lab4

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Variant: 89

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[1]:
```
import numpy as np
import matplotlib.pyplot as plt
import networkx as nx
import math
```

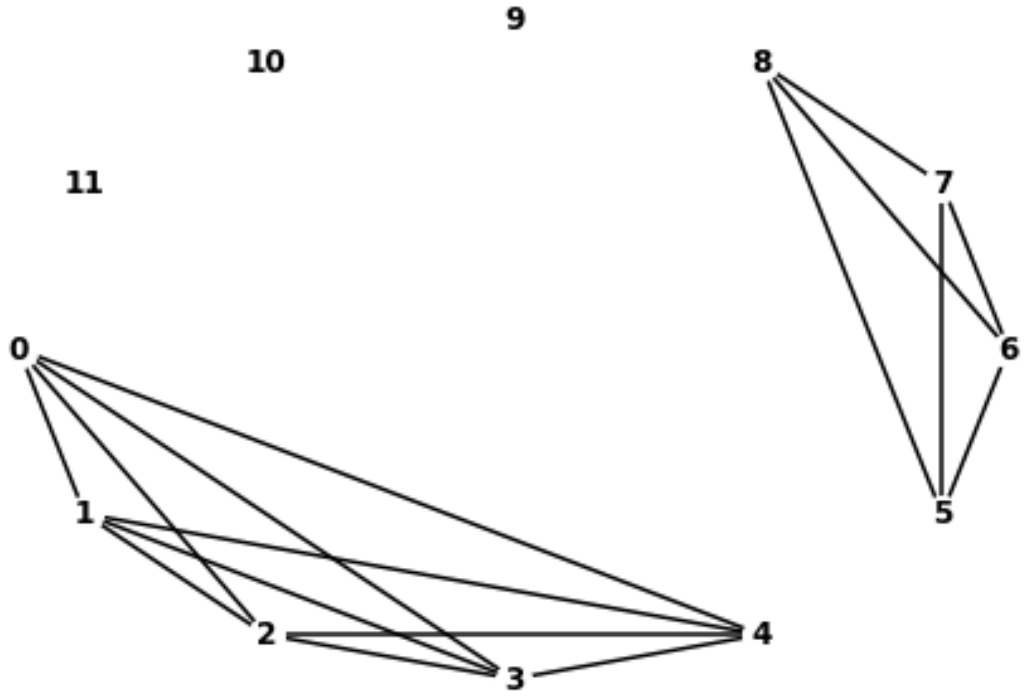
[2]:
```
base= {
    'with_labels': True, 'font_color' : 'black','font_weight':'bold',
    'node_color' : 'white','node_size' : 200, 'width':1.5
}
```

#1

[3]:
```
Graph = nx.Graph()
Graph.add_nodes_from(range(12))
Graph.add_edges_from(
    [(0,1),(0,2),(0,3),(0,4),(1,2),(1,3),(1,4),(2,3),
     (2,4),(3,4),(5,6),(5,7),(5,8),(6,7),(6,8),(8,7)])
fname='Graph.txt'
nx.write_adjlist(Graph,fname)
```

