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ML-IV Experiment-8

```
[1] import networkx as nx
    import matplotlib.pyplot as plt
    import itertools
```

```
[2] def girvan_newman_step(G):
      edge_betweenness = nx.edge_betweenness_centrality(G)
      max_betweenness = max(edge_betweenness.values())
      for edge, betweenness in edge_betweenness.items():
        if betweenness == max_betweenness:
          G.remove_edge(*edge)
          break
```

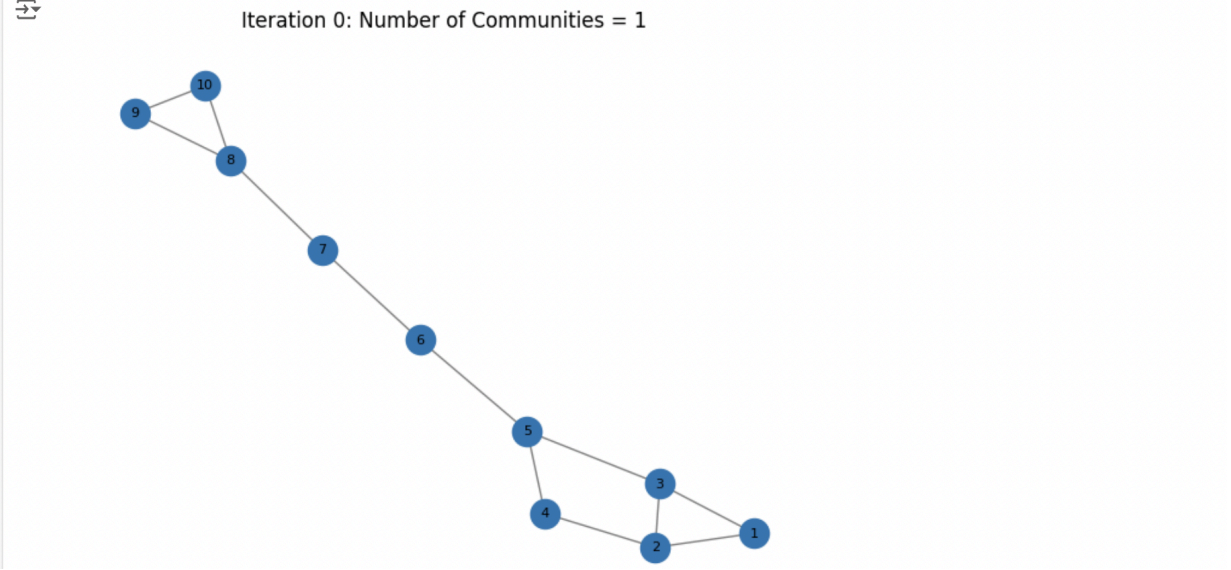
```
def plot_communities(G, pos, iteration):
  communities = list(nx.connected_components(G))
  plt.figure(figsize=(8, 6))
  for i, community in enumerate(communities):
    nx.draw_networkx_nodes(G, pos, nodelist=community, node_color=f"C{i}")
  nx.draw_networkx_edges(G, pos, edge_color='gray')
  nx.draw_networkx_labels(G, pos, font_size=8)
  plt.title(f"Iteration {iteration}: Number of Communities = {len(communities)}")
  plt.axis("off")
  plt.show()
```

```
[6] def girvan_newman(G):
      iteration = 0
      pos = nx.spring_layout(G)
      while len(list(nx.connected_components(G))) < G.number_of_nodes():
        plot_communities(G.copy(), pos, iteration)
        girvan_newman_step(G)
        iteration += 1
```

