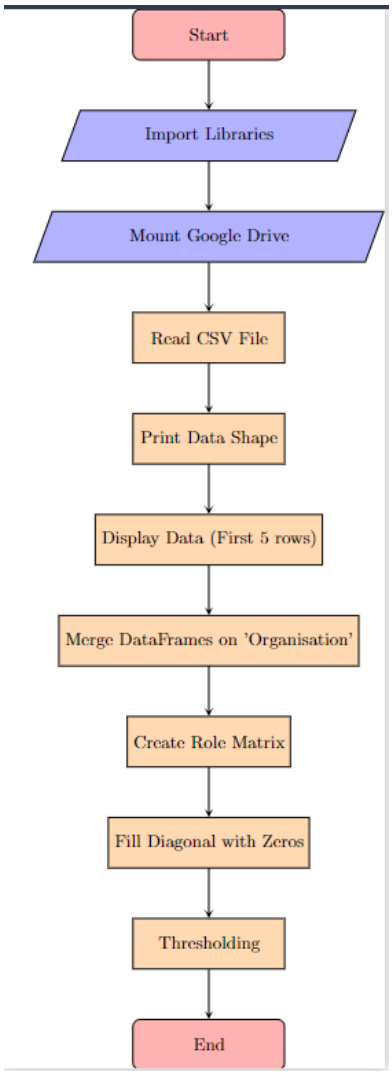
Experiment 1

Aim: Write a program to construct a social network object using Sociomatrix.

Flowchart:



Code:

#

#

#
#

```
import pandas as pd #


import numpy as np #
import networkx as nx #
import matplotlib.pyplot as plt #
%matplotlib inline
from operator import itemgetter #



from google.colab import drive
drive.mount('/content/drive/')
df = pd.read_csv ("/content/drive/MyDrive/organization.csv")
print(df.shape)
df.head(5)
df_merge = df.merge(df,on="Organisation")
role_mat = pd.crosstab(df_merge.member_x,df_merge.member_y)
#

np.fill_diagonal(role_mat.values, 0) #

role_mat[role_mat >= 1] = 1
role_mat
```

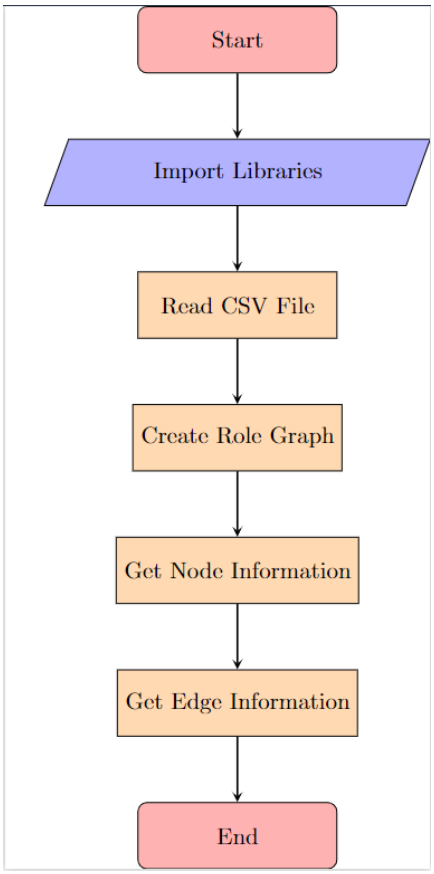
Output:

member_y	./c²	7	@profGbenga	A. Anil Sinaci	A. Cody Schuffelen	A. Jesse Jiryu Davis	A. Soroka	A.J. Roberts	AL Bot	APAR SINGHAL	...	气氖氚	江子健	琚致远	罗泽轩	胡锋	裴孟齐	谐极 yì jí	达峰的夏天	高阳阳	김건희
member_x																					
./c²	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
@profGbenga	0	0	0	0	1	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
A. Anil Sinaci	0	0	0	0	0	0	1	0	0	0	...	1	0	1	1	1	0	1	0	0	1
A. Cody Schuffelen	0	0	1	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
裴孟齐	0	0	0	0	0	0	0	0	1	1	...	0	1	0	0	0	0	0	0	0	0
谐极 yì jí	0	0	0	1	0	0	1	0	0	0	...	1	0	1	1	1	0	0	0	0	1
达峰的夏天	0	0	0	0	0	0	0	1	0	0	...	0	0	0	0	0	0	0	0	0	0
高阳阳	0	0	0	0	0	0	0	0	0	0	...	0	1	0	0	0	0	0	0	0	0

Experiment 2

Aim: Write a program to create node and edge lists network objects.

Flowchart:



Code:

```
import pandas as pd
import numpy as np
import networkx as nx #



import matplotlib.pyplot as plt
%matplotlib inline
from operator import itemgetter #


df = pd.read_csv ("/content/drive/MyDrive/organization.csv")

#
```

```
type(role_graph)
```

```
role_graph.nodes()
```


```
len(role_graph.nodes())
```

```
8920
```

```
role_graph.edges()
```

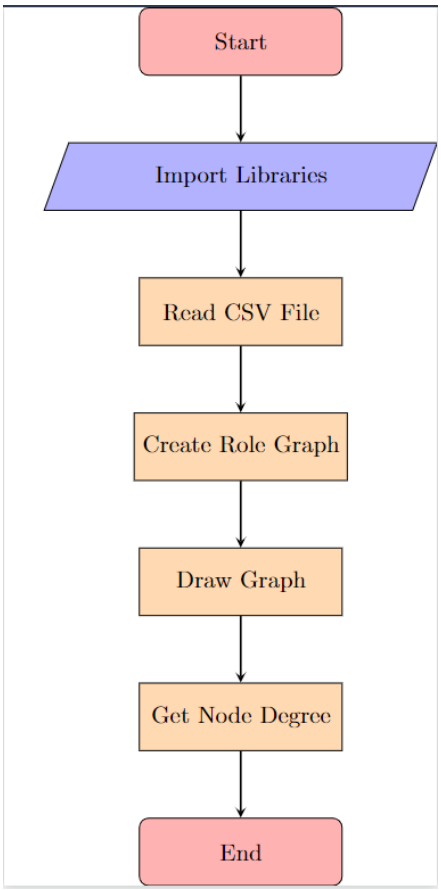

```
len(role_graph.edges())
```

```
9656
```

Experiment 3

Aim: Write a program to visualize a social network with matplotlib library.

