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B.TECH. III SEM MAIN/BACK (NEW SCHEME)
ACADEMIC SESSION 2023-24

(Artificial Intelligence And Data Science)
III And Other Branches

3AD4–03 - Data Structures and Algorithms

Common to CS, IT, AI, DS, MC, CM, CD, CA, AD, AM, CY, IO

Time : 3 Hours] [Max. Marks : 70

[Min. Passing Marks :

Instructions to Candidates :

Part–A : Short Answer Type Questions (up to **25** words) $10 \times 2 = 20$ marks. All 10 questions are compulsory.

Part–B : Analytical/Problem Solving questions $5 \times 4 = 20$ marks. Candidates have to answer 5 questions out of 7.

Part–C : Descriptive/Analytical/Problem Solving questions 3×10 marks $= 30$ marks. Candidates have to answer 3 questions out of 5.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.

Use of the following supporting materials is permitted during examination. (Mentioned in form no. 205).

1_____ 2_____

Part–A

10×2=20

Q. 1. What is the time complexity of the following code :

```
void fun(int n)
{
for(int i = 0; i < n; i+ = 3)
    printf("Data Structure");
}
```

Q. 2. What is Asymptotic Notation ?

Q 3. What is the time complexity of following recurrence relation using master method :

$$T(n) = 3*T(n/2) + n*n$$

Q. 4. What is time complexity of linear search ?

Q 5. Compute the value of postfix expression using stack :

4 2 3 + * 3 4 2 * + / 7 % 3 +

Q. 6. Compute the postfix expression of following infix expression :

(A – B + C)*(D+E)/(G+F)

Q 7. What is the suitable and efficient data structure to implement graph ?

Q. 8. What is Dynamic Programming ?

Q. 9. What is meant by complete graph ?

Q. 10. Given the address of Arr[100] an array Arr as 1020 and size of each element is 2 bytes in the memory. Find the address of Arr[66].

Part–B

5×4=20

Q. 1. What is the time complexity of the following recurrence relation :

$$T(n) = T(n/4) + T(n/2) + n$$

Q. 2. The Preorder traversal of a tree is :

15, 6, 3, 2, 4, 7, 13, 9, 18, 17, 20.

The inorder traversal of same tree is :

2, 3, 4, 6, 7, 9, 13, 15, 17, 18, 20.

Construct the tree and write its postorder traversal ?

Q. 3. Consider the following instructions :

```
Queue q = new Queue();
Stact s = new Stack();
s.push (1);
s.push (2);
s.push (3);
s.push(4)
s.push (5);
q.enque(s.pop( ));
q.enque(s.pop( ));
q.enque(s.pop( ));
s.push(q.deque( ));
s.push(q.deque( ));
q.enque (4);
q.enque (5);
```

Find the top element of the stack, rear and front of the queue.

Q. 4. Find the value returned by sam(1) of the below function.

```
int sam (int n)
{
static int i = 5;
if(n >= 5)
return n;
n=n+i;
i++;
return sam(n);
}
```

Q. 5. Write recurrence relation of merge sort and compute the time complexity of the merge sort. Apply merge sort for the following list of the elements: 69, 31, 7, 18, 21, 44, 5, and 19.

Q. 6. An Array P[30][16] is stored along the column with each of its elements occupying 4 bytes. Find out the base address and address of an element P[2][5] if the location P[5][9] is stored at the address 5000.