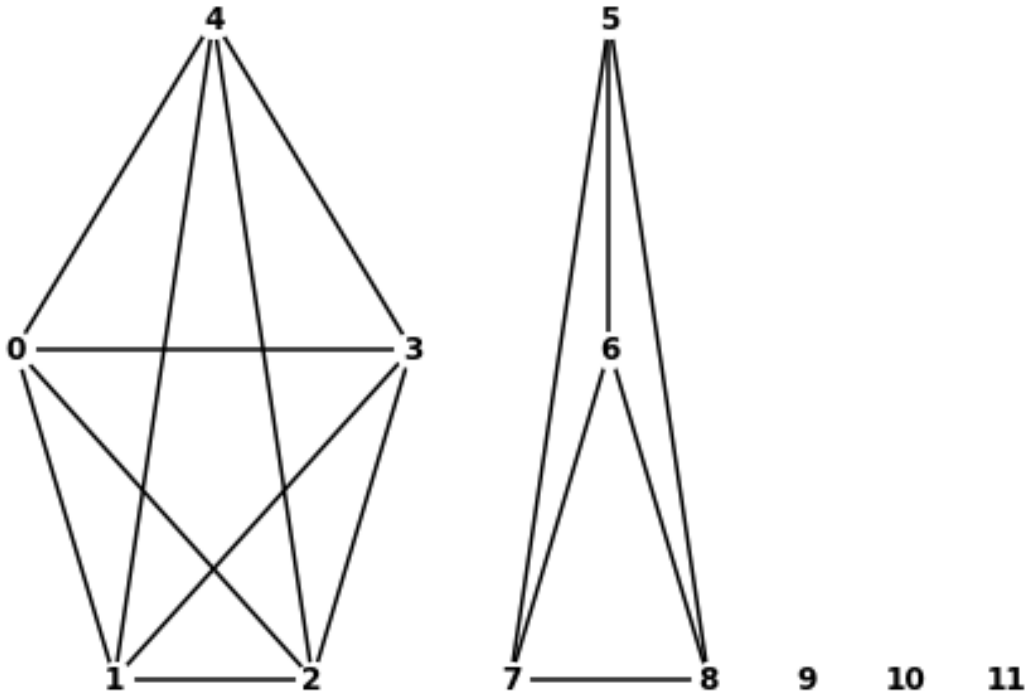
#2

[4]:
```
Graph_1 = nx.read_adjlist(fname,nodetype= int)
Graph_1.edges
nx.draw_shell(Graph_1,**base)
plt.savefig("Graph_1.png")
```



#3

[5]:
```
Graph_2= nx.read_adjlist(fname,nodetype= int)
pos = {
    0:(0, 2), 1:(1, 1),2:(3, 1), 3:(4, 2),4:(2, 3), 5:(6, 3),
    6:(6,2),7:(5, 1), 8:(7, 1),9:(8, 1), 10:(9, 1),11:(10, 1)}
nx.draw(Graph_2,pos =pos,**base)
plt.savefig("Graph_2.png")
```