Flowchart:



Code:

```
df = pd.read_csv("/content/drive/MyDrive/organization.csv")
nx.draw(role_graph)
#
```

```
nx.degree(role_graph) #
```

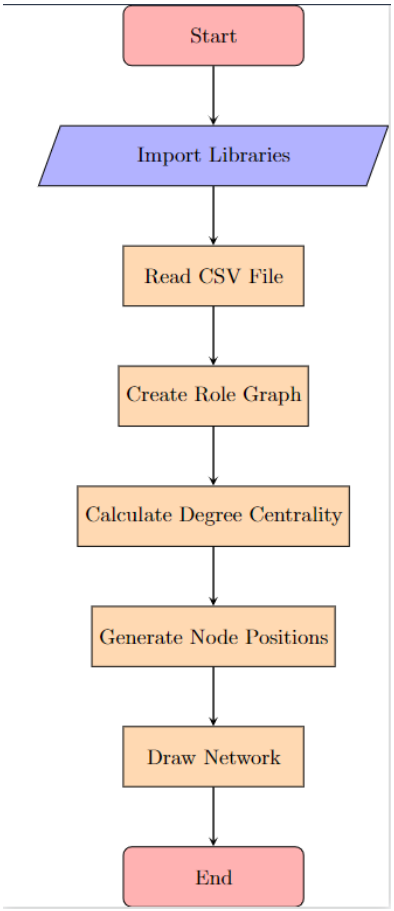
Output:

```
DegreeView({'Oleh Aldekein': 1, 'ethereum': 74, 'None': 27, 'Frank Szendzielarz': 1, 'Kolby Moroz Liebl': 1, 'Marius van der Wijden': 1,
'Mihai Alisie': 1, 'Anton Nashatyrev': 1, 'Justin Martin': 1, 'RJ Catalano': 1, 'Yoshitomo Nakanishi': 1, 'Alexander Arlt': 1, 'Alessandro
Coglio': 1, 'acud': 1, 'Patricio Palladino': 1, 'Angela Lu': 1, 'Alex Beregszaszi': 1, 'becca': 1, 'Kamil Śliwak': 1, 'Cesar Brazon': 1,
'Christian Parpart': 1, 'Corwin Smith': 1, 'Marian OANCEA': 1, 'Darko Macesic': 1, 'Daniel Kirchner': 1, 'Ev': 1, 'franzihei': 1, 'Ferenc
Szabo': 1, 'Grant Wuerker': 1, 'Gabriel Rocheleau': 1, 'Guillaume Ballet': 1, 'Andrei Maiboroda': 1, 'sacha': 1, 'Harikrishnan Mulackal': 1,
'Hugo': 1, 'David Disu': 1, 'Iuri Matias': 1, 'busyforking': 1, 'Jochem Brouwer': 1, 'Jamie Pitts': 1, 'Jutta Steiner': 1, 'Péter Szilágyi':
1, 'Karl Floersch': 1, 'kumavis': 1, 'Jakub Vysoký': 1, 'Leo': 2, 'ligi': 1, 'Maran': 1, 'Marc Garreau': 1, 'Mario Vega': 1, 'Matthew Di
Ferrante': 1, 'Kevin Mai-Husan Chia': 1, 'Nicolás Quiroz': 1, 'Nicolas Fierro': 1, 'Samuel Furter': 1, 'Anton Evangelatov': 1, 'Jeffrey
Wilcke': 1, 'Ognyan Genev': 1, 'Johnson Ogwuru': 1, 'Pablo Pettinari': 1, 'Piper Merriam': 1, 'Yoichi Hirai': 1, 'Alex Stokes': 1, 'Edward
Ruchevits': 1, 'Sam Calder-Mason': 1, 'Rafael Matias': 1, 'Mário Havel': 1, 'tintin': 1, 'Jack Peterson': 1, 'Ulrich Petri': 1, 'Virgil
Griffith': 1, 'Paul Wackerow': 1, 'Wesley': 1, 'Matthew Doty': 1, 'Andrew Ashikhmin': 1, 'Howard Huang': 2, 'pytorch': 48, 'Nicolas Hug': 1,
'Patrick Kan': 1, 'Aaron Shi': 1, 'Anthony Liu': 1, 'Asjad Syed': 2, 'Lucas Hosseini': 1, 'Jon Janzen': 2, 'Caroline Chen': 1, 'Sam Gross': 1,
'Tristan Rice': 1, 'Vasilis Vryniotis': 1, 'David Esiobu': 1, 'Dmytro Dzhulgakov': 1, 'Elizabeth Santorella': 1, 'Francisco Massa': 1, 'G.
Jerry Chen': 1, 'Hanton Yang': 2, 'hl475': 2, 'Lu Fang': 1, 'Lin': 1, 'JIN SUN': 1, 'Jessica': 1, 'Jianyu Huang': 1, 'Jing Shan': 1, 'Jamie
King': 1, 'Joel Pobar': 1, 'Sergii Dymchenko': 1, 'Karl Ostmo': 1, 'nateanl': 1, 'Naveed Golafshani': 1, 'Neeraj Pradhan': 1, 'Omkar
Salpekar': 1, 'Pavithran Ramachandran': 1, 'Peng Wu': 1, 'Radhakrishnan Venkataramani': 1, 'Rohan Varma': 1, 'Peter Romov': 1, 'Shishir Bhat':
1, 'Eli Uriegas': 1, 'Stephen Macke': 1, 'Soumith Chintala': 2, 'Michael Suo': 1, 'Wei Wen': 1, 'Zafar': 1, 'Rui Zhu': 1, 'Zheng Yan': 1,
'Jacob Walker': 1, 'udacity': 5, 'Patrick': 1, 'Richard Kalehoff': 1, 'Aaron Stone': 1, 'Elliot Hesp': 2, 'firebase': 39, 'Feiyang': 1,
'Ilja': 1, 'James He': 1, 'Mike Diarmid': 2, 'Alex Astrum': 1, 'Allen Vicencio': 2, 'Darren Ackers': 1, 'David East': 1, 'Greg K': 1, 'Iman
Rahmatizadeh': 1, 'Thomas Bouldin': 1, 'James Daniels': 1, 'Jeffrey Dallatezza': 1, 'Kato Richardson': 1, 'Kiana McNellis': 2, 'Lahiru
Maramba': 1, 'Patryk Lesiewicz': 1, 'Andrei Lesnitsky': 1, 'Mahesh Jamdade': 2, 'makuchaku': 1, 'Majid Hajian': 2, 'Mertcan Mermerkaya': 2,
'Nick Cooke': 1, 'Nicolas Garnier': 3, 'Paul Beusterien': 2, 'Mais Alheraki': 1, 'Raymond Lam': 1, 'Rosalyn Tan': 1, 'Russell Wheatley': 1,
'Ryan Wilson': 3, 'Sebastian Schmidt': 1, 'Rosário Pereira Fernandes': 1, 'Hsin-pei Toh': 1, 'Ibrahim Ulukaya': 1, 'Vladimir Kryachko': 2,
'Yuchen Shi': 2, 'Kai Wu': 1, 'Alex Li': 1, 'flutter': 67, 'Ayush Bherwani': 1, 'BeMacized': 1, 'ColdPaleLight': 1, 'Faisal Abid': 1,
'Hidenori Matsubayashi': 1, 'Ian Hickson': 1, 'Marcus Tomlinson': 1, 'Andre': 1, 'Taha Tesser': 1, 'YeungKC': 1, 'Alexander Aprelev': 1, 'Aart
Bik': 1, 'Anna Gringauze': 2, 'Alan Trope': 1, 'Brandon DeRosier': 1, 'Emmanuel Garcia': 2, 'Bruno Garcia': 1, 'Chris Bracken': 2, 'Chinmay
```

