In [38]:

```
"""
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Var 91
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"""

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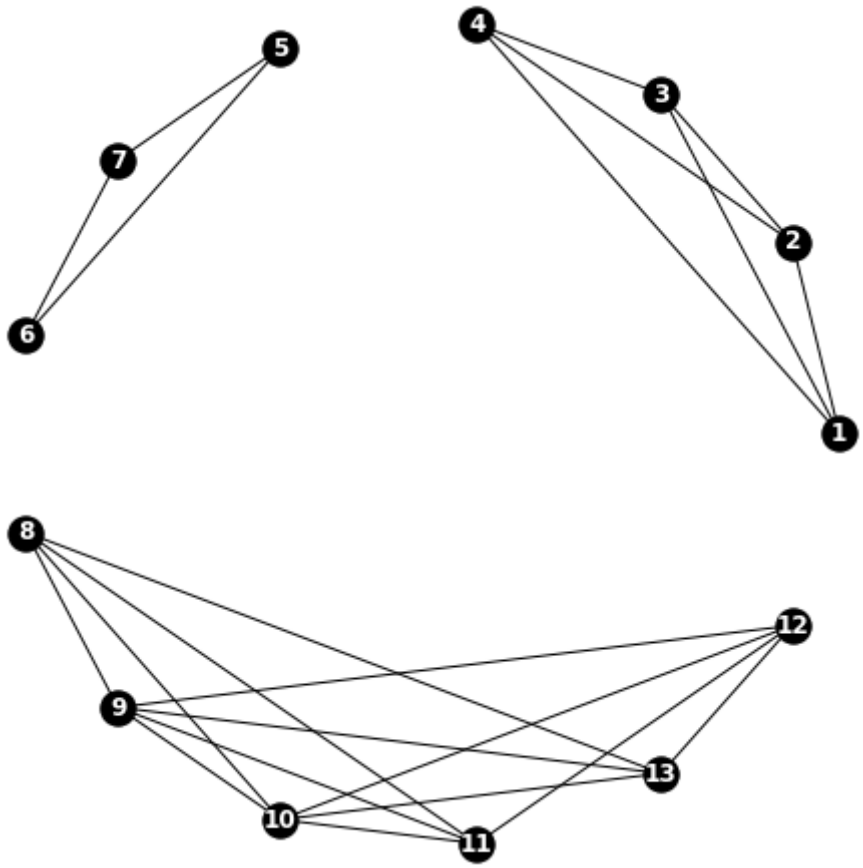

In [44]:

```
def set_own_pos():
    """
    own nodes pattern
    :return: pos (for networkx) of nodes in the Graph after optimization
    """
    pos = {x: [float(x) // 2, math.sin(float(x) * (math.pi / 1.5))] for x in G.nodes()}
    pos["8"] = [3.4, 0]
    pos["9"] = [4.4, -0.1]
    pos["10"] = [5.1, 0.3]
    pos["13"] = [5, 2]
    return pos

def finding_edges(x,tmp, diam):
    tmp_edges = []
    for node1 in x:
        for node2 in x:
            for path in (nx.all_simple_edge_paths(tmp, node1, node2)):
                if len(list(path)) == diam:
                    tmp_edges.append(path)
    random_edges = random.choice(tmp_edges)
    return random_edges



def new_edges(edge_list, node=0):
    """
    highlighting given edges
    :param edge_list: list of edges which need to be highlighted
    :param node: if you need a list of nodes set 1
    :return: list of nodes which belong to starting or enging of given edges if param node

    """
    tmp_node = []
    for elements in edge_list:
        for node_ in elements:
            if node_ not in tmp_node:
                tmp_node.append(node_)
    G.remove_edges_from(edge_list)

    nx.draw(G, pos=set_own_pos(), with_labels=True, font_weight='bold', node_color="black",
            font_color="w")
    G.add_edges_from(edge_list)

    nx.draw_networkx_edges(G, pos=set_own_pos(), edgelist=edge_list, edge_color='r')
    if node == 1:

        return tmp_node


def part3_4():
    """
    Finding components of the Graph
    for each component finding amount of nodes and edges, radius, diameter
    for each node finding degree of that and eccentricity

    then highlighting random way(path) with length equals to diameter of each component
    and showing it up