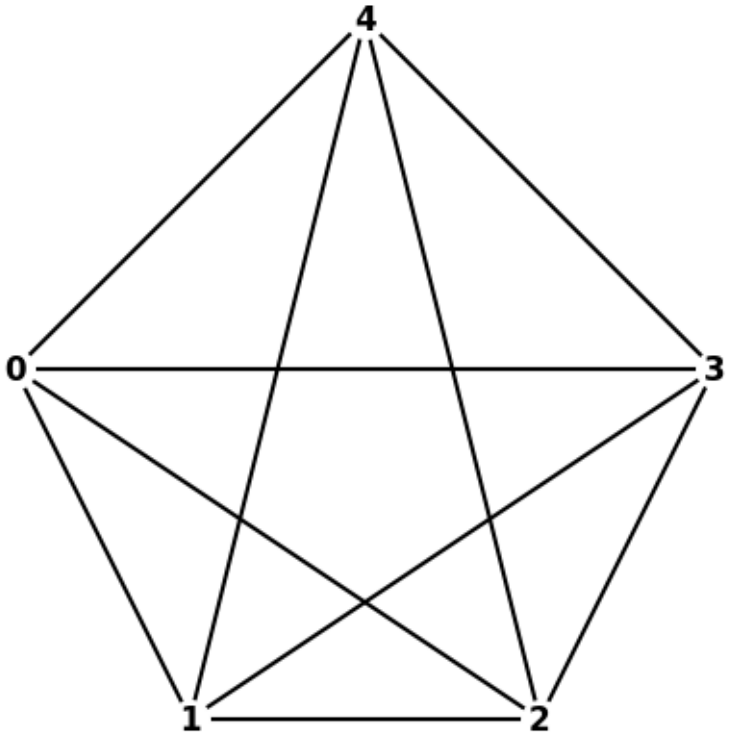


#4

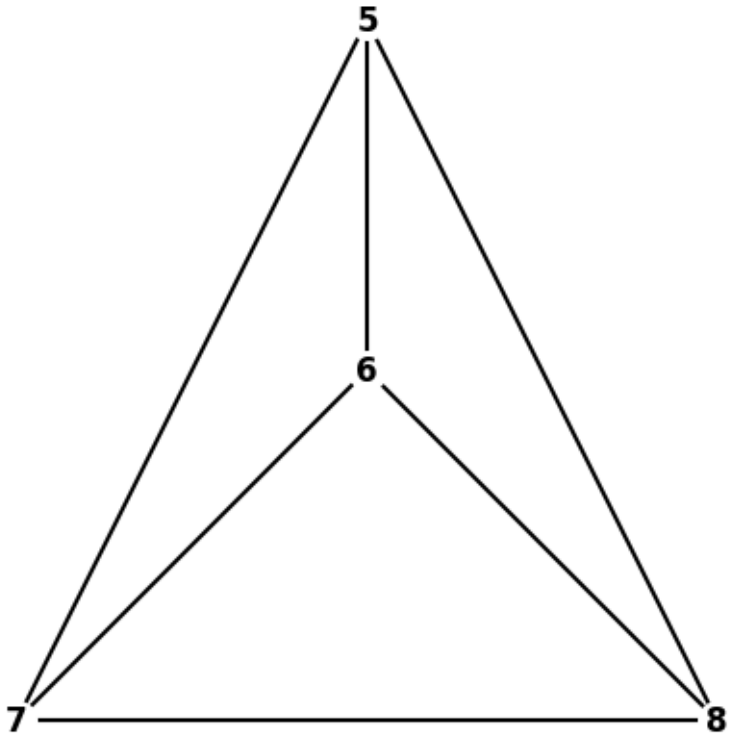
[6]:
```
Graph_2 = nx.read_adjlist(fname,nodetype= int)
node_number=0
for component in nx.connected_components(Graph_2):
    sub = Graph_2.subgraph(component)
    subgraph_nodes = nx.number_of_nodes(sub)
    subgraph_edges = nx.number_of_edges(sub)
    subgraph_dim = nx.diameter(sub)
    subgraph_rad = nx.radius(sub)
    subgraph_ecc =nx.eccentricity(sub)
    plt.figure(figsize=(4, 4), dpi=100)
    nx.draw(sub,pos =pos,**base)
    print("graph nodes:",subgraph_nodes)
    print("graph edges:",subgraph_edges)
    print("graph diameter:",subgraph_dim)
    print("graph radius:",subgraph_rad)
    for el in subgraph_ecc.values():
        print("graph eccentricity for node",node_number,el)
        node_number+=1
    for node in component:
        plt.show()
```

```
graph nodes: 5
```

```
graph edges: 10
graph diameter: 1
graph radius: 1
graph eccentricity for node 0 1
graph eccentricity for node 1 1
graph eccentricity for node 2 1
graph eccentricity for node 3 1
graph eccentricity for node 4 1
```




```
graph nodes: 4
graph edges: 6
graph diameter: 1
graph radius: 1
graph eccentricity for node 5 1
graph eccentricity for node 6 1
graph eccentricity for node 7 1
graph eccentricity for node 8 1
```




```
graph nodes: 1
graph edges: 0
graph diameter: 0
graph radius: 0
graph eccentricity for node 9 0
```

9

```
graph nodes: 1
graph edges: 0
graph diameter: 0
graph radius: 0
graph eccentricity for node 10 0
```

10

```
graph nodes: 1
graph edges: 0
graph diameter: 0
graph radius: 0
graph eccentricity for node 11 0
```