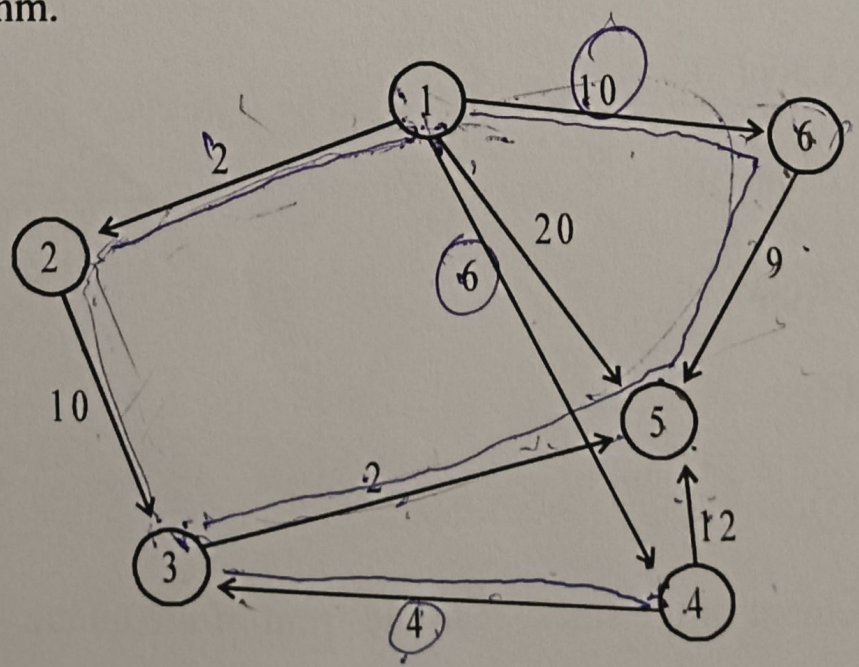
Q. 7. Construct binary tree for below array representation :

A	C	D	B	E	I	F	G	H	K	J	O	N	P

Part–C

3×10=30

Q. 1. (i) Find the minimum spanning tree of the graph given below using Kruskal Algorithm.



(ii) Demonstrate Dijkstra algorithm on graph shown above where the source vertex is 1. Write the shortest path and its distance from 1 to 6.

Q. 2. What is the output of the below program ? Assume no error in o de and data structure initialized as in figure below.

```
struct node (
    int data;
    struct node *link;
};
void printv(struct *start) {
    struct node *st;
    st=start->link;
```

(i) `printf("%d ",st->data); //` [3]

`start->link=st->link;`

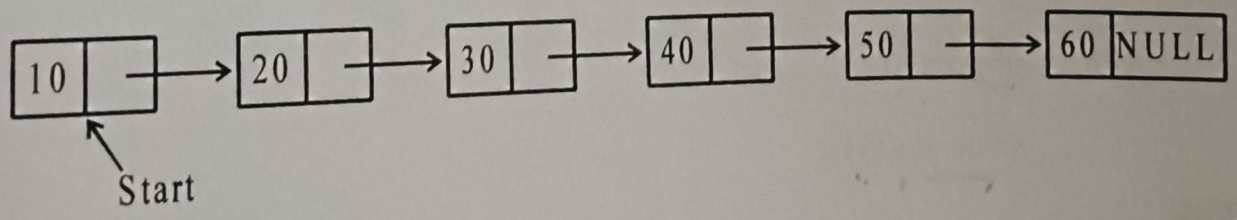
(ii) `printf("%d", start->data); //` [3]

`st->link->link=st;`

(iii) `printf("%d ",st->link->link->data); //` [3]

(iv) `printf("%d ",start->link->link->data); //` [3]

(v) `printf("%d",sizeof(start->link->link->link)); //` [3]



Q. 3. Construct AVL tree for the following data :

Mar, May, Nov, Aug, Apr, Jan, Dec, Jul, Feb, Jun, Oct, Sep.

After creating the tree delete following node one by one : Apr, Mar. Follow the order of elements given for insertion and deletion. Show AVL tree after each insertion and deletion. Also mention the type of rotation at each step that is used at the time of insertion and deletion.

Q. 4. Find the value of Toh('S', 'D',' A', 4')

```
void Toh(char s, char d, char a, int nob)
    {
    If(nob > 0){
        Toh(s, a, d, nob-1);
        printf("%c---- % c" .s.d);
        Toh(a, d, s, nob-1);
    }}
```

Q. 5. Consider a stack S with element 1, 0, 2, 4, 5, 7 with top of the stack as 7 and two ques Q1 and Q2. Q1 contains elements 3, 6, 7, 8, 9, 0 in the order from front to rear and Q2 is initially empty. What are the contents of Q1 and Q2 if we execute the following code ?

```
void fun( )
{
    int x,y;
    while(!empty(S))
    {
        x=pop(S)
        y=deque(Q1);
```



```
        x=x+y++;
        y=x*y;
        x=x+y++;
        enque(Q1,x);
        enque(Q2,y);
    }
}
```

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