Experiment 4

Aim: Write a program to calculate the node-level degree centrality measures for social network and plot the graph.

Flowchart:



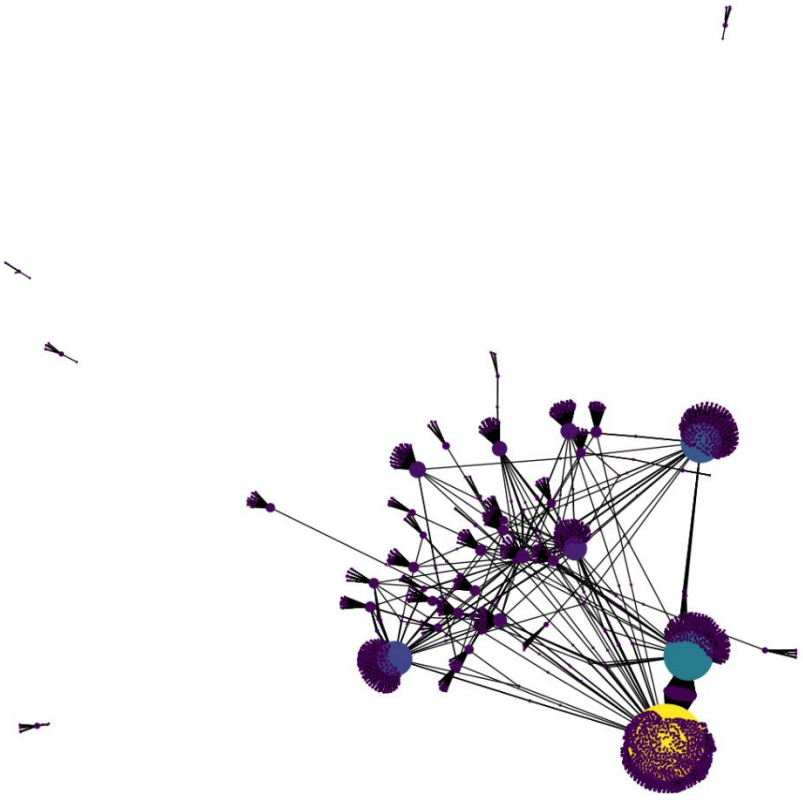
Code:

```
import pandas as pd
import numpy as np
import networkx as nx
import matplotlib.pyplot as plt
%matplotlib inline
from operator import itemgetter #

df=pd.read_csv("/content/drive/MyDrive/organization.csv")
nx.degree_centrality(role_graph) #
```

```
pos = nx.spring_layout(role_graph) #


#



degCent = nx.degree_centrality(role_graph)
node_color = [20000.0 * role_graph.degree(v) for v in
role_graph]
node_size =  [v * 10000 for v in degCent.values()]
plt.figure(figsize=(15,15))
nx.draw_networkx(role_graph, with_labels=False,
                 node_color=node_color,
                 node_size=node_size )
plt.axis('off')
sorted(degCent, key=degCent.get, reverse=True)[:5]
```

Output:

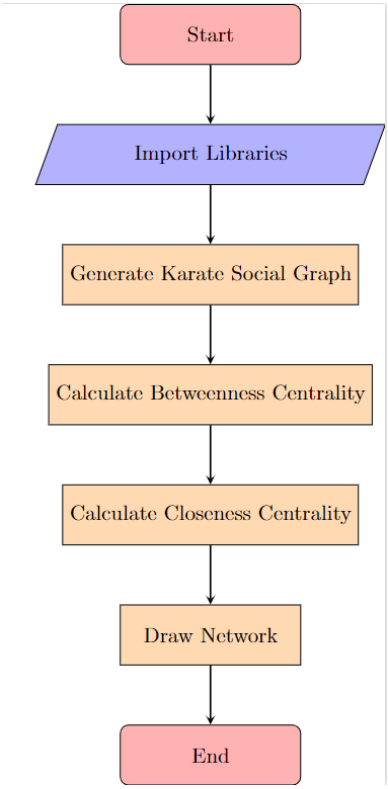
```
{'Oleh Aldekein': 0.00011208249271463797,
 'ethereum': 0.008406186953597848,
 'None': 0.003026227303295225,
 'Frank Szendzielarz': 0.00011208249271463797,
 'Kolby Moroz Liebl': 0.00011208249271463797,
 'Marius van der Wijden': 0.00011208249271463797,
 'Mihai Alisie': 0.00011208249271463797,
 'Anton Nashatyrev': 0.00011208249271463797,
 'Justin Martin': 0.00011208249271463797,
 'RJ Catalano': 0.00011208249271463797,
 'Yoshitomo Nakanishi': 0.00011208249271463797,
 'Alexander Arlt': 0.00011208249271463797,
 'Alessandro Coglio': 0.00011208249271463797,
 'acud': 0.00011208249271463797,
 'Patricio Palladino': 0.00011208249271463797,
 'Angela Lu': 0.00011208249271463797,
 'Alex Beregszaszi': 0.00011208249271463797,
 'becca': 0.00011208249271463797,
 'Kamil Śliwak': 0.00011208249271463797,
 'Cesar Brazon': 0.00011208249271463797,
 'Christian Parpart': 0.00011208249271463797,
 'Corwin Smith': 0.00011208249271463797,
 'Marian OANCΞA': 0.00011208249271463797,
 'Darko Macesic': 0.00011208249271463797,
 'Daniel Kirchner': 0.00011208249271463797,
 'Ev': 0.00011208249271463797,
 'franzihei': 0.00011208249271463797,
 'Ferenc Szabo': 0.00011208249271463797,
 'Grant Wuerker': 0.00011208249271463797,
 'Gabriel Rocheleau': 0.00011208249271463797,
 'Guillaume Ballet': 0.00011208249271463797,
 'Andrei Maiboroda': 0.00011208249271463797,
 'sacha': 0.00011208249271463797,
```



