Distributed Systems

Lab 5 – Chord Protocol

S Abhishek

AM.EN.U4CSE19147

```
import matplotlib.pyplot as plt
import networkx as nx

def succ(key, arr, identifier):
    arr = sorted(arr)
    for i in range(len(arr)):
        if arr[i] >= key%pow(2,identifier):
            return arr[i]
    return arr[0]


class chord:
    def __init__(self, identifier):
        self.identifier = identifier
        self.G = nx.DiGraph()
        self.nodes = dict()

    def add_node(self, node_id):
        self.nodes[node_id] = [[]]
        self.nodes[node_id] = [[i,succ(node_id+pow(2,i-1), self.nodes.keys(),
self.identifier)] for i in range(1,self.identifier+1)]
        for j in self.nodes:
            self.nodes[j] = [[i,succ(j+pow(2,i-1), self.nodes.keys(),
self.identifier)] for i in range(1,self.identifier+1)]
        print("Nodes in the ring :",self.nodes.keys())


    def remove_node(self, node_id):
        self.nodes.pop(node_id)
        for j in self.nodes:
            self.nodes[j] = [[i,succ(j+pow(2,i-1), self.nodes.keys(),
self.identifier)] for i in range(1,self.identifier+1)]
        print("Nodes in the ring :",self.nodes.keys())
    def finger_table(self, node_id):
        self.G.add_nodes_from(self.nodes.keys())
        return self.nodes[node_id]

    def look_up(self, key, node):

        print("Route : ", end = "")
        k=0
        edge = []
        print(node, "->", end=" ")
        edge.append(node)
        if key in [i[1] for i in self.nodes[node]]:
            print(key)
            edge.append(key)
            k=1
        while True:
            if k==1:
                break
            for i in range(0,self.identifier-1):
                if node < key and key < self.nodes[node][0][1]:
                    node = self.nodes[node][0][1]
                    print(node)
                    edge.append(node)
                    k=1
                    break
                if self.nodes[node][i][1] <= key and self.nodes[node][i+1][1]
> key:
                    node = self.nodes[node][i][1]
                    print(node, "->",end=" ")
                    edge.append(node)