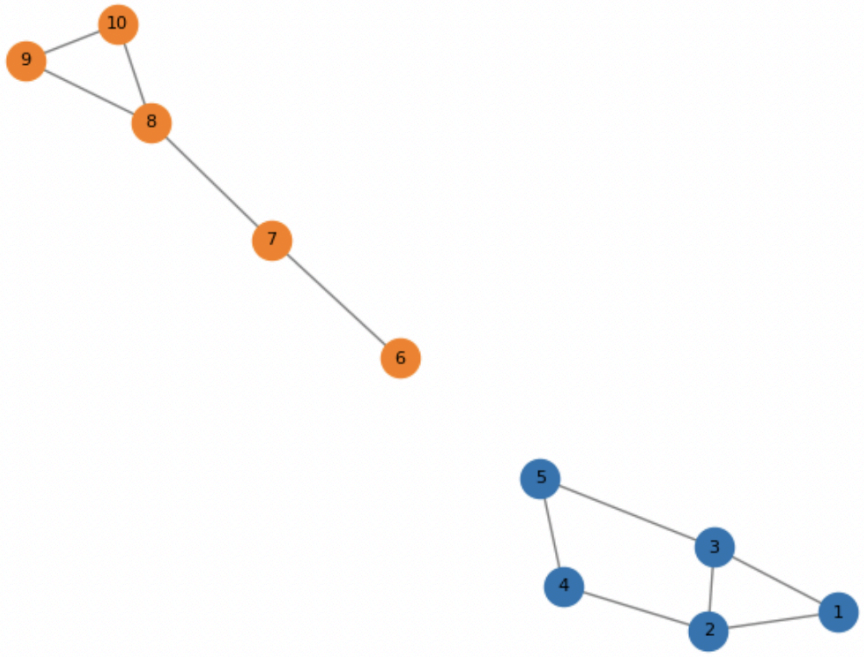
```
[7] def create_small_graph():
        G = nx.Graph()
        edges = [
            (1, 2), (1, 3), (2, 3), (2, 4),
            (3, 5), (4, 5), (5, 6), (6, 7),
            (7, 8), (8, 9), (8, 10), (9, 10)
        ]
        G.add_edges_from(edges)
        return G
```

```
[8] G = create_small_graph()
```