Experiment 5

Aim: Write a program to calculate the node-level betweenness centrality and closeness centrality measures for social network and plot the graph.

Flowchart:

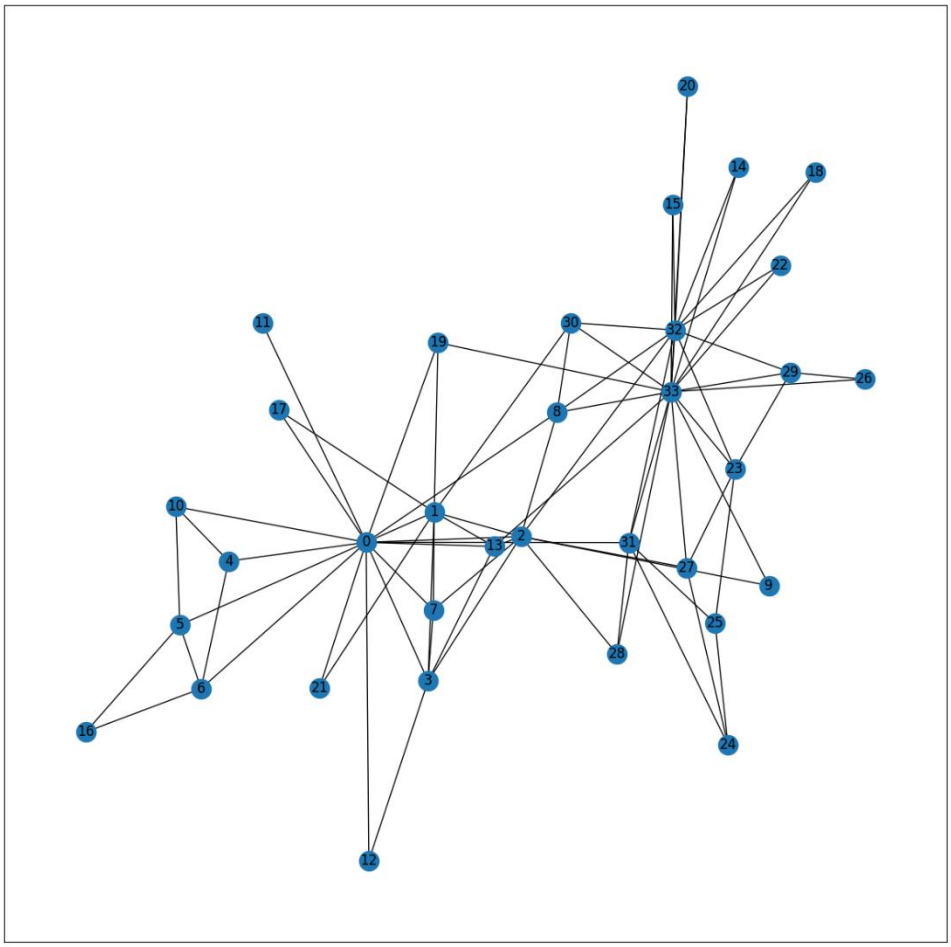


Code:

```
import random
import networkx as nx

# G is the Karate Social Graph
G = nx.karate_club_graph()

# betweenness_centrality
b=nx.betweenness_centrality(G)
print(b)

# closeness_centrality
c = nx.closeness_centrality(G)
print(c)

plt.figure(figsize =(15, 15))
nx.draw_networkx(G, with_labels = True)
```

Output:

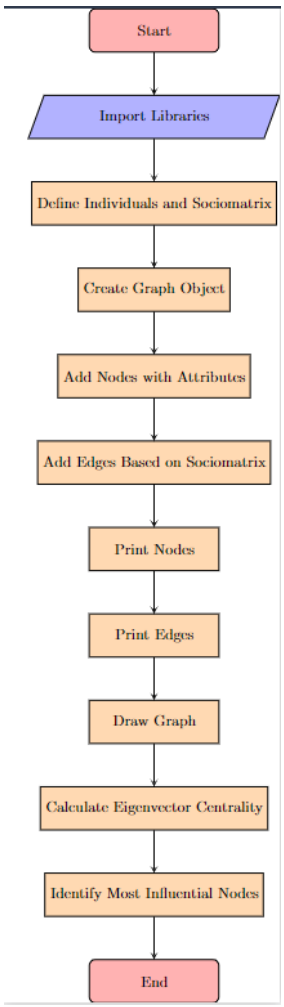

{0: 0.43763528138528146, 1: 0.05393668831168831, 2: 0.14365680615680618, 3: 0.011909271284271283, 4: 0.0006313131313131313, 5: 0.029987373737373737, 6: 0.029987373737373736, 7: 0.0, 8: 0.055926827801827801, 9: 0.0008477633477633478, 10: 0.000631313
{0: 0.5689655172413793, 1: 0.4852941176470588, 2: 0.5593220338983051, 3: 0.4647887323943662, 4: 0.3793103448275862, 5: 0.3837209302325581, 6: 0.3837209302325581, 7: 0.44, 8: 0.515625, 9: 0.4342105263157895, 10: 0.3793103448275862, 11: 0.3666666666


20
14
18
15
22
11
30
32
19
29
26
33
17
8
23
10
1
0
2
31
13
4
27
9
7
5
25
28
3
21
6
16
24
12

Experiment 6

Aim: Write a program to create network-level measures of centrality for social network.

