



Comsats University Islamabad

Department of Computer Science

Terminal Paper Spring 2022

SP21-BSE-090

Umer-Farooq

Semester:- 3rd CS/SE/AI/DS/CT

Subject: - Data Structures and Algorithms

Instructor: - Dr. Inayat Ur Rehman/Azfar Shakeel/Rashid Mehmood

Marks: - 50

Time:- 3 Hours

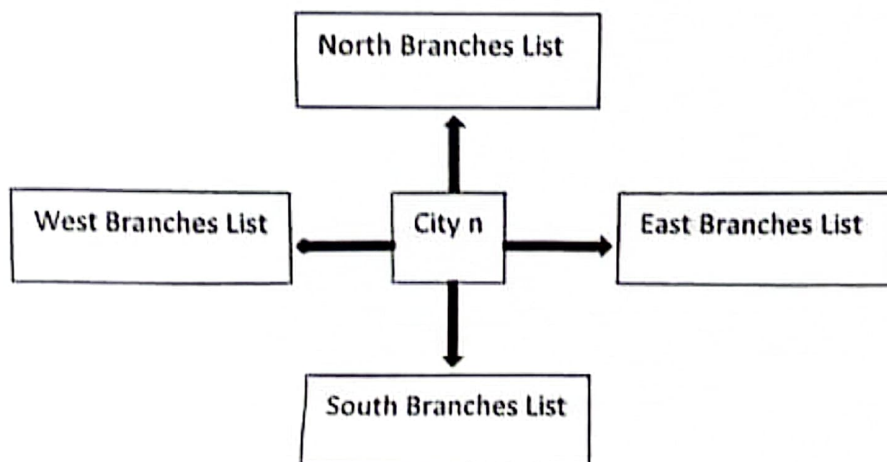
Date:- 06 July, 2022

Instructions: Understand the questions thoroughly before attempting.
Use of Mobile, Digital Diaries etc. are strictly prohibited

*****CLOI*****

Q-1). You are required to write code to implement the design of following data structure.

[Marks: 10]



There can be multiple cities with multiple branches in each direction (North, South, East, West). The city node stores city name and required links as shown in the above figure, the branch node contains an integer showing number of people working in that branch.

Task:

- You are required to write code for declaration of structure for City Node and Directional Branches Node.
- Write method for insertion of city and branch.
- Write a method that returns total number of employees (working in all branches and cities).

Q-2). Trace the following program by showing the Stack and Queue status in each iteration. [Marks: 05]

```
int main()
{
    stack<int> stk;
    queue<int> que;
    int num = 1000;
    int r;
    que.enqueue(num);
    while (!que.empty())
    {
        num = que.front();
        que.dequeue();
        r = num % 2;
        stk.push(r);
        num = (num - r) / 2;
        if (num == 0) break;
        que.enqueue(num);
    }

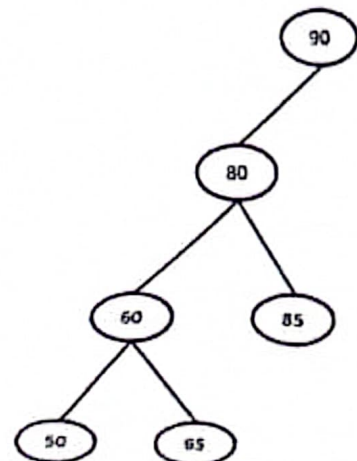
    while (!stk.empty())
    {
        cout << stk.top();
        stk.pop();
    }
}
```

*****CLO-2*****

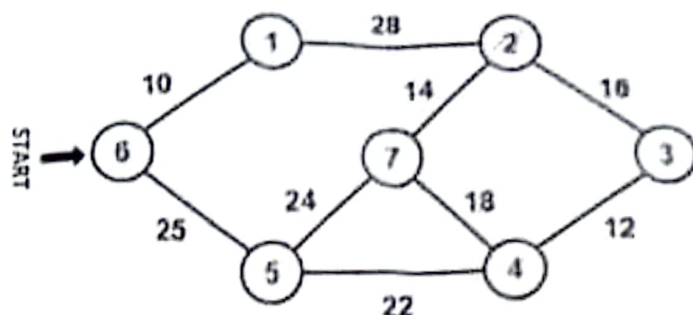
Q-3). The following code is incorporated in BST class, apply the code to the given tree (calling Act method), what will be the result of this code after execution, and draw the final tree. [Marks: 05]

```
void Act()
{
    while (root->lc != NULL)
        root = transform(root);
}

TNode *transform(TNode *y)
{
    TNode *x = y->lc;
    TNode *z = x->rc;
    x->rc = y;
    y->lc = z;
    return x;
}
```



- Q-4) Given the following graph apply the Prim's Algorithm to find out the cost of Minimum Spanning Tree. Show your working, how you get the solution.



[Marks: 05]

- Q-5) Given a Max Heap, write code to display the values of heap in ascending order, you can use Stack or Queue in order solved the problem, assuming all the functionality of Stack/ Queue is available.

[Marks: 10]

```
void DisplayAscending (MaxHeap maxHeap)
{
    //At the end Heap may be Empty
}
```

***** CLO-3*****

- Q-6). Demonstrate merge sort for the given data

[Marks: 05]

25	45	35	20	10	30	50	15	85	90	37	20
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- Q-7). Given the following data and hash function, apply separate chaining hashing technique that will store the data in appropriate locations, you are supposed to draw the hash table/ diagram.

[Marks: 05]

6554	2456	1554	1665	2495	2468	1657	1666	1349	1466	2465
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- Hash table size is 10
- Hash function is $\text{Key} \% 10$