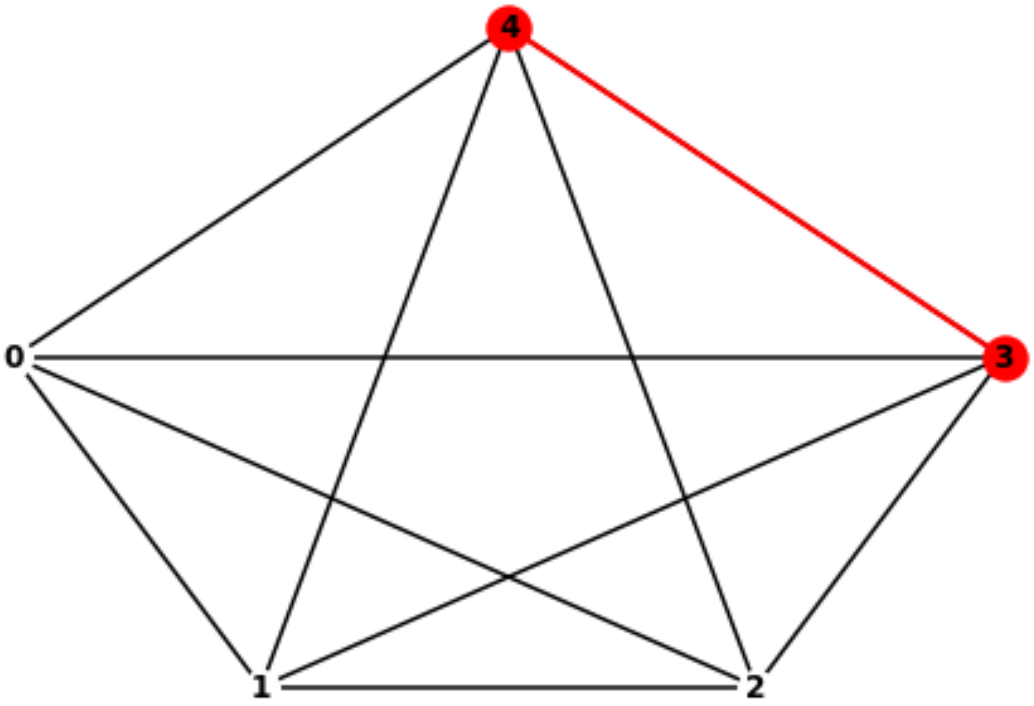
11

#5

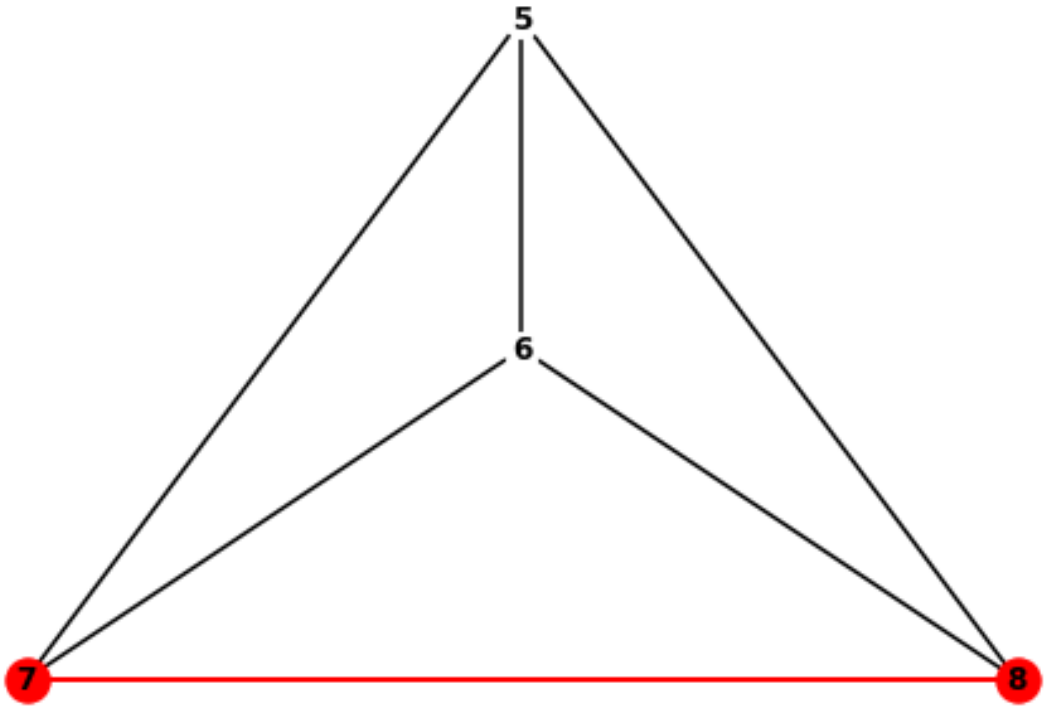
[7]:
```
number_of_component = 0
for component in nx.connected_components(Graph_2):
    sub = Graph_2.subgraph(component)
    number_of_component+= 1
    if len(sub.nodes())>1:
        for node in sub.nodes():
            max_way =[]
            dim_edge =[]
            way = nx.shortest_path(sub,node)
            for el in way.values():
                max_way.append(len(el)- 1)
                if len(el)>1:
                    dim_edge.append(el)
            dim = max(max_way)
        red_edge = []
        for el in dim_edge:
            detailed_way = []
            way = el
            i = 0
            while i + 1 < len(way):
```

```
                detailed_way.append([way[i], way[i + 1]])
                i += 1
                red_edge = detailed_way
                red_node = el
        print("component",number_of_component,"diameter:",dim)
        nx.draw(sub, pos=pos,**base)
        nx.draw_networkx_nodes(sub, pos=pos, nodelist=red_node,node_color =␣
↪"red")
        nx.draw_networkx_edges(sub, pos=pos, edgelist=red_edge,␣
↪edge_color="red",width=2)
        plt.show()
    else:
        pass
```

```
component 1 diameter: 1
```