Flowchart:



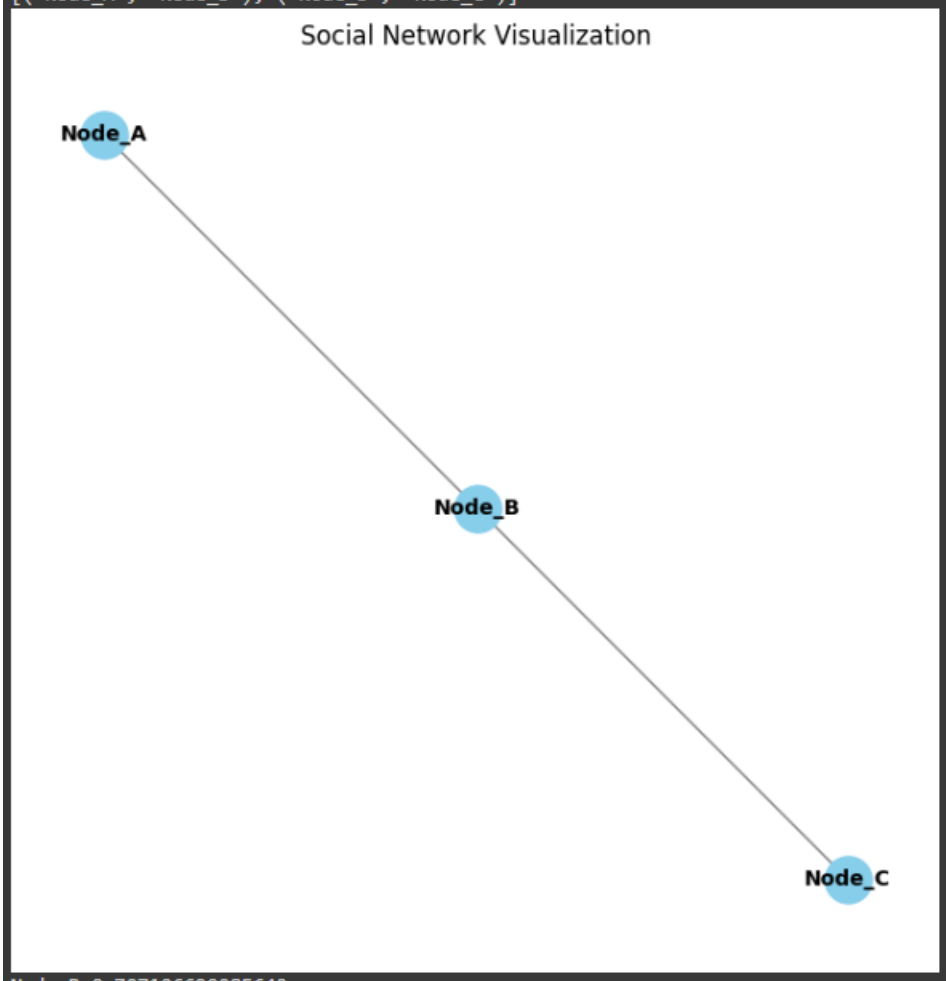
Code:

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

#
names = ['Node_A', 'Node_B', 'Node_C']

#
sociomatrix = np.array([
#
    [0, 1, 0 ], #
    [1, 0, 1 ], #
```

```
    [0, 1, 0 ]  #
])

#
G = nx.Graph()

#
for i, name in enumerate(names):
    G.add_node(name)

#
for i in range(len(names)):
    for j in range(i + 1, len(names)):
        if sociomatrix[i][j] == 1:
            G.add_edge(names[i], names[j])


#
print("Nodes of the social network:")
print(names)


#
print("Edges of the social network:")
print(list(G.edges()))

#
pos = nx.spring_layout(G)  #
plt.figure(figsize=(6,6))
nx.draw(G, pos, with_labels=True, node_size=500,
node_color='skyblue',
        font_size=10, font_weight='bold', edge_color='gray')

#
plt.title('Social Network Visualization')
plt.show()

eigenvector_centrality = nx.eigenvector_centrality(G)
#

for node in sorted(eigenvector_centrality,
key=eigenvector_centrality.get, reverse=True):
  print(node, eigenvector_centrality[node])
```

Output:

```
Nodes of the social network:
['Node_A', 'Node_B', 'Node_C']
Edges of the social network:
[('Node_A', 'Node_B'), ('Node_B', 'Node_C')]
```

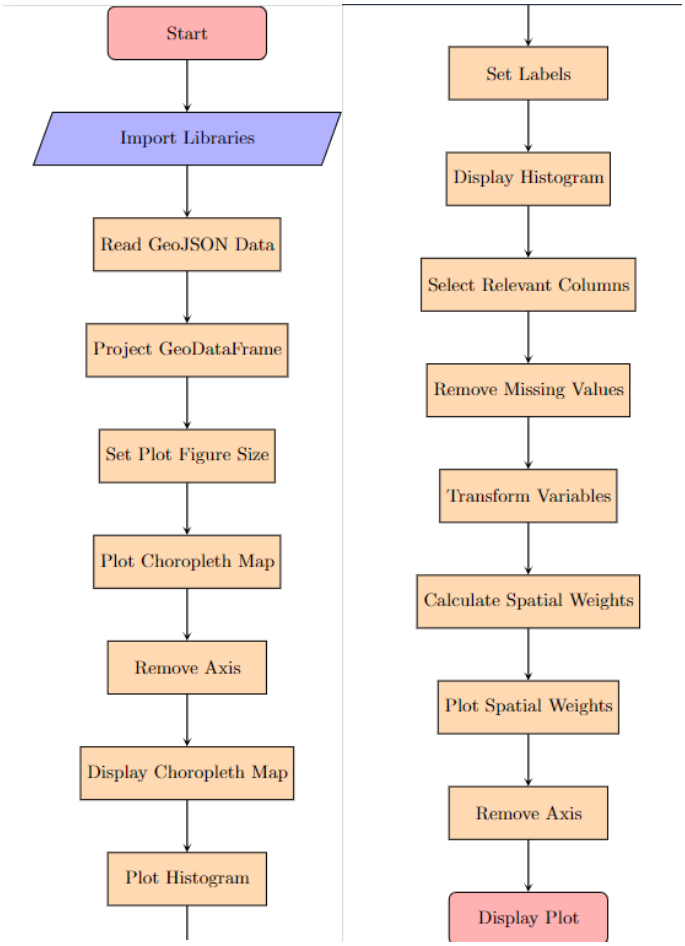



