

# GraphMissingEdges Challenge 1

In [13]:

```
#Importing bibs
import networkx as nx
import matplotlib.pyplot as plt
import matplotlib.cm as cm
import pandas as pd
import statistics
import community as community_louvain
from networkx.algorithms.community import k_clique_communities
```

In [25]:

```
allCategories = pd.read_csv("../categories.csv", index_col=0)
G = nx.read_gml("../GraphMissingEdges.gml")
print(nx.info(G))
```

Graph with 11080 nodes and 52990 edges

## Initial analisys

In [58]:

```
n = G.number_of_nodes()
e = G.number_of_edges()
print("Number of nodes : %d" % n)
print("Number of edges : %d" % e)
print("Number of connected components : %d" % nx.number_connected_components(G))
```

Number of nodes : 11080  
 Number of edges : 52990  
 Number of connected components : 1489

In [59]:

```
print("Max degree of nodes:")
sorted(G.degree, key=lambda x: x[1], reverse=True)
```

Out[59]:

```
Max degree of nodes:
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('i7\_JPit-2kAbtRTLkic2jA', 27),



```
('J-SZZniOp7nNsCNbj5rIUQ', 27),
...]
```

## Clustering Coefficient

In [47]:

```
print("General clustering coefficient: "+ str(round(nx.average_clustering(G),5)

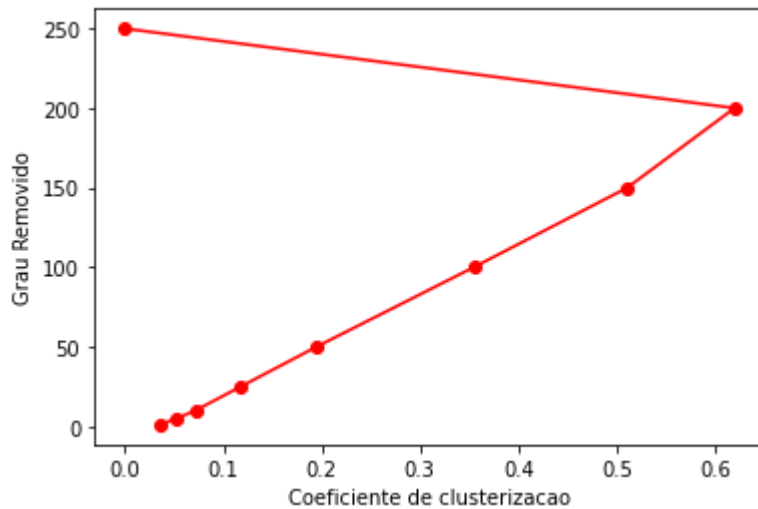
removeDegrees = [1,5,10,25,50,100,150,200,250]

print("Clustering coefficient evolution analisys:")
coefList = []
degreeRemoved = []
for num in removeDegrees:
    G = nx.read_gml("../GraphMissingEdges.gml")
    remove = [node for node,degree in dict(G.degree()).items() if degree < num]
    print("Items to remove: " + str(len(remove)))
    G.remove_nodes_from(remove)
    coef = round(nx.average_clustering(G),3)
    coefList.append(coef)
    degreeRemoved.append(num)
    print("Removed "+ str(num) + " degrees nodes: " + str(coef))

plt.plot(coefList, degreeRemoved, 'ro-')
plt.xlabel('Coeficiente de clusterizacao')
plt.ylabel('Grau Removido')

# Keep original file to other analisys below
G = nx.read_gml("../GraphMissingEdges.gml")
```

```
General clustering coefficient: 0.03079
Clustering coefficient evolution analisys:
Items to remove: 1418
Removed 1 degrees nodes: 0.035
Items to remove: 6590
Removed 5 degrees nodes: 0.053
Items to remove: 8400
Removed 10 degrees nodes: 0.072
Items to remove: 9969
Removed 25 degrees nodes: 0.118
Items to remove: 10673
Removed 50 degrees nodes: 0.195
Items to remove: 10988
Removed 100 degrees nodes: 0.355
Items to remove: 11047
Removed 150 degrees nodes: 0.511
Items to remove: 11070
Removed 200 degrees nodes: 0.62
Items to remove: 11078
Removed 250 degrees nodes: 0.0
```



De acordo com o coeficiente de clusterização demonstrado acima, é possível perceber que o grafo está muito longe de ser completo, pois o coeficiente geral em 0.03 está muito abaixo de 1% de possíveis conexões entre todos os nós, isso é decorrência da grande quantidade de nós e do baixo grau de conexões entre eles, isso fica evidente no histograma acima, com a remoção de nós de baixo grau, o grande aumento do coeficiente para a rede, isso cai bruscamente no final pois apenas 2 nós possuem mais de 250 arestas. Esse coeficiente também comprova que o grafo não tem probabilidade de ter sido gerado aleatoriamente, pois há muitos nós sem arestas e alguns nós com muitas arestas, o que tornou o grafo desbalanceado.

## Nodes Degrees Distribution

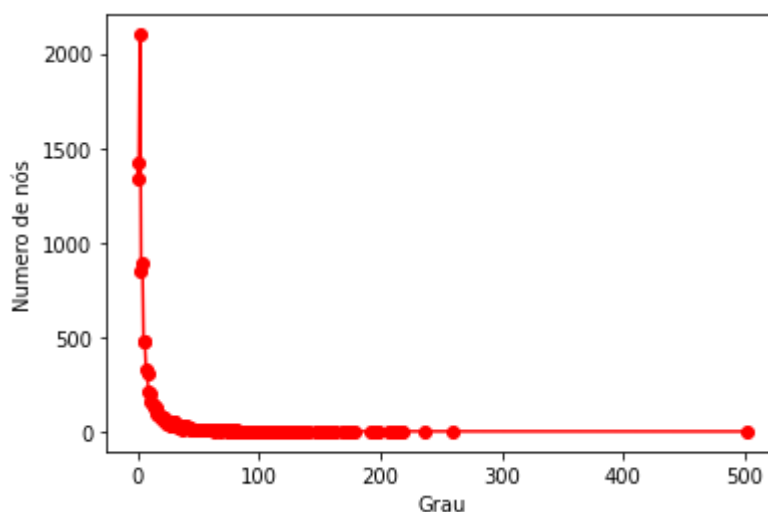
In [54]:

```
dicDegree = dict(G.degree())
valores = sorted(set(dicDegree.values()))
hist = [list(dicDegree.values()).count(x) for x in valores]
plt.plot(valores, hist, 'ro-')
plt.xlabel('Grau')
plt.ylabel('Numero de nós')

degreeMean = statistics.mean(valores)
print("Degree Mean: " + str(degreeMean))
degreeMedian = statistics.median(valores)
print("Degree Median: " + str(degreeMedian))
```

Degree Mean: 89.80503144654088

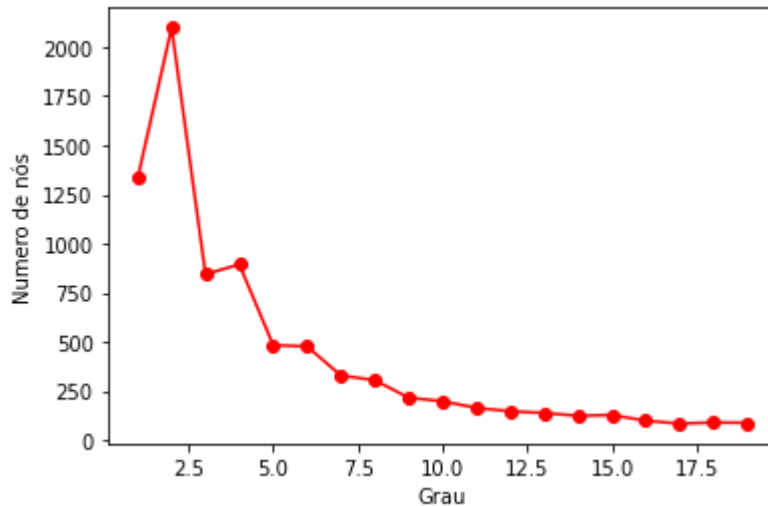
Degree Median: 80



In [55]:

```
# Nodes degrees distribution zoomed
dicDegree1={k: v for k, v in dicDegree.items() if v > 0 and v < 20}
valores = sorted(set(dicDegree1.values()))
hist = [list(dicDegree1.values()).count(x) for x in valores]
plt.plot(valores, hist, 'ro-')
plt.xlabel('Grau')
plt.ylabel('Numero de nós')
```

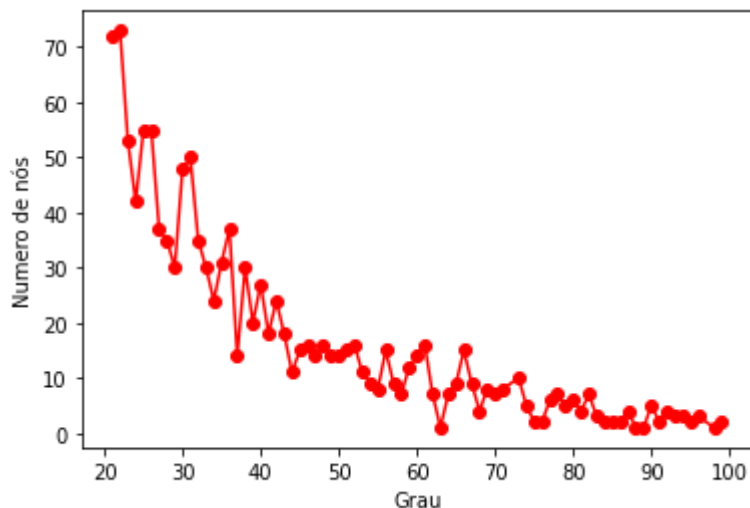
Out[55]: Text(0, 0.5, 'Numero de nós')



In [56]:

```
# Nodes degrees distribution zoomed
dicDegree2={k: v for k, v in dicDegree.items() if v > 20 and v < 100}
valores = sorted(set(dicDegree2.values()))
hist = [list(dicDegree2.values()).count(x) for x in valores]
plt.plot(valores, hist, 'ro-')
plt.xlabel('Grau')
plt.ylabel('Numero de nós')
```

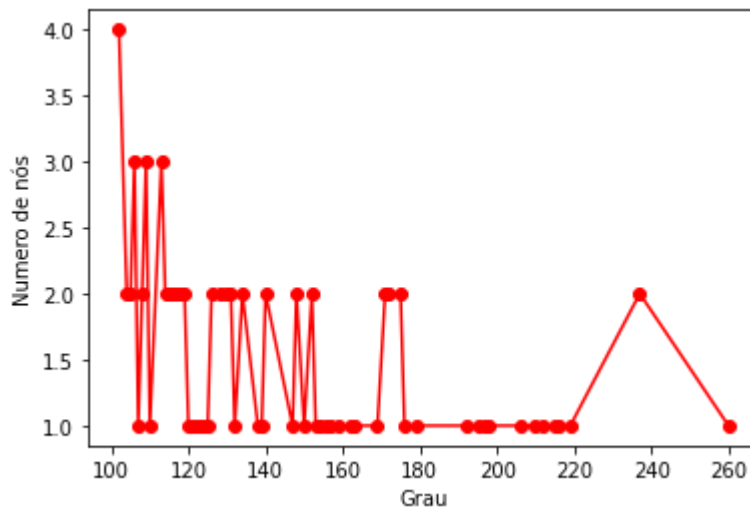
Out[56]: Text(0, 0.5, 'Numero de nós')



In [57]:

```
# Nodes degrees distribution zoomed
dicDegree3={k: v for k, v in dicDegree.items() if v > 100 and v < 502}
valores = sorted(set(dicDegree3.values()))
hist = [list(dicDegree3.values()).count(x) for x in valores]
plt.plot(valores, hist, 'ro-')
plt.xlabel('Grau')
plt.ylabel('Numero de nós')
```

Out[57]: Text(0, 0.5, 'Numero de nós')



Através da distribuição foi percebido que nós com poucas conexões são a grande maioria apesar da média e mediana estarem 89 e 80 respectivamente, quem puxa essa conta para cima são os nós mais com mais conexões, como pode ser visto nos histogramas acima.

## Centralities

### Degree centrality

```
In [6]: degree = nx.degree centrality(G)
sort_orders = sorted(degree.items(), key=lambda degree: degree[1], reverse=True)
# print(sort_orders)
top50 = sort_orders[:50]

dfDegree = pd.DataFrame(columns=['key', 'value', 'name', 'categories'])

print("Centralidade de grau")
for key,value in top50:
    cats = G.nodes[key]['categories'].split(",")
    categoriesString = []
    for cat in cats:
        categoriesString.append(allCategories.loc[int(cat)][ 'names' ])

    dfDegree.loc[key] = pd.Series({'key':key, 'value':round(value,6), 'name':G.nodes[key]['name']})