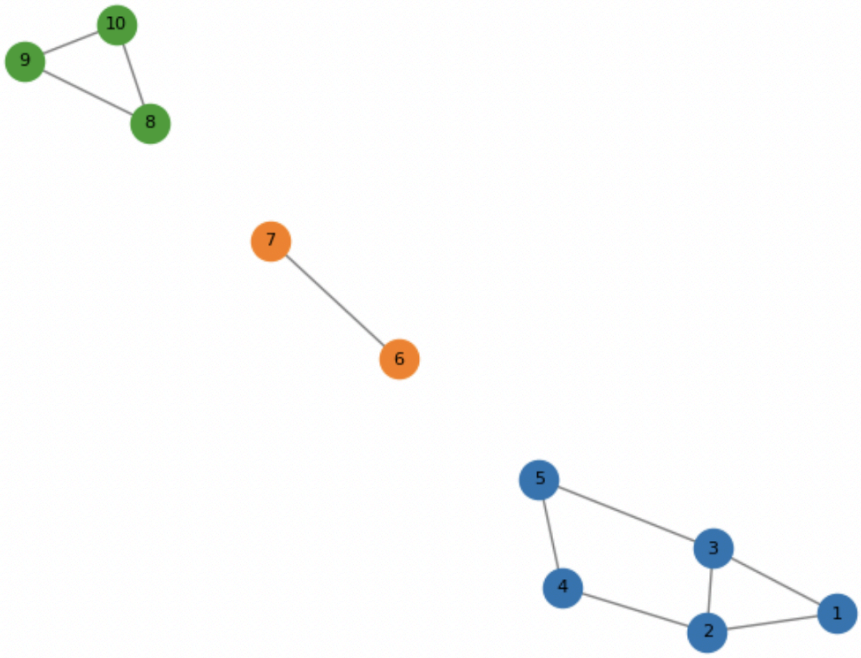
```
girvan_newman(G)
```



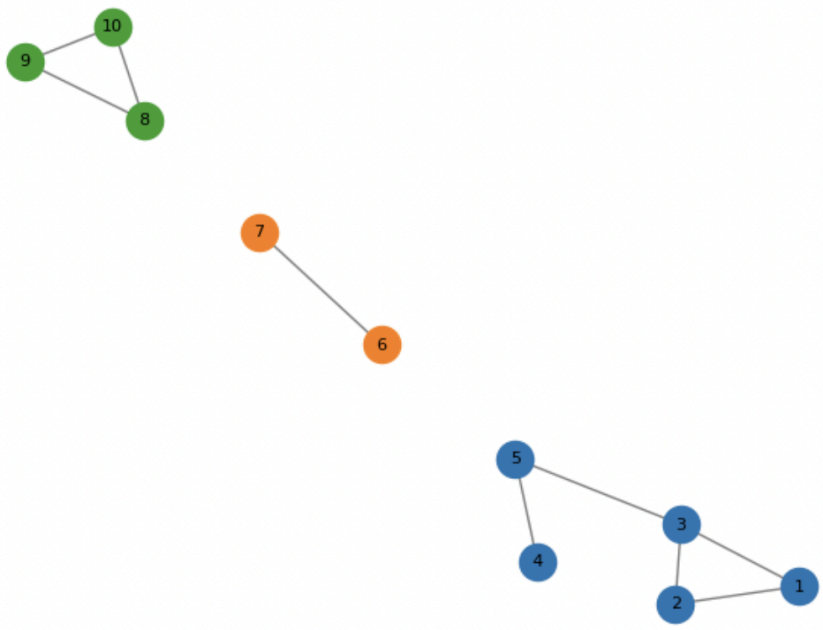
Iteration 1: Number of Communities = 2



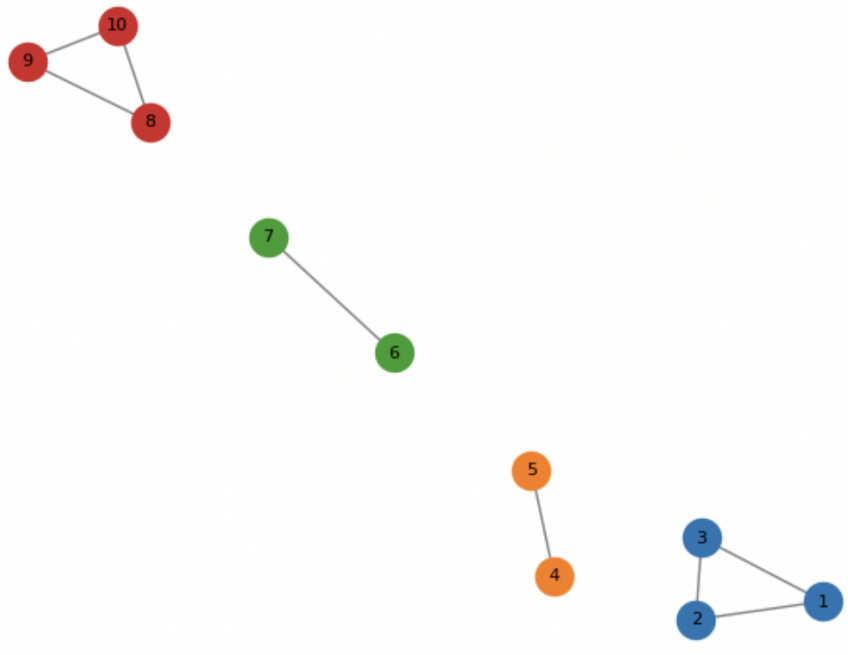