```
Node_B 0.707106690085642
Node_A 0.5000000644180599
Node_C 0.5000000644180599
```

Experiment 7

Aim: Write a program to incorporate and plot network connectivity in a spatial regression model.

Flowchart:



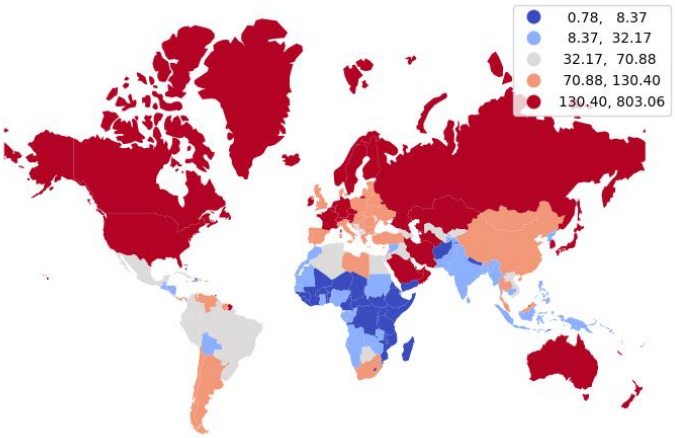
Code:

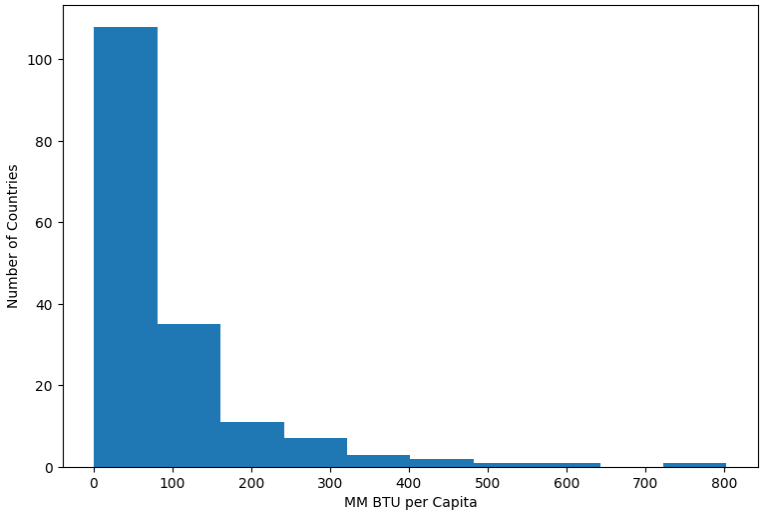
```
#
import geopandas
import matplotlib.pyplot as plt
import numpy
import pysal.lib

#

countries =
geopandas.read_file("https://michaelminn.net/tutorials/data/20
19-world-energy-indicators.geojson")

#
```

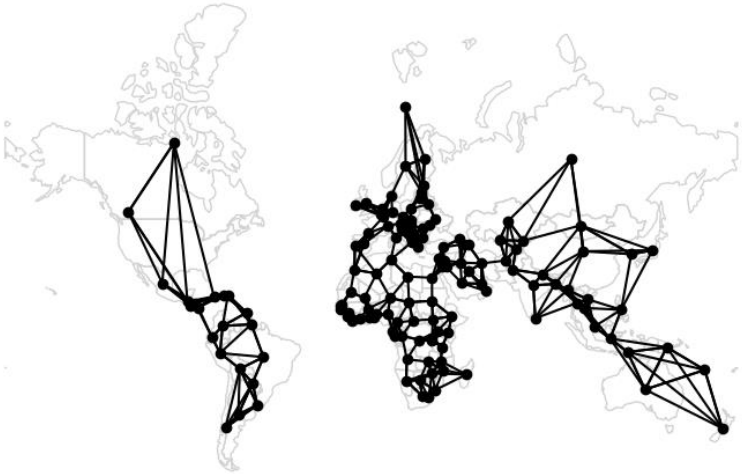
```
countries = countries.to_crs("EPSG:3857")

#
plt.rcParams['figure.figsize'] = [9, 6]

#

axis = countries.plot("MM_BTU_per_Capita", cmap="coolwarm",
legend=True, scheme="quantiles")

#
axis.set_axis_off()

#
plt.show()

#
axis = plt.hist(countries["MM_BTU_per_Capita"])

#
plt.xlabel("MM BTU per Capita")
plt.ylabel("Number of Countries")

#
plt.show()

#
dependent_name = ["Democracy_Index"]
independent_names = ["GDP_per_Capita_PPP_Dollars",
"Military_Percent_GDP", "Resource_Rent_Percent_GDP",
"Industry_Percent_GDP"]

#

model_data = countries[dependent_name + independent_names +
["geometry", "Latitude", "Longitude"]]
model_data = model_data.dropna()

#

transform_vars = ["GDP_per_Capita_PPP_Dollars",
"Military_Percent_GDP", "Resource_Rent_Percent_GDP"]
model_data[transform_vars] =
numpy.log(model_data[transform_vars] + 1)

#

weights = pysal.lib.weights.KNN.from_dataframe(model_data,
k=4)

#
```

```
axis = model_data.plot(edgecolor="lightgray",
facecolor="none")
model_data["index"] = model_data.index
weights.plot(gdf=model_data, indexed_on="index", ax=axis)

