order Traversal d) In-order Traversal

(xxii) The number of edges from the root to the node is called _____ of the tree.

a) Height b) Depth c) Length d) Width [CO4]

(xxiii) What is the worst case time complexity of Quick sort algorithm [CO5]

a) $O(n^2)$ b) O(nlog n) c) O(n) d) $O(2^n)$

(xxiv) On which algorithm is heap sort based on? [CO4, CO5]

a) Fibonacci heap b) Binary tree c) Priority queue d) FIFO

(xxv) What is the number of edges present in a complete graph having n vertices? [CO5]

a) (n*(n+1))/2 b) (n*(n-1))/2 c) n d) Information given is insufficient

(xxvi)Merge sort uses which of the following algorithm to implement sorting? [CO5]

a) backtracking b) greedy algorithm
c) divide and conquer d) dynamic programming

(xxvii)What is the typical running time of a heap sort algorithm? [CO5]

a) O(N) b) O(N log N) c) O(log N) d) $O(N^2)$

(xxviii)Which of the following is false about a binary search tree? [CO4]

a) The left child is always lesser than its parent
b) The right child is always greater than its parent
c) The left and right sub-trees should also be binary search trees
d) In order sequence gives decreasing order of elements

(xxix) Why we need to a binary tree which is height balanced? [CO4]

a) to save memory b) to attain faster memory access
c) to avoid formation of skew trees d) to simplify storing

(xxx)What is an AVL tree? [CO4]

a) a tree which is balanced and is a height balanced tree
b) a tree which is unbalanced and is a height balanced tree
c) a tree with three children
d) a tree with at most 3 children a tree with atmost 3 children

Group – B
(Multiple Choice Type Questions)

2. Choose the correct alternatives from the followings: 20 x 2 = 40

(i) An algorithm is made up of 2 modules M1 and M2. If order of M1 is f(n) and M2 is g(n) then the order of the algorithm is: [CO1,CO6]

a)f(n) + g(n) b) min(f(n), g(n)) c) f(n)*g(n) d) max(f(n), g(n))

(ii) What does the following function do for a given Linked List considering head as the first node?

```
void fun1(struct node* head) {
if(head == NULL)
      return;
fun1(head->next);
printf("%d ", head->data);
}
```

a) Prints all nodes b) Prints alternate nodes [CO4]
c) Does not prints any nodes d) Prints all nodes of linked list in reverse order

(iii)A binary search tree is generated by inserting in order the following integers: **50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24**. The number of nodes in the left subtree and right subtree of the root respectively is [CO4]

a) (4, 7) b)(7, 4) c)(8, 3) d)(3, 8)

(iv)The number of swapping needed to sort the numbers **8, 22, 7, 9, 31, 19, 5, 13** in ascending order using bubble sort is [CO5]

a) 11 b) 12 c) 14 d) None of these

(v)Consider an array [20, 10], assume 4 words per memory cell and the base address of A is 100. What is the address of A[11, 4]? Assume row major ordering. [CO2]

a) 560 b) 556 c) 570 d) None of these

(vi)The result of evaluating the postfix expression 5, 4, 6, +, *, 4, 9, 3, /, +, * is ? [CO3]

a)600 b)350 c) 650 d) 588

(vii)The postfix form of the expression (A+ B)*(C*D- E)*F / G is? [CO3]

a)AB+ CD*E – FG /** b)AB + CD* E – F **G /

c)AB + CD* E – *F *G / d)AB + CDE * – * F *G /

(viii) What is the time complexity of following code: [CO1]

```
int a = 0, i = N;
while (i> 0)
{
       a += i;
      i /= 2;
 }
```

a)O(n) b) O(sqrt(n)) c) O(n/2) d)O(log n)

(ix)Convert the following Infix expression to Postfix form using a stack. [CO3]

x + y * z + (p * q + r) * s

a)xyz*+pq*r+s*+ b)xyz*+pq*r+s+*

c)xyz+*pq*r+s*+ d)xyzp+**qr+s*+

(x)What is the value of the postfix expression 6 3 2 4 + – *? [CO3]

a) 1 b) 40 c)74 d) -18

(xi)The prefix form of A-B/ (C * D ^ E) is? [CO3]

a) -/*^ACBDE b) -ABCD*^DE

c) -A/B*C^DE d) -A/BC*^DE

(xii)Assume that the operators +,-, X are left associative and ^ is right associative. The order of precedence (from highest to lowest) is ^, X, +, -. The postfix expression for the infix expression a + b X c – d ^ e ^ f is? [CO3,CO6]

a) abc X+ def ^^ – b)abc X+ de^f^ –

c)ab+cXd – e ^f^ d) -+aXbc^ ^def

(xiii)Consider the function f defined below. [CO1,CO4]

```
struct item {

int data;
struct item * next;
   };

int f(struct item *p) {
return ((p == NULL) || (p ->next == NULL) ||
      ((p->data <= p -> next -> data) &&
f(p-> next)));
}
```

For a given linked list p, the function f returns 1 if and only if

a) The list is empty or has exactly one element.
b) The elements in the list are sorted in non-decreasing order of data value
c) The elements in the list are sorted in non-increasing order of data value
d) Not all elements in the list have the same data value.