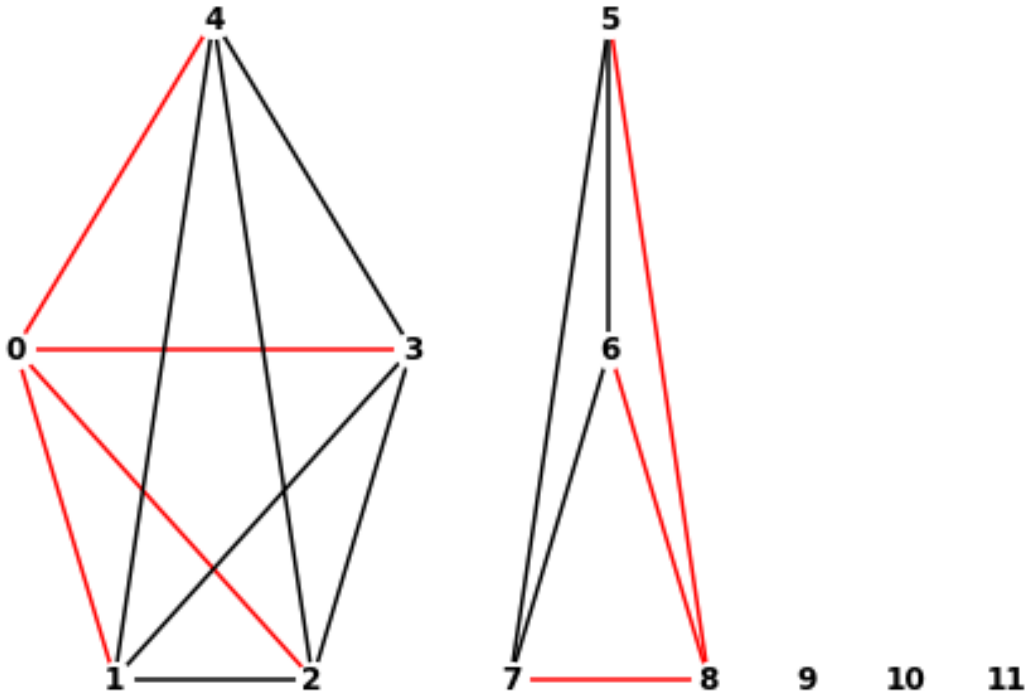

```
component 2 diameter: 1
```



#6

[8]:
```
edges = set()
for component in nx.connected_components(Graph_2):
    sub = Graph.subgraph(component)
    first_node = list(sub.nodes)[0]
    tree = nx.bfs_tree(sub, first_node)
    tree_edge = tree.edges()
    edges.update(tree_edge)

edge_color = ["red" if (i, j) in edges or (j, i) in edges else "black" for (i,␣
 ↪j) in Graph_2.edges]
nx.draw(Graph_2,pos= pos, **base, edge_color = edge_color)
plt.savefig("Tree.png")
```


4
5
0
3
6
1
2
7
8
9
10
11