#
axis.set_axis_off()

#
plt.show()
```

Output:


0.78, 8.37
8.37, 32.17
32.17, 70.88
70.88, 130.40
130.40, 803.06

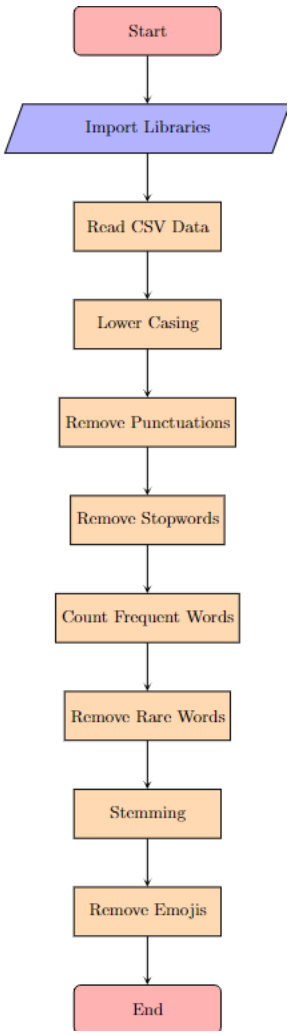

Number of Countries
MM BTU per Capita
0
20
40
60
80
100
0
100
200
300
400
500
600
700
800



Experiment 8

Aim: Write a program for preprocessing of social media text and detect sentiment from it.

Flowchart:



Code:

```
#
import numpy as np
import pandas as pd
import re
import nltk
import spacy
import string
pd.options.mode.chained_assignment = None

full_df = pd.read_csv("/content/drive/MyDrive/sample.csv")
df = full_df[["text"]]
df["text"] = df["text"].astype(str)
```

```
full_df.head()
```

	tweet_id	author_id	inbound	created_at	text	response_tweet_id	in_response_to_tweet_id
0	119237	105834	True	Wed Oct 11 06:55:44 +0000 2017	@AppleSupport causing the reply to be disregar...	119236	NaN
1	119238	ChaseSupport	False	Wed Oct 11 13:25:49 +0000 2017	@105835 Your business means a lot to us. Pleas...	NaN	119239.0
2	119239	105835	True	Wed Oct 11 13:00:09 +0000 2017	@76328 I really hope you all change but I'm su...	119238	NaN
3	119240	VirginTrains	False	Tue Oct 10 15:16:08 +0000 2017	@105836 LiveChat is online at the moment - htt...	119241	119242.0
4	119241	105836	True	Tue Oct 10 15:17:21 +0000 2017	@VirginTrains see attached error message. I've...	119243	119240.0

```
#
df["text_lower"] = df["text"].str.lower()
df.head()
```

	text	text_lower
0	@AppleSupport causing the reply to be disregar...	@applesupport causing the reply to be disregar...
1	@105835 Your business means a lot to us. Pleas...	@105835 your business means a lot to us. pleas...
2	@76328 I really hope you all change but I'm su...	@76328 i really hope you all change but i'm su...
3	@105836 LiveChat is online at the moment - htt...	@105836 livechat is online at the moment - htt...
4	@VirginTrains see attached error message. I've...	@virgintrains see attached error message. i've...

```
#
#
df.drop(["text_lower"], axis=1, inplace=True)

PUNCT_TO_REMOVE = string.punctuation
def remove_punctuation(text):
    """custom function to remove the punctuation"""
    return text.translate(str.maketrans('', '',
PUNCT_TO_REMOVE))

df["text_wo_punct"] = df["text"].apply(lambda text:
remove_punctuation(text))
df.head()
```

	text	text_wo_punct
0	@AppleSupport causing the reply to be disregar...	AppleSupport causing the reply to be disregard...
1	@105835 Your business means a lot to us. Pleas...	105835 Your business means a lot to us Please ...
2	@76328 I really hope you all change but I'm su...	76328 I really hope you all change but Im sure...
3	@105836 LiveChat is online at the moment - htt...	105836 LiveChat is online at the moment https...
4	@VirginTrains see attached error message. I've...	VirginTrains see attached error message Ive tr...

```
#
#


#
#
from nltk.corpus import stopwords
", ".join(stopwords.words('english'))
```

```
'i, me, my, myself, we, our, ours, ourselves, you, you're, you've, you'll, you'd, your, yours, yourself, yourselves, he, him, his
what, which, who, whom, this, that, that'll, these, those, am, is, are, was, were, be, been, being, have, has, had, having, do, d
against, between, into, through, during, before, after, above, below, to, from, up, down, in, out, on, off, over, under, again, f
me, such, no, nor, not, only, own, same, so, than, too, very, s, t, can, will, just, don, don't, should, should've, now, d, ll, m
asn't, haven, haven't, isn, isn't, ma, mightn, mightn't, mustn, mustn't, needn, needn't, shan, shan't, shouldn, shouldn't, wasn,
```

```
STOPWORDS = set(stopwords.words('english'))
def remove_stopwords(text):
    """custom function to remove the stopwords"""
    return " ".join([word for word in str(text).split() if
word not in STOPWORDS])

df["text_wo_stop"] = df["text_wo_punct"].apply(lambda text:
remove_stopwords(text))
df.head()
```

	text	text_wo_punct	text_wo_stop
0	@AppleSupport causing the reply to be disregar...	AppleSupport causing the reply to be disregard...	AppleSupport causing reply disregarded tapped ...
1	@105835 Your business means a lot to us. Pleas...	105835 Your business means a lot to us Please ...	105835 Your business means lot us Please DM na...
2	@76328 I really hope you all change but I'm su...	76328 I really hope you all change but Im sure...	76328 I really hope change Im sure wont Becaus...
3	@105836 LiveChat is online at the moment - htt...	105836 LiveChat is online at the moment https...	105836 LiveChat online moment httpstcoSY94VtU8...
4	@VirginTrains see attached error message. I've...	VirginTrains see attached error message Ive tr...	VirginTrains see attached error message Ive tr...