(xiv)Consider the following function that takes reference to head of a Doubly Linked List as parameter. Assume that a node of doubly linked list has previous pointer as *prev* and next pointer as *next*. [CO2]

```
void fun(struct node **head_ref)
{
   struct node *temp = NULL;
   struct node *current = *head_ref;
```

```
    while (current !=  NULL)
    {
       temp = current->prev;
       current->prev = current->next;
       current->next = temp;
       current = current->prev;
    }

    if(temp != NULL )
       *head_ref = temp->prev;
}
```

Assume that reference of head of following doubly linked list is passed to above function 1 <--> 2 <--> 3 <--> 4 <--> 5 <-->6. What should be the modified linked list after the function call?

a) 2< -- > 1 < -- > 4< -- > 3< -- >6< -- > 5
b) 5< -- > 4 < -- > 3< -- > 2< -- >1< -- > 6
c) 6< -- > 5 < -- > 4< -- > 3< -- >2< -- > 1
d) 6< -- > 5 < -- > 4< -- > 3< -- >1< -- > 2

(xv)Construct a BST with the elements 7, 11, 6, 4, and 13. What will be the inorder traversal

a) 4, 7, 6, 11, 13 b) 4, 6, 7, 11, 13 c) 13, 6, 7, 11, 4 d) 7, 6, 4, 11, 13 [CO4]

(xvi)Given two statements:

i) Insertion of an element should be done at the last node in a circular linked list
ii) Deletion of an element should be done at the last node in a circular linked list [CO2]

a) Both are true
b) Both are false
b) c) First is false and Second is true
d) None of the above

(xvii)Construct an AVL tree with the elements 1, 2, and 3. What will be the inorder traversal

a) 1, 3, 2 b) 3, 2, 1 c) 1, 2, 3 d) 2, 3, 1 [CO4]

(xviii)The recurrence relation capturing the optimal execution time of the Towers of Hanoi problem with n discs is [CO1, CO3]

a) $T(n) = 2T(n - 2) + 2$

b)$T(n) = 2T(n - 1) + n$

c) $T(n) = 2T(n/2) + 1$

d) $T(n) = 2T(n-1) + 1$

(xix)The inorder traversal of some binary tree produced the sequence D B E A F C and the postorder traversal of the same tree produced the sequence D E B F C A. Which of the following is a correct preorder traversal sequence? [CO4]

a) D B A E C F b) A B E D F C c) A B D E C F d) None of these

(xx)Which of the following is TRUE? [CO1,CO4]

a) The cost of searching an AVL tree is O (log n) but that of a binary search tree is O(n)

b)The cost of searching an AVL tree is O(log n) but that of a complete binary tree is O(n log n)

c)The cost of searching a binary search tree is O(log n) but that of an AVL tree is O(n)

d) The cost of searching an AVL tree is O(n log n) but that of a binary search tree is O(n)

Signature of the Paper Setter/Moderator

Answer Key:

Group – A

1. (i)	D	(ii)	A	(iii)	C	(iv)	B	(v)	A	(vi)	D
(vii)	C	(viii)	C	(ix)	C	(x)	A	(xi)	C	(xii)	C
(xiii)	A	(xiv)	A	(xv)	A	(xvi)	D	(xvii)	D	(xviii)	D
(xix)	C	(xx)	C	(xxi)	C	(xxii)	B	(xxiii)	A	(xxiv)	C
(xxv)	B	(xxvi)	C	(xxvii)	B	(xxviii)	D	(xxix)	C	(xxx)	A

Group – B

2. (i)	D	(ii)	D	(iii)	B	(iv)	C	(v)	B	(vi)	B
(vii)	C	(viii)	D	(ix)	A	(x)	D	(xi)	C	(xii)	B
(xiii)	B	(xiv)	C	(xv)	B	(xvi)	B	(xvii)	C	(xviii)	D
(xix)	C	(xx)	A								