

# Network Data Analytics

## Table of Contents

<b>I. Page Rank.....</b>	<b>3</b>
<b>II. Exercises.....</b>	<b>4</b>

# I. Page Rank

In this exercise, you will implement the pagerank centrality.

- ✓ First, you need to run the following command (note the exclamation mark).  
!conda install networkx -yes
- ✓ Import required libraries and load the sample 'karate\_club\_graph' from networkx library.

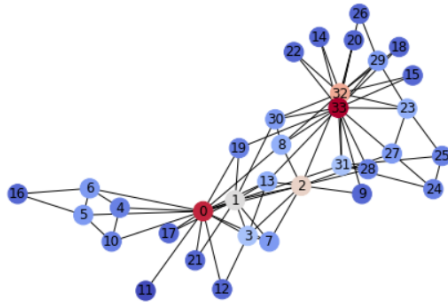
```
import matplotlib.pyplot as plt
import networkx as nx
import numpy as np
G = nx.karate_club_graph()
print(nx.info(G))
```

Name: Zachary's Karate Club  
Type: Graph  
Number of nodes: 34  
Number of edges: 78  
Average degree: 4.5882

- ✓ Calculate page rank by using simple degree centrality.

```
def simple_pagerank(G):
    p = np.array([G.degree(index) for node, index in enumerate(G.nodes())])
    return p

values = simple_pagerank(G)
nx.draw(G, cmap=plt.get_cmap('coolwarm'), node_color = values, with_labels=True)
```



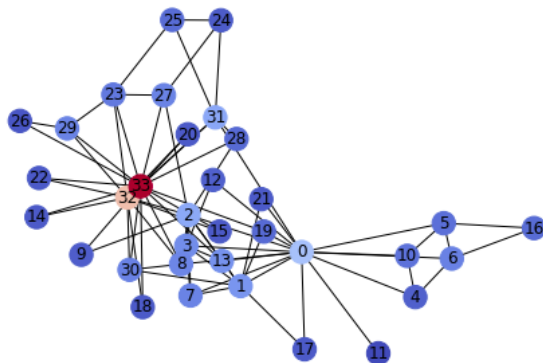
- ✓ Take the effects of neighbours into the page rank calculation by updating the centrality of each node with the iteration.

```
def pagerank_centrality(G, iter=100):
    p = np.array([1 for i in G.nodes()])

    for k in range(iter):
        for i in G.nodes():
            for j in G.nodes():
                # update the centrality
                p[i] += G.number_of_edges(i, j) * p[j] / G.degree[j]

    norm = sum(p)
    p = p / norm
    return p

values = pagerank_centrality(G)
nx.draw(G, cmap=plt.get_cmap('coolwarm'), node_color = values, with_labels=True)
```



- ✓ Which algorithm created a better result? Justify your choice.

## II. Exercises

Given the list of nodes which are the pages matching the query “California” (gr0.California.nodes.txt) and their relationships (gr0.California.edegs.txt). Use these data to finish the following tasks.

- ✓ Load into the graph using `nx.read_edgelist`.
- ✓ Get a subgraph of the above graph using `subgraph` method.

Hint: `G.subgraph(list(G.nodes())[100:150])`

- ✓ Calculate page rank of the above subgraph using simple degree centrality.
- ✓ Calculate page rank of the above subgraph by updating the centrality of each node with the iteration.