dfDegree = dfDegree.set_index('key')
print(dfDegree)
# print(dfDegree.info())
# print(dfDegree.index)
dfDegree.to_csv('degreeCentrality.csv', sep=',', encoding='utf-8')
```

Centralidade de grau

key	value	name \
r_BrIgzYcwolNAuG9dLbpg	0.045311	Pai Northern Thai Kitchen
iGEvDk6hsizigmXhDKs2Vg	0.023468	Seven Lives Tacos Y Mariscos
0a20150ytxrDjDzXNfRWkA	0.021392	Miku
hPXR-Bi8U-uz6TUViqmGpg	0.021392	Fat Ninja Bite
G24ploGGfY3t-m8Z2lPCaQ	0.019767	Tinuno
bLrjQj3G9NAyKoi5EROj1Q	0.019496	iHalo Krunch
kOFDvcnj-8fd3doIpCQ06A	0.019406	Mildred's Temple Kitchen
JG9UpsFR6hrqQqsKh_RyaQ	0.019135	Planta

XYIPXJ9parr9FtvvcGI1SA	0.018955	GB Hand-pulled Noodles
B70iTJjcPkuYn8ouUewWgw	0.018594	Gusto 101
U4iqELk1IiqARpk5uJJOZg	0.017872	Eva's Original Chimneys
xL9EhlyVMSe2mdkisYjXog	0.017781	The Halal Guys
uAAWlLdsoUf872F1FKiX1A	0.017601	Bang Bang Ice Cream and Bakery
RtUvSWO_UZ8V3Wpj0n077w	0.017330	KINKA IZAKAYA ORIGINAL
jc3p5SFyt9qrrMXt6E13ig	0.016157	Tsujiri
BYDs_o6U4CLxJec8k1Q90Q	0.015886	Poke Guys
5m2JukTajxMk-qS5W4s-FA	0.015796	Charidise
fNc1WuGwiT7RhqXUIe4S8A	0.015796	Sabai Sabai Kitchen and Bar
aLcFhMe6DDJ430zelCpd2A	0.015525	Khao San Road
_xAJZOKBMPOe47p1MphB2w	0.015525	Fishman Lobster Clubhouse Restaurant
Yl2TN9c23ZGLUBSD9ks5Uw	0.015435	Byblos
e41TP5cXZqSrZ50xCBjQZw	0.015435	Insomnia Restaurant & Lounge
zgQhtqX0ggMw1nlBZ12VnQ	0.015254	Momofuku Noodle Bar
N_2yEZ41g9zDW_gWArFiHw	0.014713	Sweet Jesus
f507v_X_jCg2itqacRfxhg	0.014622	Sansotei Ramen
SjgeuBlgKER9yegpoxT99w	0.014351	Nomé Izakaya
mZRKH9ngRY92bI_irrHq6w	0.014171	Richmond Station
5aeOewSy4RiI8sLLWpeNGA	0.014081	Pablo Cheesetart Canada
yY3jNsrpCyKTqQuRuLV8gw	0.013900	Cactus Club Cafe
Fx5haZv9PP3E7Ljp-h7B1Q	0.013810	Eggspectation
UxWH8zRYIBgs6Q2oykvRdw	0.013720	Cluny Bistro & Boulangerie
h_4dPV9M9aYaBliH1Eoeeg	0.013720	Wvrst
crstB-H5rOfbXhV8pX0e6g	0.013539	Ramen Isshin
hDy-uY7Vy_TzdGBzw59lhA	0.013359	Saku Sushi
35SEr0cPTuoBJ1DYQ686pA	0.013359	Katsuya
73_UT7fz7mzXcguX8-oSuQ	0.013268	Amsterdam BrewHouse
pSMK_FtULKiU-iuh7SMKwg	0.012637	Blaze Fast-Fire'd Pizza
0-k_-9YoWXpmtiaLdKeQJQ	0.012637	The Rec Room
a8pmtlVKf7NiSLI-4KejIw	0.012546	El Catrin Destileria
DE89UdHFMCN6DtYWZuer5A	0.012456	Hokkaido Ramen Santouka
Qmwfg-PtYuCo5Q_IwcA_HQ	0.012095	JaBistro
OA1o0ixPWw-maEq2CF1Qag	0.012095	Kiin
nBl_4gw5ecGzNkHyzfii8g	0.011914	Terroni
C8_zdU7zGLUK3uC4e5AepQ	0.011824	MeNami
HgL6gGEGoAUBKGrT6BXU4Q	0.011824	Eat Jackpot
G4pt2q9Tr5SkwCw3Wb43VA	0.011734	Snow Time
gOvEzwpu3KbW5aJReQzYRg	0.011734	North Poke
oOGLdf2rzeCPS7UQ8hhPlQ	0.011553	SU&BU
VRwT0pscR5vESCrAnUpNwQ	0.011553	Wilbur Mexicana
trKyIRyjKqVSZmcU0AnICQ	0.011373	Pearl Diver

## categories

key	
r_BrIgzYcwolNAuG9dLbpg	Restaurants, Food, Thai, Ethnic Food, Specialt...
iGEvDk6hsizigmXhDKs2Vg	Seafood, Restaurants, Mexican
0a20150ytXrDjDzXNfRwKA	Sushi Bars, Restaurants, Japanese, Seafood
hPXR-Bi8U-uz6TUViqmGpg	Food, Burgers, Desserts, Restaurants, Korean, ...
G24ploGGfy3t-m8Z21PCaQ	Restaurants, Filipino
bLrjQj3G9NAYKoi5EROj1Q	Ice Cream & Frozen Yogurt, Food, Desserts
kOFDVcnj-8fd3doIpCQ06A	Venues & Event Spaces, Event Planning & Servic...
JG9UpsFR6hrqQqsKh_RyaQ	Salad, Restaurants, Bars, Vegan, Nightlife, Ta...
XYIPXJ9parr9FtvvcGI1SA	Chinese, Restaurants, Noodles
B70iTJjcPkuYn8ouUewWgw	Italian, Restaurants
U4iqELk1IiqARpk5uJJOZg	Desserts, Food Stands, Ice Cream & Frozen Yogu...
xL9EhlyVMSe2mdkisYjXog	Desserts, Restaurants, Food, Food Stands, Hala...
uAAWlLdsoUf872F1FKiX1A	Ice Cream & Frozen Yogurt, Desserts, Food
RtUvSWO_UZ8V3Wpj0n077w	Bars, Restaurants, Japanese, Tapas/Small Plate...
jc3p5SFyt9qrrMXt6E13ig	Tea Rooms, Ice Cream & Frozen Yogurt, Food, De...
BYDs_o6U4CLxJec8k1Q90Q	Poke, Restaurants, Hawaiian, Food, Fast Food
5m2JukTajxMk-qS5W4s-FA	Restaurants, Desserts, Taiwanese, Food, Tea Rooms
fNc1WuGwiT7RhqXUIe4S8A	Restaurants, Vegan, Tapas/Small Plates, Laotia...
aLcFhMe6DDJ430zelCpd2A	Thai, Restaurants
_xAJZOKBMPOe47p1MphB2w	Chinese, Restaurants, Live/Raw Food, Seafood

Yl2TN9c23ZGLUBSD9ks5Uw  
e41TP5cXZqSrZ50xCBjQzW  
zgQhtqX0ggMwlnlBZl2VnQ  
N\_2yEZ41g9zDW\_gWArFiHw  
f507v\_X\_jCg2itqacRfxhg  
SjgeuBlgKER9yegpoxT99w  
mZRKH9ngRY92bI\_irrHq6w  
5aeOewSy4RiI8sLLWpeNGA  
yY3jNsrpCyKTqQuRuLV8gw  
Fx5haZv9PP3E7Ljp-h7B1Q  
UxWH8zRYIBgs6Q2oykvRdw  
h\_4dpV9M9aYaBlIH1Eoeeg  
crstB-H5rOfbXhV8pX0e6g  
hDY-uY7Vy\_TzdGBzw59lhA  
35SEr0cPTuoBJlDYQ686pA  
73\_UT7fz7mzXcguX8-oSuQ  
pSMK\_FtULKiU-iuh7SMKwg  
0-k\_-9YoWxpmtiaLdKeQJQ  
a8pmtlVKf7NiSLI-4KejIw  
DE89UdHFMCN6DTYWZuer5A  
Qmwfg-PtYuCo5Q\_IwcA\_HQ  
OA1o0ixPWw-maEq2CF1Qag  
nBl\_4gw5ecGzNkHyzfii8g  
C8\_zdU7zGLUK3uC4e5AepQ  
HgL6gGEGoAUBKGrT6BXU4Q  
G4pt2q9Tr5SkwCw3Wb43VA  
gOvEzwpu3Kbw5aJReQzYRg  
oOGLDf2rzcPS7UQ8hhPlQ  
VRwT0pscR5vESCrAnUpNwQ  
trKyIRyjKqV5ZmcU0AnICQ

Restaurants, Middle Eastern, Mediterranean  
French, Bars, Caterers, Canadian (New), Breakf...  
Ramen, Soup, Korean, Japanese, Asian Fusion, A...  
Desserts, Ice Cream & Frozen Yogurt, Food, Cof...  
Restaurants, Ramen, Japanese, Noodles  
Tapas Bars, Japanese, Restaurants, Lounges, Ba...  
Canadian (New), Restaurants  
Desserts, Food, Restaurants, Cafes  
Restaurants, Cocktail Bars, Nightlife, Canadia...  
Juice Bars & Smoothies, Breakfast & Brunch, Re...  
Nightlife, Restaurants, Bars, Wine Bars, Cockt...  
Nightlife, Pubs, Bars, Restaurants, Canadian (...  
Ramen, Noodles, Tapas/Small Plates, Food, Japa...  
Breakfast & Brunch, Sushi Bars, Japanese, Rest...  
Japanese, Restaurants, Asian Fusion  
Breweries, Food, Nightlife, Restaurants, Burge...  
Gluten-Free, Restaurants, Salad, Pizza, Fast Food  
Sports Bars, Arcades, Restaurants, Canadian (N...  
Tapas/Small Plates, Mexican, Restaurants  
Japanese, Restaurants, Noodles, Ramen  
Japanese, Sushi Bars, Restaurants  
Restaurants, Thai  
Restaurants, Italian  
Japanese, Asian Fusion, Restaurants, Nightlife...  
Singaporean, Restaurants, Chinese, Nightlife, ...  
Shaved Snow, Korean, Food, Restaurants, Desser...  
Seafood Markets, Specialty Food, Hawaiian, Foo...  
Asian Fusion, Sushi Bars, Mexican, Japanese, R...  
Restaurants, Ethnic Food, Specialty Food, Mexi...  
Chinese, Steakhouses, Seafood, Breakfast & Bru...

## Betweenness centrality

In [7]:

```
betweenness = nx.betweenness centrality(G)
sort_orders = sorted(betweenness.items(), key=lambda betweenness: betweenness
# print(sort_orders)
top50 = sort_orders[:50]

dfBetweenness = pd.DataFrame(columns=['key', 'value', 'name', 'categories'])

print("Centralidade de proximidade")
for key, value in top50:
    cats = G.nodes[key]['categories'].split(",")
    categoriesString = []
    for cat in cats:
        categoriesString.append(allCategories.loc[int(cat)][ 'names' ])

    dfBetweenness.loc[key] = pd.Series({'key':key , 'value':round(value,6), 'name':G.nodes[key]['name'], 'categories':categoriesString})

dfBetweenness = dfBetweenness.set_index('key')
print(dfBetweenness)
# print(dfBetweenness.info())
# print(dfBetweenness.index)
dfBetweenness.to_csv('betweennessCentrality.csv', sep=',', encoding='utf-8')
```

Centralidade de proximidade

key	value	name \
r_BrIgzYcwolNAuG9dLbpg	0.053927	Pai Northern Thai Kitchen
iGEvDk6hsizigmXhDKs2Vg	0.017764	Seven Lives Tacos Y Mariscos
hPXR-Bi8U-uz6TUViqmGpg	0.014250	Fat Ninja Bite
XYIPXJ9parr9FtvvcGI1SA	0.013402	GB Hand-pulled Noodles
G24p1oGGfy3t-m8Z2lPCaQ	0.013044	Tinuno

JG9UpsFR6hrqQqsKh_RyaQ	0.012744	Planta
0a20150ytxrDjDzXNfRWkA	0.012591	Miku
kOFDVCnj-8fd3doIpCQ06A	0.012419	Mildred's Temple Kitchen
xL9EhlyVMSe2mdkisYjXog	0.012151	The Halal Guys
RtUvSWO_UZ8V3Wpj0n077w	0.011654	KINKA IZAKAYA ORIGINAL
bLrjQj3G9NAyKoi5EROj1Q	0.011580	iHalo Krunch
U4iqELklIiqARpk5uJJOZg	0.011478	Eva's Original Chimneys
B70iTJjcPkuYn8ouUewWgw	0.010614	Gusto 101
fNc1WuGwiT7RhqXUIe4S8A	0.009910	Sabai Sabai Kitchen and Bar
uAAWlLdsoUf872F1FKiX1A	0.009894	Bang Bang Ice Cream and Bakery
e41TP5cXZqSrZ50xCBjQzW	0.009414	Insomnia Restaurant & Lounge
Yl2TN9c23ZGLUBSD9ks5Uw	0.009045	Byblos
BYDs_o6U4CLxJec8k1Q90Q	0.008940	Poke Guys
zgQHtqX0ggMwlnlBZl2VnQ	0.008768	Momofuku Noodle Bar
_xAJZOKBMP0e47p1MphB2w	0.008280	Fishman Lobster Clubhouse Restaurant
N_2yEZ41g9zDW_gWArFiHw	0.008152	Sweet Jesus
mZRKH9ngRY92bI_irrHq6w	0.008127	Richmond Station
jc3p5SFyt9qrrMXt6E13ig	0.007787	Tsujiri
f507v_X_jCg2itqacRfxhg	0.007509	Sansotei Ramen
aLcFhMe6DDJ430zelCpd2A	0.007366	Khao San Road
5m2JukTajxMk-qS5W4s-FA	0.007203	Charidise
SjgeuBlgKER9yegpoxT99w	0.007200	Nomé Izakaya
73_UT7fz7mzXcguX8-oSuQ	0.007156	Amsterdam BrewHouse
yY3jNsrpCyKTqQuRuLV8gw	0.006788	Cactus Club Cafe
5aeOewSy4RiI8sLLWpeNGA	0.006782	Pablo Cheesetart Canada
h_4dPV9M9aYaBliH1Eoeeg	0.006692	Wvrst
Fx5haZv9PP3E7Ljp-h7B1Q	0.006669	Eggspectation
DE89UdHFMCN6DtYWZuer5A	0.006558	Hokkaido Ramen Santouka
hDy-uY7Vy_TzdGBzw59lhA	0.006481	Saku Sushi
a8pmtlVKf7NiSLI-4KejIw	0.006036	El Catrin Destileria
0-k_-9YoWXpmtiaLdKeQJQ	0.006008	The Rec Room
UxWH8zRYIBgs6Q2oykvRdw	0.006003	Cluny Bistro & Boulangerie
RA00GtlU25TkIP9i9wd8bg	0.005907	Ripley's Aquarium of Canada
crstB-H5rOfbXhV8pX0e6g	0.005856	Ramen Isshin
pSMK_FtULKiU-iuh7SMKwg	0.005782	Blaze Fast-Fire'd Pizza
35SEr0cPTuoBJ1DYQ686pA	0.005557	Katsuya
fh8a_k9osLEDShbmJLzUrQ	0.005457	Kekou Gelato
VRwT0pscR5vESCrAnUpNwQ	0.005416	Wilbur Mexicana
Zq9WPT7ZAOYlQ0GV8OQWKQ	0.005374	Cluck Clucks
dAmVTQ6ukuLh4UxTmBoRkg	0.005221	Maha's
6EVBc9kdc3Hd8KZkLVPnGA	0.005136	Kaiju
fQwB9Z98YEhkJit7c3z51A	0.005056	The Carbon Bar
HgL6gGEGoAUBKGrT6BXU4Q	0.004961	Eat Jackpot
nBl_4gw5ecGzNkHyzfii8g	0.004903	Terroni
L3R7y3_tUKQlM9kor4-Ccw	0.004872	Jamie's Italian

categories

key	
r_BrIgzYcwo1NAuG9dLbpg	Restaurants, Food, Thai, Ethnic Food, Specialt...
iGEvDk6hsizigmXhDKs2Vg	Seafood, Restaurants, Mexican