Iteration 2: Number of Communities = 3



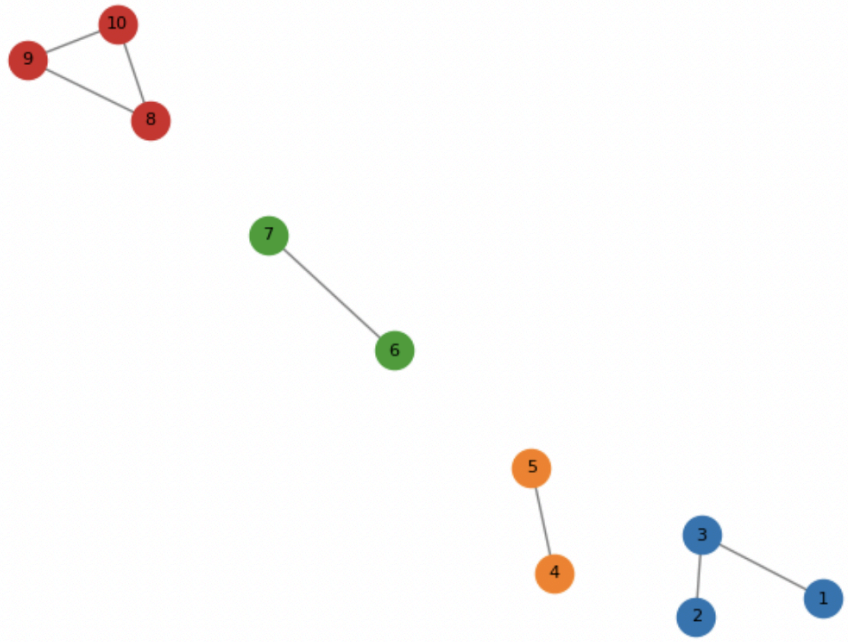
Iteration 3: Number of Communities = 3



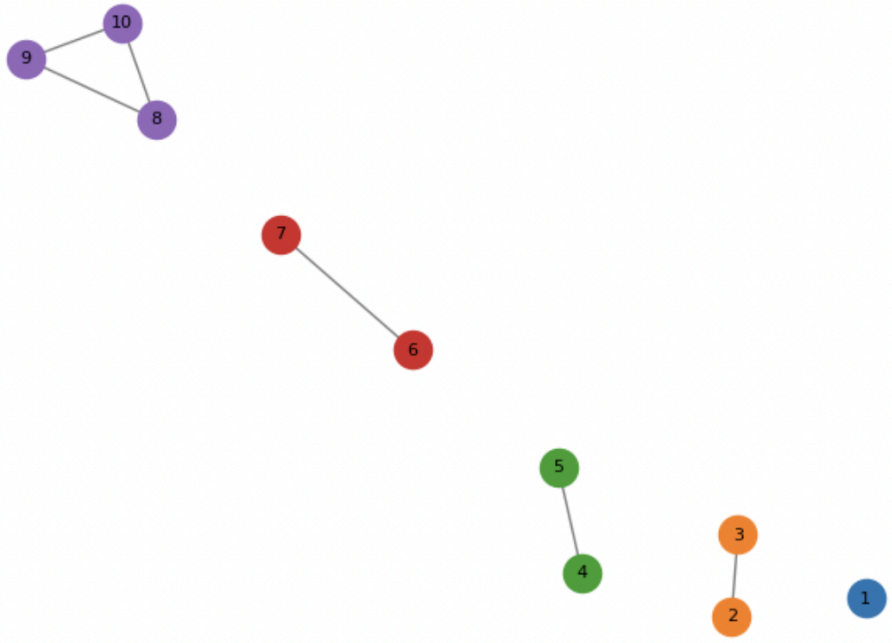
Iteration 4: Number of Communities = 4