                    break
                if (self.nodes[node][0][1] - node < 0) and node<key:
                    node = self.nodes[node][i+1][1]
                    print(node)
                    edge.append(node)
                    k=1
                    break
                if i == (self.identifier-2):
                    node = self.nodes[node][i+1][1]
                    print(node, "->",end=" ")
                    edge.append(node)

        color_map = []
        for n in range(0,pow(2,self.identifier)):
            if n in edge:
                color_map.append('green')
            elif n in self.nodes.keys():
                color_map.append('cyan')
            else:
                color_map.append('orange')
        edges = [[edge[i],edge[i+1]] for i in range(0,len(edge)-1)]
        self.G.remove_nodes_from(list(self.G.nodes))
        self.G.add_nodes_from(range(0,pow(2,self.identifier)))
        self.G.add_edges_from(edges)
        print()
        plt.figure(figsize=(10,7))
        plt.title('S Abhishek - AM.EN.U4CSE19147')
        nx.draw_circular(self.G, with_labels=True, font_weight='bold',
node_size=500, node_color=color_map)
```

```
c = chord(6)

c.add_node(0)
c.add_node(11)
c.add_node(18)
c.add_node(21)
c.add_node(29)
c.add_node(40)
c.add_node(46)
c.add_node(51)
c.add_node(58)
```

```
Nodes in the ring : dict_keys([0])
Nodes in the ring : dict_keys([0, 11])
Nodes in the ring : dict_keys([0, 11, 18])
Nodes in the ring : dict_keys([0, 11, 18, 21])
Nodes in the ring : dict_keys([0, 11, 18, 21, 29])
Nodes in the ring : dict_keys([0, 11, 18, 21, 29, 40])
Nodes in the ring : dict_keys([0, 11, 18, 21, 29, 40, 46])
Nodes in the ring : dict_keys([0, 11, 18, 21, 29, 40, 46, 51])
Nodes in the ring : dict_keys([0, 11, 18, 21, 29, 40, 46, 51, 58])
```

```
c.nodes
```

```
{0: [[1, 11], [2, 11], [3, 11], [4, 11], [5, 18], [6, 40]],
 11: [[1, 18], [2, 18], [3, 18], [4, 21], [5, 29], [6, 46]],
 18: [[1, 21], [2, 21], [3, 29], [4, 29], [5, 40], [6, 51]],
 21: [[1, 29], [2, 29], [3, 29], [4, 29], [5, 40], [6, 58]],
 29: [[1, 40], [2, 40], [3, 40], [4, 40], [5, 46], [6, 0]],