hPXR-Bi8U-uz6TUViqmGpg	Food, Burgers, Desserts, Restaurants, Korean, ...
XYIPXJ9parr9FtvvcGI1SA	Chinese, Restaurants, Noodles
G24ploGGfY3t-m8Z2lPCaQ	Restaurants, Filipino
JG9UpsFR6hrqQqsKh_RyaQ	Salad, Restaurants, Bars, Vegan, Nightlife, Ta...
0a20150ytxrDjDzXNfRWkA	Sushi Bars, Restaurants, Japanese, Seafood
kOFDVCnj-8fd3doIpCQ06A	Venues & Event Spaces, Event Planning & Servic...
xL9EhlyVMSe2mdkisYjXog	Desserts, Restaurants, Food, Food Stands, Hala...
RtUvSWO_UZ8V3Wpj0n077w	Bars, Restaurants, Japanese, Tapas/Small Plate...
bLrjQj3G9NAyKoi5EROj1Q	Ice Cream & Frozen Yogurt, Food, Desserts
U4iqELklIiqARpk5uJJOZg	Desserts, Food Stands, Ice Cream & Frozen Yogu...
B70iTJjcPkuYn8ouUewWgw	Italian, Restaurants
fNc1WuGwiT7RhqXUIe4S8A	Restaurants, Vegan, Tapas/Small Plates, Laotia...
uAAWlLdsoUf872F1FKiX1A	Ice Cream & Frozen Yogurt, Desserts, Food
e41TP5cXZqSrZ50xCBjQzW	French, Bars, Caterers, Canadian (New), Breakf...
Yl2TN9c23ZGLUBSD9ks5Uw	Restaurants, Middle Eastern, Mediterranean



BYDs\_o6U4CLxJec8klQ90Q  
 zgQhtqX0ggMwlnlBZl2VnQ  
 \_xAJZOKBMOe47p1MphB2w  
 N\_2yEZ41g9zDW\_gWArFiHw  
 mZRKH9ngRY92bI\_irrHq6w  
 jc3p5SFyt9qrrMXt6El3ig  
 f507v\_X\_jCg2itqacRfxhg  
 aLcFhMe6DDJ430zelCpd2A  
 5m2JukTajxMk-qS5W4s-FA  
 SjgeuBlgKER9yegpoxT99w  
 73\_UT7fz7mzXcguX8-oSuQ  
 yY3jNsrrpCyKTqQuRuLV8gw  
 5aeOewSy4RiI8sLLWpeNGA  
 h\_4dPV9M9aYaBliHlEoeeg  
 Fx5haZv9PP3E7Ljp-h7B1Q  
 DE89UdHFMCN6DtYWZuer5A  
 hDy-uY7Vy\_TzdGBzw59lhA  
 apmtlVKf7NiSLI-4KejIw  
 0-k\_-9YoWXpmtiaLdKeQJQ  
 UxWH8zRYIBgs6Q2oykvRdw  
 RA00GtlU25TkIP9i9wd8bg  
 crstB-H5rOfbXhV8pX0e6g  
 pSMK\_FtULKiU-ih7SMKwg  
 35SEr0cPTuoBJ1DYQ686pA  
 fh8a\_k9osLEDShbmJLzUrQ  
 VRwT0pscR5vESCraNUpNwQ  
 Zq9WPT7ZA0YlQ0GV8OQWKQ  
 dAmVTQ6ukuLh4UxTmBoRkg  
 6EVBc9kdc3Hd8KZkLVPnGA  
 fQwB9Z98YEhkJit7c3z51A  
 HgL6gGEGoAUBKGrT6BXU4Q  
 nBl\_4gw5ecGzNkHyzfii8g  
 L3R7y3\_tUKQlM9kor4-Ccw

Poke, Restaurants, Hawaiian, Food, Fast Food  
 Ramen, Soup, Korean, Japanese, Asian Fusion, A...  
 Chinese, Restaurants, Live/Raw Food, Seafood  
 Desserts, Ice Cream & Frozen Yogurt, Food, Cof...  
 Canadian (New), Restaurants  
 Tea Rooms, Ice Cream & Frozen Yogurt, Food, De...  
 Restaurants, Ramen, Japanese, Noodles  
 Thai, Restaurants  
 Restaurants, Desserts, Taiwanese, Food, Tea Rooms  
 Tapas Bars, Japanese, Restaurants, Lounges, Ba...  
 Breweries, Food, Nightlife, Restaurants, Burge...  
 Restaurants, Cocktail Bars, Nightlife, Canadia...  
 Desserts, Food, Restaurants, Cafes  
 Nightlife, Pubs, Bars, Restaurants, Canadian (...  
 Juice Bars & Smoothies, Breakfast & Brunch, Re...  
 Japanese, Restaurants, Noodles, Ramen  
 Breakfast & Brunch, Sushi Bars, Japanese, Rest...  
 Tapas/Small Plates, Mexican, Restaurants  
 Sports Bars, Arcades, Restaurants, Canadian (N...  
 Nightlife, Restaurants, Bars, Wine Bars, Cockt...  
 Aquariums, Active Life  
 Ramen, Noodles, Tapas/Small Plates, Food, Japa...  
 Gluten-Free, Restaurants, Salad, Pizza, Fast Food  
 Japanese, Restaurants, Asian Fusion  
 Desserts, Ice Cream & Frozen Yogurt, Food  
 Restaurants, Ethnic Food, Specialty Food, Mexi...  
 Soul Food, Chicken Shop, Restaurants, Comfort ...  
 Breakfast & Brunch, Egyptian, Middle Eastern, ...  
 Malaysian, Asian Fusion, Restaurants, Japanese  
 Restaurants, Bars, Barbeque, Southern, Cocktai...  
 Singaporean, Restaurants, Chinese, Nightlife, ...  
 Restaurants, Italian  
 Italian, Food, Desserts, Restaurants, Pizza

## Closeness centrality

In [8]:

```
closeness = nx.closeness centrality(G)
sort_orders = sorted(closeness.items(), key=lambda closeness: closeness[1], r
# print(sort_orders)
top50 = sort_orders[:50]

dfCloseness = pd.DataFrame(columns=['key', 'value', 'name', 'categories'])

print("Centralidade de proximidade")
for key, value in top50:
    cats = G.nodes[key]['categories'].split(",")
    categoriesString = []
    for cat in cats:
        categoriesString.append(allCategories.loc[int(cat)][ 'names' ])

    dfCloseness.loc[key] = pd.Series({'key':key , 'value':round(value,6), 'name

dfCloseness = dfCloseness.set_index('key')
print(dfCloseness)
# print(dfCloseness.info())
# print(dfCloseness.index)
dfCloseness.to_csv('closenessCentrality.csv', sep=',', encoding='utf-8')
```

Centralidade de proximidade

key	value	name \
r_BrIgzYcwolNAuG9dLbpg	0.349649	Pai Northern Thai Kitchen
iGEvDk6hsizigmXhDKs2Vg	0.325540	Seven Lives Tacos Y Mariscos



hPXR-Bi8U-uz6TUViqmGpg	0.323142	Fat Ninja Bite
0a20150ytxrDjDzXNfRWkA	0.322582	Miku
kOFDVCnj-8fd3doIpCQ06A	0.320239	Mildred's Temple Kitchen
G24ploGGfY3t-m8Z2lPCaQ	0.317758	Tinuno
XYIPXJ9parr9FtvvcGI1SA	0.317549	GB Hand-pulled Noodles
xL9EhlyVMSe2mdkisYjXog	0.317094	The Halal Guys
RtUvSWO_UZ8V3Wpj0n077w	0.316556	KINKA IZAKAYA ORIGINAL
BYDs_o6U4CLxJec8k1Q90Q	0.316373	Poke Guys
fNclWuGwiT7RhqXUIe4S8A	0.316214	Sabai Sabai Kitchen and Bar
bLrjQj3G9NAyKoi5EROj1Q	0.315800	iHalo Krunch
mZRKH9ngRY92bI_irrHq6w	0.315776	Richmond Station
B70iTJjcPkuYn8ouUewWgw	0.315024	Gusto 101
5m2JukTajxMk-qS5W4s-FA	0.314275	Charidise
f507v_X_jCg2itqacRfxhg	0.314239	Sansotei Ramen
Yl2TN9c23ZGLUBSD9ks5Uw	0.313411	Byblos
Fx5haZv9PP3E7Ljp-h7B1Q	0.312312	Eggspectation
jc3p5SFyt9qrrMXt6E13ig	0.312099	Tsujiri
e41TP5cXZqSrZ50xCBjQZw	0.311411	Insomnia Restaurant & Lounge
N_2yEZ4lg9zDW_gWArFiHw	0.310797	Sweet Jesus
uAAWlLdsoUf872F1FKiX1A	0.309788	Bang Bang Ice Cream and Bakery
h_4dPV9M9aYaBliH1Eoeeg	0.309566	Wvrst
JG9UpsFR6hrqQqsKh_RyaQ	0.309052	Planta
U4iqELklIiqARpk5uJJOZg	0.308820	Eva's Original Chimneys
Qmwfg-PtYuCo5Q_IwcA_HQ	0.308355	JaBistro
35SEr0cPTuoBJ1DYQ686pA	0.307938	Katsuya
73_UT7fz7mzXcguX8-oSuQ	0.307730	Amsterdam BrewHouse
OAlo0ixPWw-maEq2CF1Qag	0.307350	Kiin
yY3jNsrpCyKTqQuRuLV8gw	0.307235	Cactus Club Cafe
N93EYzy9R0sdlEvubu94ig	0.305962	Banh Mi Boys
_xAJZOKBMP0e47p1MphB2w	0.305780	Fishman Lobster Clubhouse Restaurant
SjgeuBlgKER9yegpoxT99w	0.305484	Nomé Izakaya
Dpl8d6eXq-YnF5zEVlcwMw	0.305336	Poop Cafe
aLcFhMe6DDJ430ze1Cpd2A	0.305233	Khao San Road
C8_zdU7zGLUK3uC4e5AepQ	0.304961	MeNami
a8pmtlVKf7NiSLI-4KejIw	0.304667	El Catrin Destileria
crstB-H5rOfbXhV8pX0e6g	0.304621	Ramen Isshin
hDy-uY7Vy_TZdGBzw59lhA	0.304406	Saku Sushi
6EVBc9kdc3Hd8KZkLVPnGA	0.304327	Kaiju
UxWH8zRYIBgs6Q2oykvRdw	0.304113	Cluny Bistro & Boulangerie
trKyIRyjKqVSZmcU0AnICQ	0.304102	Pearl Diver
Zq9WPT7ZA0YlQ0GV8OQWKQ	0.304045	Cluck Clucks
SGP1jf6k7spXkgwBlhiUVw	0.303876	Kekou Gelato House
DE89UdHFMCN6DtYWZuer5A	0.303707	Hokkaido Ramen Santouka
zgQHtqX0ggMw1n1BZ12VnQ	0.303483	Momofuku Noodle Bar
snw9iNNLpFYZeHotW00uVA	0.303269	Lee Restaurant
XFU7XiXOo7LB3uPLecRlOw	0.302721	Mymy Chicken
8I5U8OQ06nSxX2y4PPOWzQ	0.302286	Japango