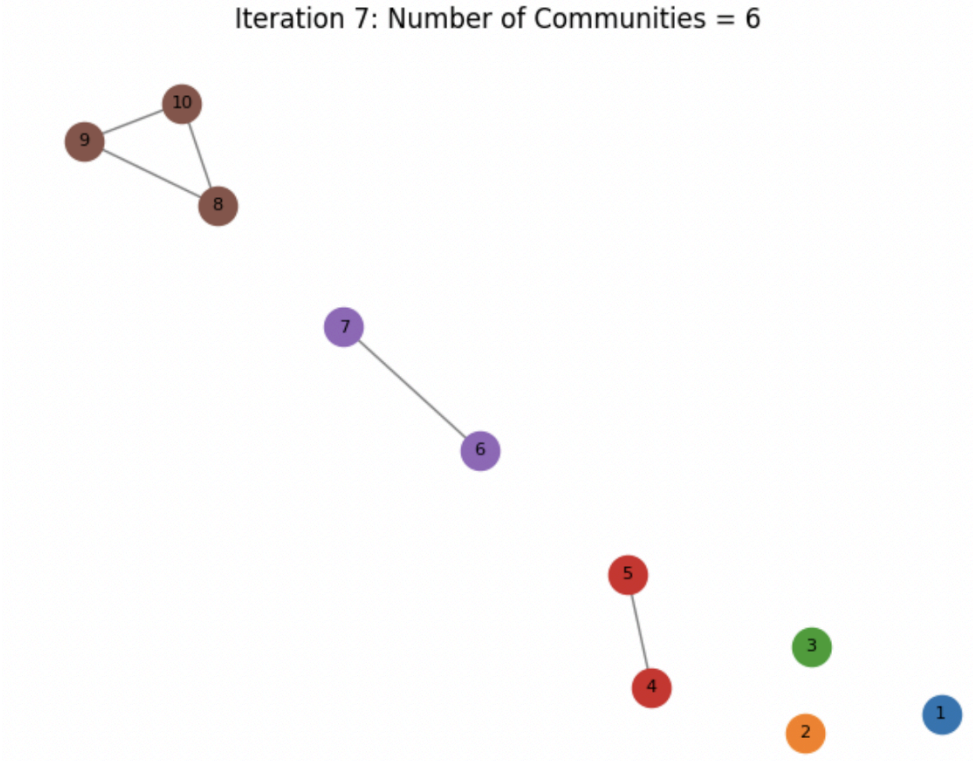


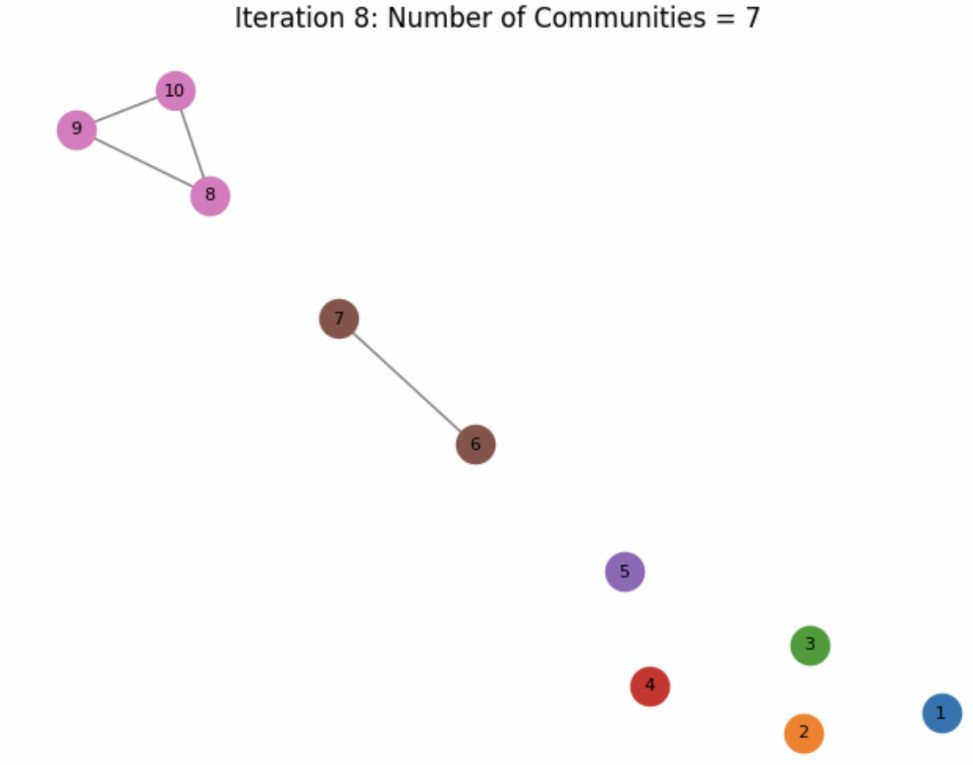
Iteration 5: Number of Communities = 4

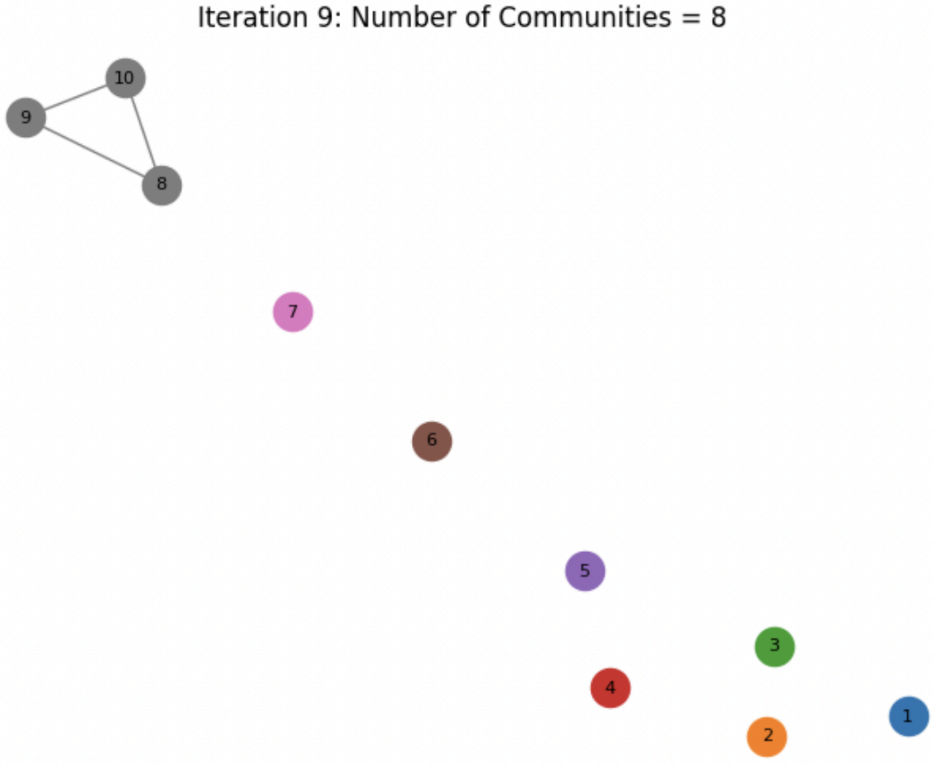


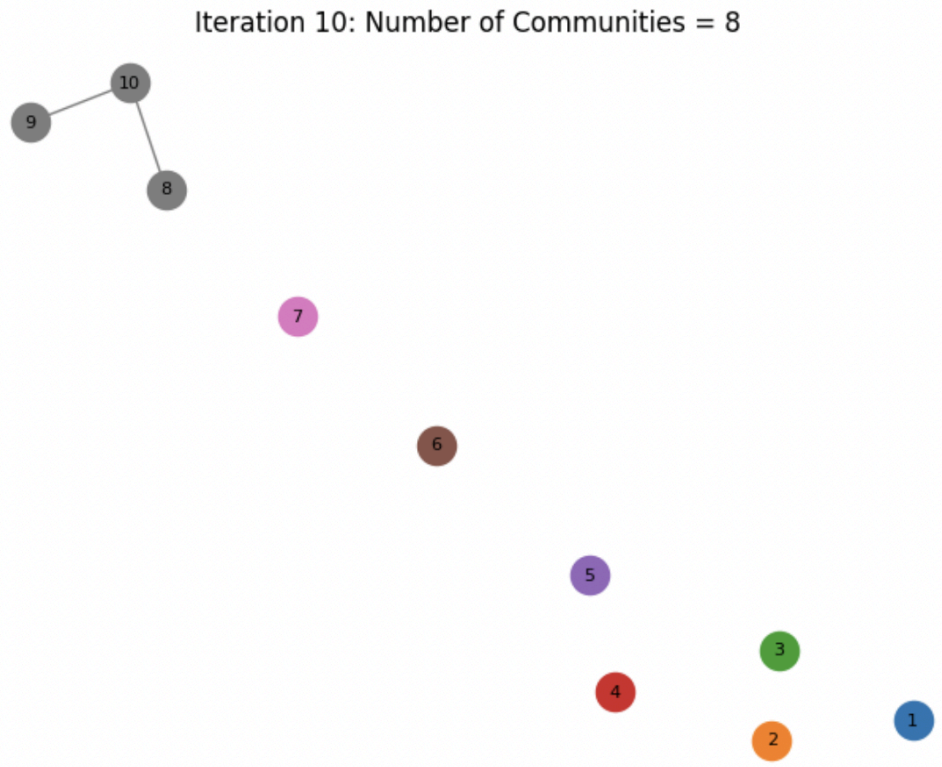