```
#
from collections import Counter
cnt = Counter()
for text in df["text_wo_stop"].values:
    for word in text.split():
        cnt[word] += 1

cnt.most_common(10)
```

```
[('I', 34),
 ('us', 25),
 ('DM', 19),
 ('help', 17),
 ('httpstcoGDrqU22YpT', 12),
 ('AppleSupport', 11),
 ('Thanks', 11),
 ('phone', 9),
 ('Hi', 8),
 ('get', 8)]
```

```
#
#
df.drop(["text_wo_punct", "text_wo_stop"], axis=1,
inplace=True)

n_rare_words = 10
```

```
RAREWORDS = set([w for (w, wc) in cnt.most_common()[:-
n_rare_words-1:-1]])
def remove_rarewords(text):
    """custom function to remove the rare words"""
    return " ".join([word for word in str(text).split() if
word not in RAREWORDS])

df["text_wo_stopfreqrare"] =
df["text_wo_stopfreq"].apply(lambda text:
remove_rarewords(text))
df.head()
```

	text	text_wo_stopfreq	text_wo_stopfreqrare
0	@AppleSupport causing the reply to be disregar...	causing reply disregarded tapped notification ...	causing reply disregarded tapped notification ...
1	@105835 Your business means a lot to us. Pleas...	105835 Your business means lot Please name zip...	105835 Your business means lot Please name zip...
2	@76328 I really hope you all change but I'm su...	76328 really hope change Im sure wont Because ...	76328 really hope change Im sure wont Because ...
3	@105836 LiveChat is online at the moment - htt...	105836 LiveChat online moment httpstcoSY94VtU8...	105836 LiveChat online moment httpstcoSY94VtU8...
4	@VirginTrains see attached error message. I've...	VirginTrains see attached error message Ive tr...	VirginTrains see attached error message Ive tr...

```
#
#



from nltk.stem.porter import PorterStemmer

#
df.drop(["text_wo_stopfreq", "text_wo_stopfreqrare"], axis=1,
inplace=True)

stemmer = PorterStemmer()
def stem_words(text):
    return " ".join([stemmer.stem(word) for word in
text.split()])

df["text_stemmed"] = df["text"].apply(lambda text:
stem_words(text))
df.head()
```

	text	text_stemmed
0	@AppleSupport causing the reply to be disregar...	@applesupport caus the repli to be disregard a...
1	@105835 Your business means a lot to us. Pleas...	@105835 your busi mean a lot to us. pleas dm y...
2	@76328 I really hope you all change but I'm su...	@76328 i realli hope you all chang but i'm sur...
3	@105836 LiveChat is online at the moment - htt...	@105836 livechat is onlin at the moment - http...
4	@VirginTrains see attached error message. I've...	@virgintrain see attach error message. i'v tri...

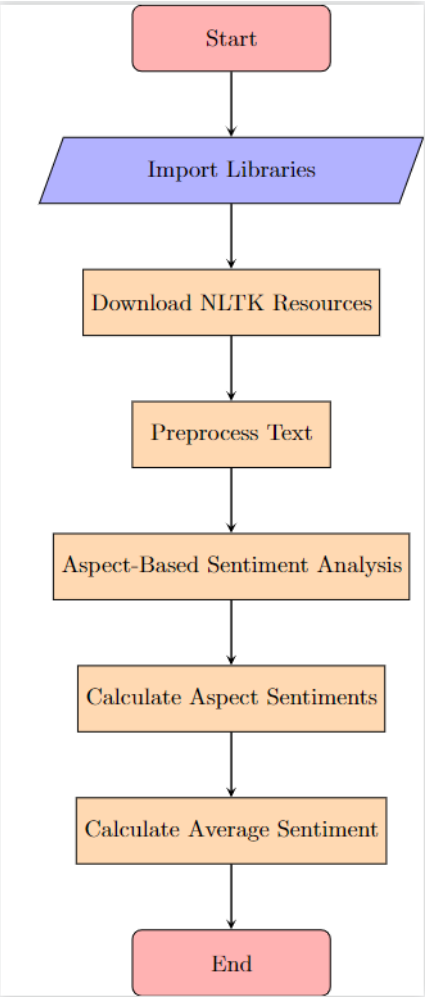
```
#
def remove_emoji(string):
    emoji_pattern = re.compile("["
                               u"\U0001F600-\U0001F64F"  #
emoticons
                               u"\U0001F300-\U0001F5FF"  # symbols
& pictographs
                               u"\U0001F680-\U0001F6FF"  #
transport & map symbols
                               u"\U0001F1E0-\U0001F1FF"  # flags
(iOS)
                               u"\U00002702-\U000027B0"
                               u"\U000024C2-\U0001F251"
                               "]+", flags=re.UNICODE)
    return emoji_pattern.sub(r'', string)

remove_emoji("game is on 🔥🔥")
```

```
'game is on '
```

Experiment 9

Aim: Write a program for Aspect-based sentiment analysis of social media text.

Flowchart:



Code:

```
import nltk
from textblob import TextBlob
from nltk.tokenize import word_tokenize, sent_tokenize
from nltk.corpus import stopwords
from collections import defaultdict

#
nltk.download('punkt')
nltk.download('stopwords')

def preprocess_text(text):
    #
```

```
    sentences = sent_tokenize(text)

    #

    stop_words = set(stopwords.words('english'))
    preprocessed_sentences = []
    for sentence in sentences:
        words = word_tokenize(sentence)
        words = [word.lower() for word in words if
word.isalnum() and word.lower() not in stop_words]
        preprocessed_sentences.append(words)

    return preprocessed_sentences

def aspect_based_sentiment_analysis(text):
    preprocessed_text = preprocess_text(text)
    print(preprocessed_text)
    aspect_sentiments = defaultdict(list)

    for sentence in preprocessed_text:
        #
        sentence = " ".join(sentence)
        blob = TextBlob(sentence)

        #
        noun_phrases = blob.noun_phrases

        #
        for aspect in noun_phrases:

aspect_sentiments[aspect].append(blob.sentiment.polarity)

    #
    aspect_average_sentiments = {}
    for aspect, sentiments in aspect_sentiments.items():
        aspect_average_sentiments[aspect] = sum(sentiments) /
len(sentiments)

    return aspect_average_sentiments

#
social_media_text = """
The camera quality of this phone is amazing. But battery life
is poor.
I love the design of the new laptop. The performance is also
great!
"""
aspect_sentiments =
aspect_based_sentiment_analysis(social_media_text)
for aspect, sentiment in aspect_sentiments.items():
    print(f"Aspect: {aspect}, Sentiment: {sentiment}")
```

Output:

```
[['camera', 'quality', 'phone', 'amazing'], ['battery', 'life', 'poor'], ['love', 'design', 'new', 'laptop'], ['performance', 'also', 'great']]
Aspect: camera quality phone, Sentiment: 0.6000000000000001
Aspect: battery life, Sentiment: -0.4
Aspect: new laptop, Sentiment: 0.3181818181818182
```