    """
```

```
    n = 1
    tmp_edges_global = []

    for x in (nx.connected_components(G)):
        tmp = nx.subgraph(G, x)

        print(f"-------Begin of the component {n}-------")
        x = sorted(x, key=float)
        print(f'nodes = {len(x)} ')
        print(f'edges = {len(G.edges(x))}')
        eccentr = nx.eccentricity(tmp)
        for node_ in x:
            print(f"~~~~~~~~Node {node_}~~~~~~~~")
            print(f'''degree: {G.degree[node_]}''')
            print(f'''eccentricity: {eccentr[node_]}''')
        print("")
        diam = nx.diameter(tmp, eccentr)
        print(f'''Radius of the component {n} = {nx.radius(tmp, eccentr)}''')
        print(f'''Diameter of the component {n} = {diam}''')
        tmp_edges_global.extend(finding_edges(x,tmp, diam))
        print(f"--------End of the component {n}--------\n")
        n += 1

    tmp_node = new_edges(tmp_edges_global, 1)
    nx.draw_networkx_nodes(G, pos=set_own_pos(), nodelist=tmp_node, node_color='r')
```

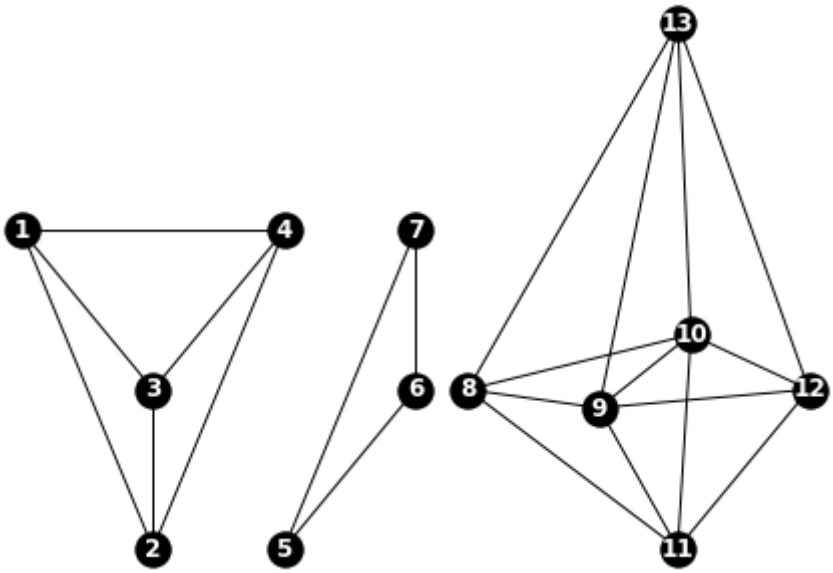
In [45]:

```
"""
PART 1
distribution of given adjacency list of edges written in a data file
with built-in networkx methods
"""

my_graph = nx.Graph()
f = open("data.txt", "r")
plt.figure(figsize=(8, 8))

plt.axes().set_aspect("equal", adjustable="datalim")
G = nx.read_adjlist("data.txt")

nx.draw_circular(G, with_labels=True, font_weight='bold', node_color="black", edge_color="b
```



In [46]:

```
"""
PART 2
Creating an own nodes distribution
"""
nx.draw(G, pos=set_own_pos(), with_labels=True, font_weight='bold', node_color="black", edg
        font_color="w")
```

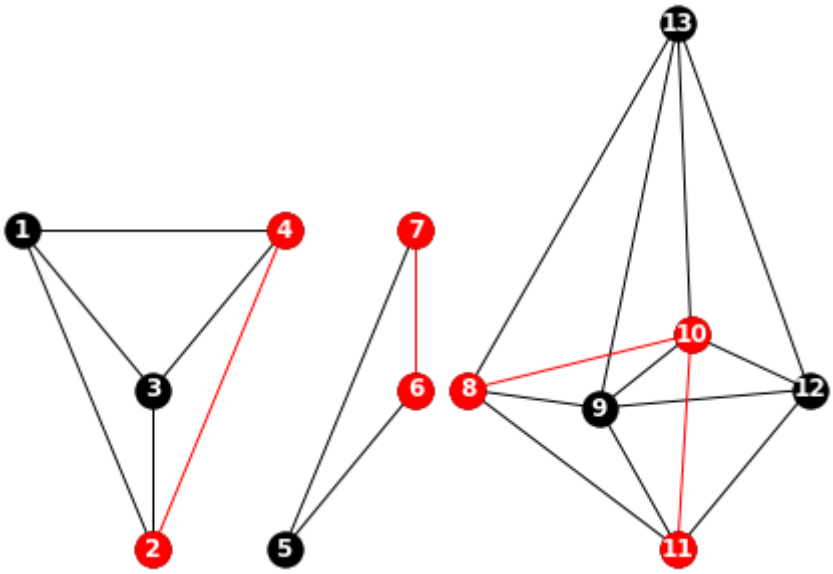


In [47]:

```
"""
PART 3-4

Finding components of the Graph
for each component finding amount of nodes and edges, radius, diameter
for each node finding degree of that and eccentricity

then highlighting random way(path) with length equals to diameter of each component
and showing it up


"""

part3_4()
```

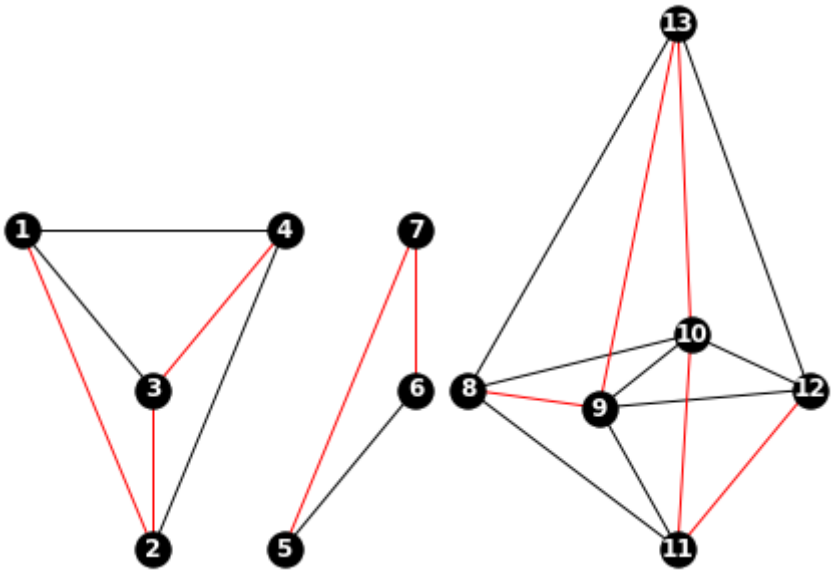
```
-------Begin of the component 1-------
nodes = 4
edges = 6
~~~~~~~~Node 1~~~~~~~~
degree: 3
eccentricity: 1
~~~~~~~~Node 2~~~~~~~~
degree: 3
eccentricity: 1
~~~~~~~~Node 3~~~~~~~~
degree: 3
eccentricity: 1
~~~~~~~~Node 4~~~~~~~~
degree: 3
eccentricity: 1

Radius of the component 1 = 1
Diameter of the component 1 = 1
--------End of the component 1--------

-------Begin of the component 2-------
nodes = 3
edges = 3
~~~~~~~~Node 5~~~~~~~~
degree: 2
eccentricity: 1
~~~~~~~~Node 6~~~~~~~~
degree: 2
eccentricity: 1
~~~~~~~~Node 7~~~~~~~~
degree: 2
eccentricity: 1

Radius of the component 2 = 1
Diameter of the component 2 = 1
--------End of the component 2--------

-------Begin of the component 3-------
nodes = 6
edges = 13
~~~~~~~~Node 8~~~~~~~~
degree: 4
eccentricity: 2
~~~~~~~~Node 9~~~~~~~~
```

```
degree: 5
eccentricity: 1
~~~~~~~~Node 10~~~~~~~~
degree: 5
eccentricity: 1
~~~~~~~~Node 11~~~~~~~~
degree: 4
eccentricity: 2
~~~~~~~~Node 12~~~~~~~~
degree: 4
eccentricity: 2
~~~~~~~~Node 13~~~~~~~~
degree: 4
eccentricity: 2

Radius of the component 3 = 1
Diameter of the component 3 = 2
--------End of the component 3--------
```



In [43]:

```
"""
PART 5
finding a DFS tree by using built-in methods of the "networkx" library  and highlighting ed
"new_edges" then showing received picture
"""
tmp_edges = []
for el in (nx.dfs_edges(G)):
    tmp_edges.append(el)
new_edges(tmp_edges)
```



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