Iteration 6: Number of Communities = 5

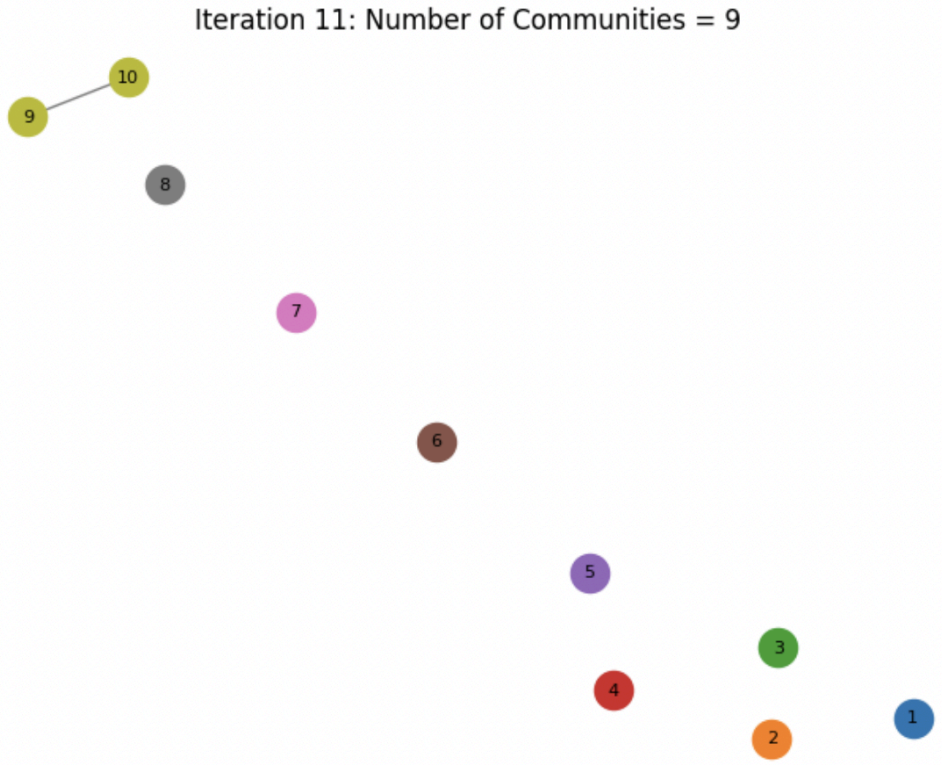



Iteration 7: Number of Communities = 6
10
9
8
7
6
5
4
3
2
1


Iteration 8: Number of Communities = 7
10
9
8
7
6
5
4
3
2
1


Iteration 9: Number of Communities = 8
10
9
8
7
6
5
3
4
1
2


Iteration 10: Number of Communities = 8
10
9
8
7
6
5
3
4
1
2


Iteration 11: Number of Communities = 9
10
9
8
7
6
5
3
4
1
2