 40: [[1, 46], [2, 46], [3, 46], [4, 51], [5, 58], [6, 11]],
 46: [[1, 51], [2, 51], [3, 51], [4, 58], [5, 0], [6, 18]],
 51: [[1, 58], [2, 58], [3, 58], [4, 0], [5, 11], [6, 21]],
 58: [[1, 0], [2, 0], [3, 0], [4, 11], [5, 11], [6, 29]]}
```

```
c.look_up(27, 51)
```

```
Route : 51 -> 21 -> 29
```

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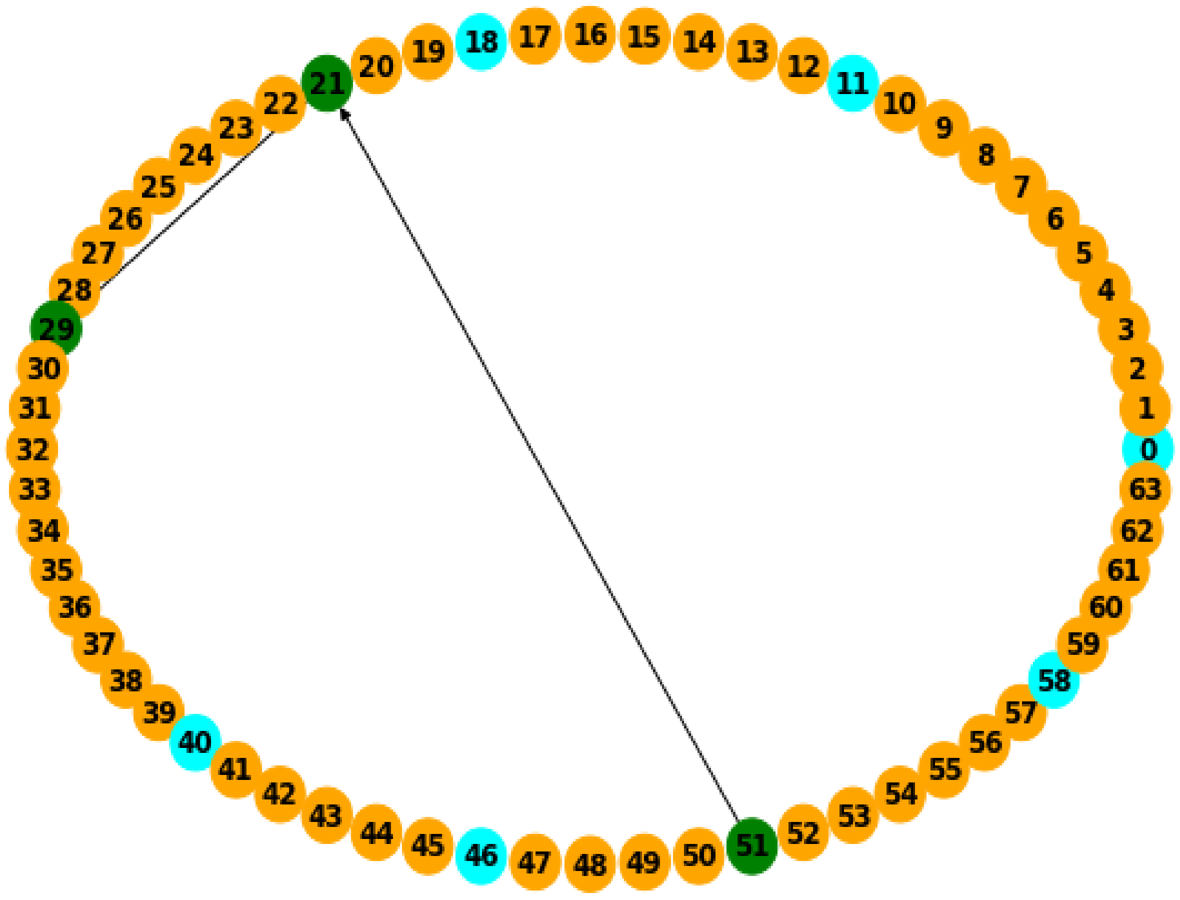
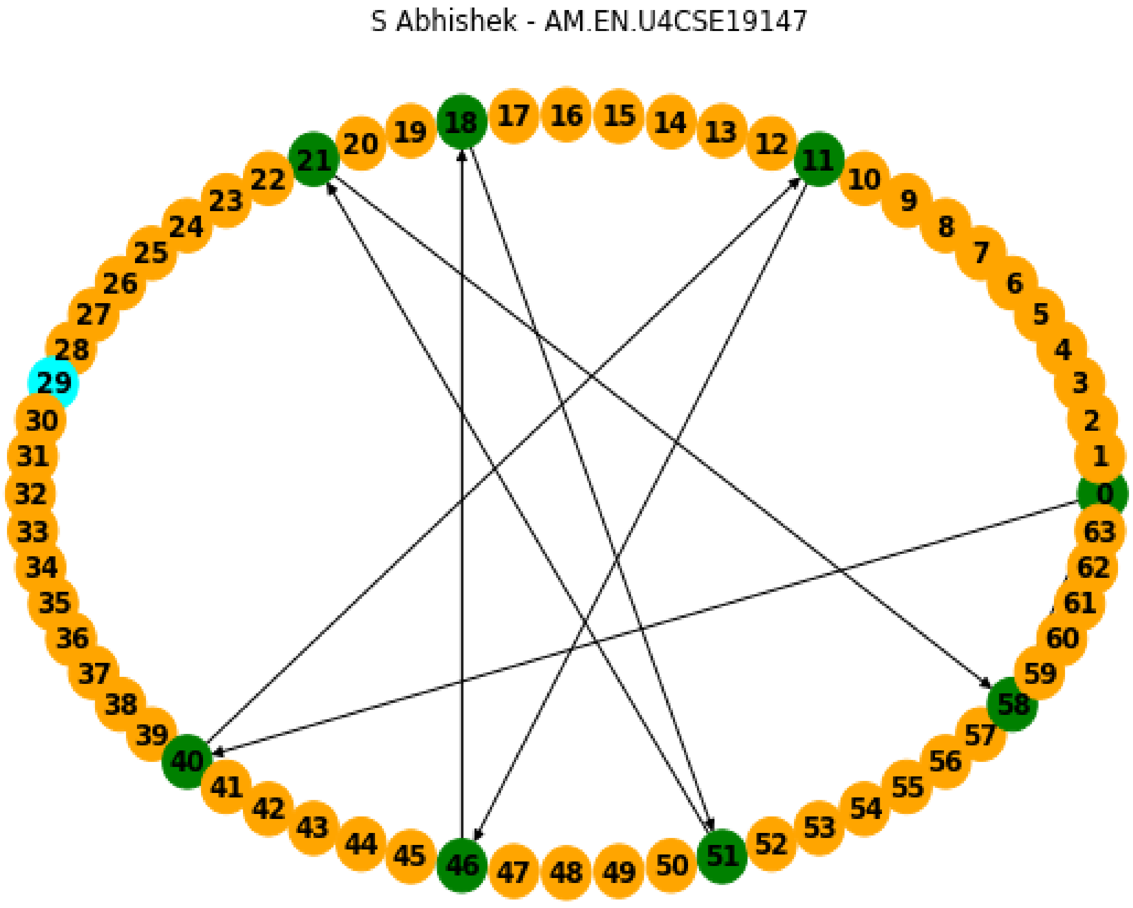


```
c.look_up(63, 0)
```

```
Route : 0 -> 40 -> 11 -> 46 -> 18 -> 51 -> 21 -> 58 -> 0
```

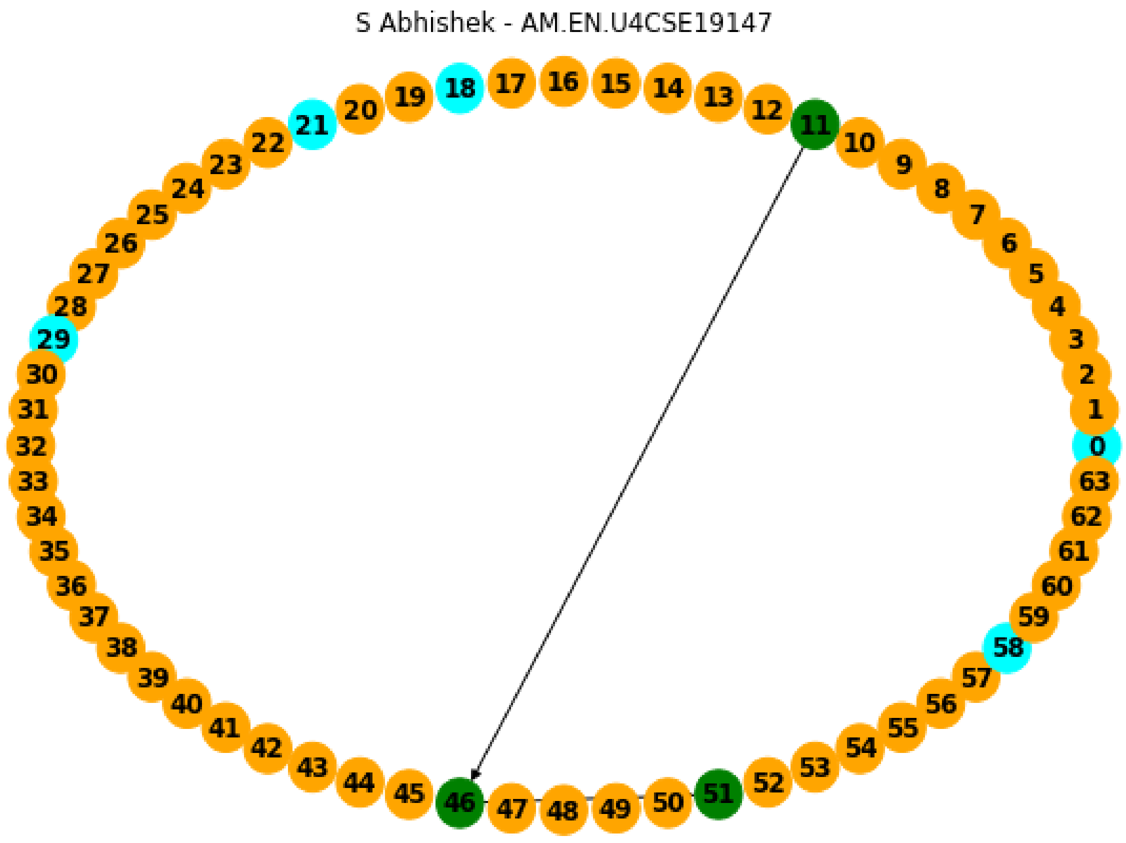


```
c.remove_node(40)
```

```
Nodes in the ring : dict_keys([0, 11, 18, 21, 29, 46, 51, 58])
```

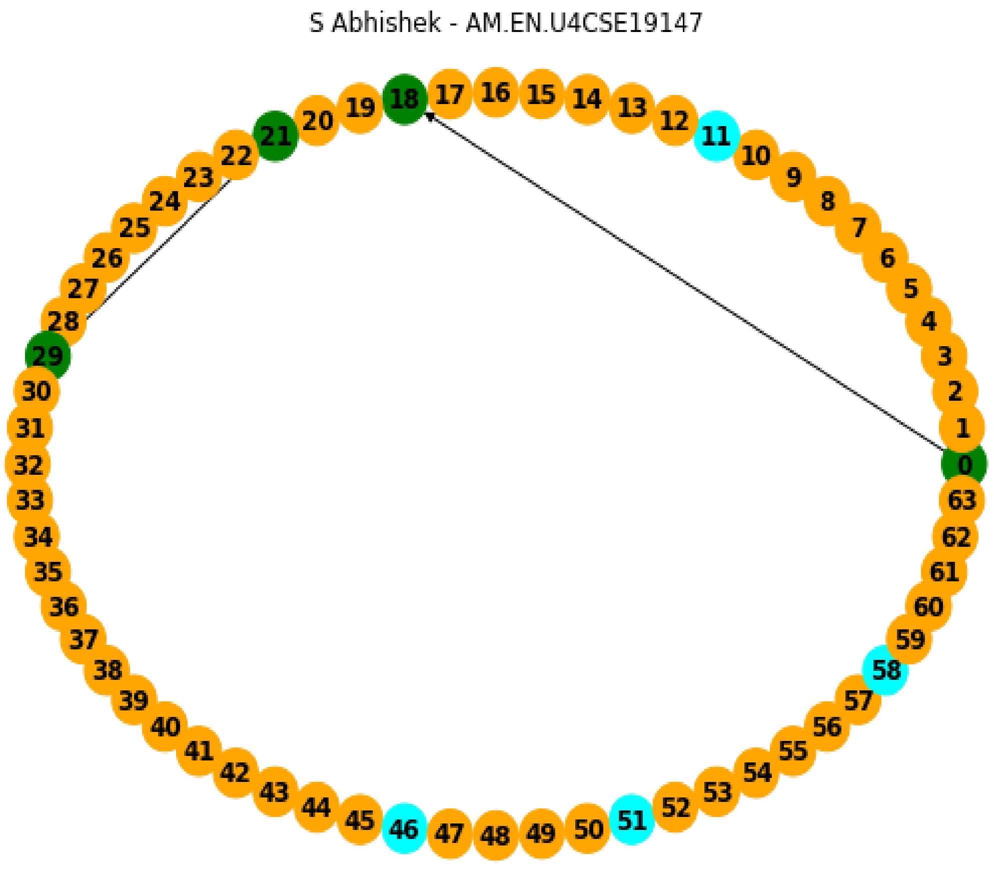
```
c.look_up(50, 11)
```

```
Route : 11 -> 46 -> 51
```



```
c.look_up(22, 0)
```

```
Route : 0 -> 18 -> 21 -> 29
```

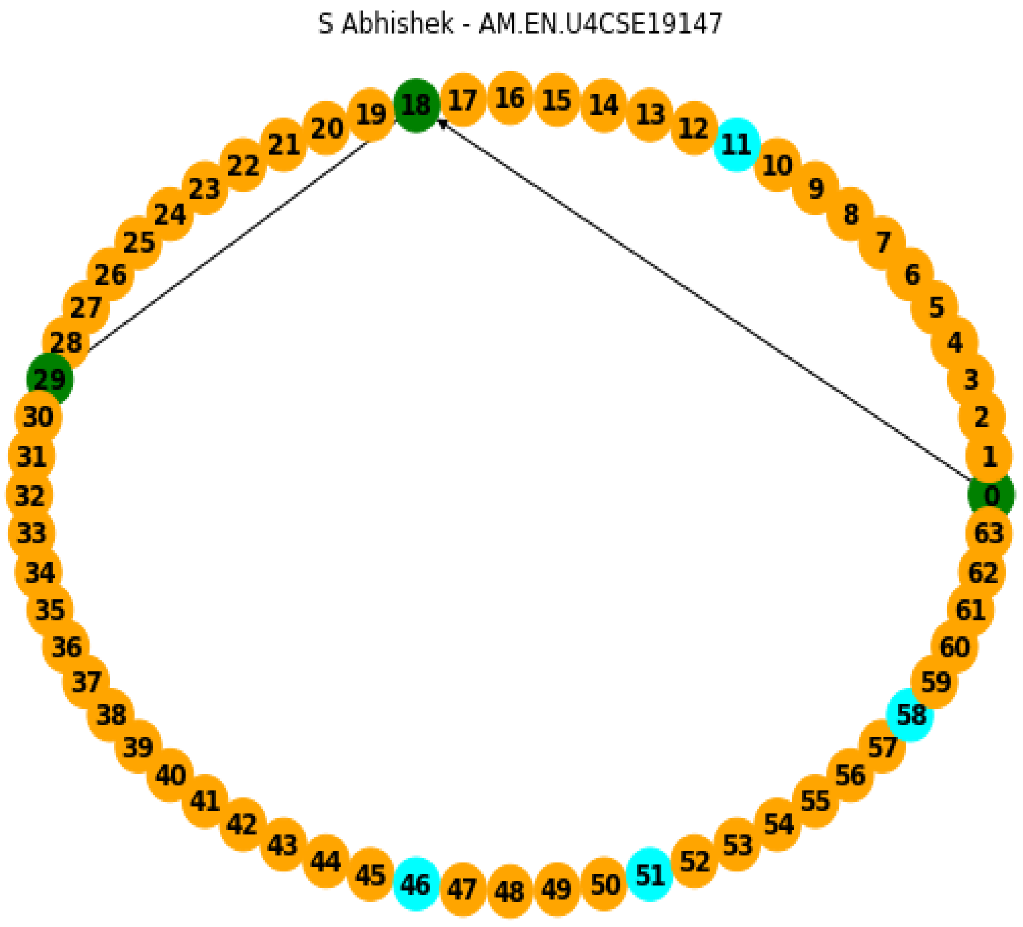


```
c.remove_node(21)
```

```
Nodes in the ring : dict_keys([0, 11, 18, 29, 46, 51, 58])
```

```
c.look_up(22, 0)
```

```
Route : 0 -> 18 -> 29
```



Thankyou!!