2i0dDzxLuQQAwzxDZVR-1g	0.302063	Oretta

## categories

key	
r_BrIgzYcwo1NAuG9dLbpg	Restaurants, Food, Thai, Ethnic Food, Specialt...
iGEvDk6hsizigmXhDKs2Vg	Seafood, Restaurants, Mexican
hPXR-Bi8U-uz6TUViqmGpg	Food, Burgers, Desserts, Restaurants, Korean, ...
0a20150ytxrDjDzXNfRWkA	Sushi Bars, Restaurants, Japanese, Seafood
kOFDVCnj-8fd3doIpCQ06A	Venues & Event Spaces, Event Planning & Servic...
G24ploGGfY3t-m8Z2lPCaQ	Restaurants, Filipino
XYIPXJ9parr9FtvvcGI1SA	Chinese, Restaurants, Noodles
xL9EhlyVMSe2mdkisYjXog	Desserts, Restaurants, Food, Food Stands, Hala...
RtUvSWO_UZ8V3Wpj0n077w	Bars, Restaurants, Japanese, Tapas/Small Plate...
BYDs_o6U4CLxJec8k1Q90Q	Poke, Restaurants, Hawaiian, Food, Fast Food
fNclWuGwiT7RhqXUIe4S8A	Restaurants, Vegan, Tapas/Small Plates, Laotia...
bLrjQj3G9NAyKoi5EROj1Q	Ice Cream & Frozen Yogurt, Food, Desserts
mZRKH9ngRY92bI_irrHq6w	Canadian (New), Restaurants
B70iTJjcPkuYn8ouUewWgw	Italian, Restaurants

5m2JukTajxMk-qS5W4s-FA  
f507v\_X\_jCg2itqacRfxhg  
Yl2TN9c23ZGLUBSD9ks5Uw  
Fx5haZv9PP3E7Ljp-h7B1Q  
jc3p5SFyt9qrrMXt6E13ig  
e41TP5cXZqSrZ50xCBjQzW  
N\_2yEZ41g9zDW\_gWArFiHw  
uAAWlLdsoUf872F1FKiX1A  
h\_4dPV9M9aYaBliH1Eoeeg  
JG9UpsFR6hrqQqsKh\_RyaQ  
U4iqELklIiqARpk5uJJ0Zg  
Qmwfg-PtYuCo5Q\_IwcA\_HQ  
35SEr0cPTuoBJ1DYQ686pA  
73\_UT7fz7mzXcguX8-oSuQ  
OAlo0ixPWw-maEq2CF1Qag  
yY3jNsrrpCyKTqQuRuLV8gw  
N93EYzy9R0sdlEvubu94ig  
\_xAJZOKBMP0e47p1MphB2w  
SjgeuBlgKER9yegpoxT99w  
Dpl8d6eXq-YnF5zEV1cwMw  
aLcFhMe6DDJ430zelCpd2A  
C8\_zdU7zGLUK3uC4e5AepQ  
a8pmtlVKf7NiSLI-4KejIw  
crstB-H5rOfbXhV8pX0e6g  
hDy-uY7Vy\_TZdGBzw59lhA  
6EVBc9kdc3Hd8KZkLVPnGA  
UxWH8zRYIBgs6Q2oykvRdw  
trKyIRyjKqVSZmcU0AnICQ  
Zq9WPT7ZAOYlQ0GV8OQWKQ  
SGP1jff6k7spXkgwBlhiUVw  
DE89UdHFMCN6DtYWZuer5A  
zgQHtqX0ggMwlnlBZl2VnQ  
snw9iNNLpFYZeHotW00uVA  
XFU7XiXOo7LB3uPLecRlOw  
8I5U8OQ06nSxX2y4PPOWzQ  
2i0dDzxLuQQAwzxDZVR-1g

Restaurants, Desserts, Taiwanese, Food, Tea Rooms  
Restaurants, Ramen, Japanese, Noodles  
Restaurants, Middle Eastern, Mediterranean  
Juice Bars & Smoothies, Breakfast & Brunch, Re...  
Tea Rooms, Ice Cream & Frozen Yogurt, Food, De...  
French, Bars, Caterers, Canadian (New), Breakf...  
Desserts, Ice Cream & Frozen Yogurt, Food, Cof...  
Ice Cream & Frozen Yogurt, Desserts, Food  
Nightlife, Pubs, Bars, Restaurants, Canadian (...  
Salad, Restaurants, Bars, Vegan, Nightlife, Ta...  
Desserts, Food Stands, Ice Cream & Frozen Yogu...  
Japanese, Sushi Bars, Restaurants  
Japanese, Restaurants, Asian Fusion  
Breweries, Food, Nightlife, Restaurants, Burge...  
Restaurants, Thai  
Restaurants, Cocktail Bars, Nightlife, Canadia...  
Sandwiches, Restaurants, Asian Fusion, Food, D...  
Chinese, Restaurants, Live/Raw Food, Seafood  
Tapas Bars, Japanese, Restaurants, Lounges, Ba...  
Cafes, Restaurants, Food, Ice Cream & Frozen Y...  
Thai, Restaurants  
Japanese, Asian Fusion, Restaurants, Nightlife...  
Tapas/Small Plates, Mexican, Restaurants  
Ramen, Noodles, Tapas/Small Plates, Food, Japa...  
Breakfast & Brunch, Sushi Bars, Japanese, Rest...  
Malaysian, Asian Fusion, Restaurants, Japanese  
Nightlife, Restaurants, Bars, Wine Bars, Cockt...  
Chinese, Steakhouses, Seafood, Breakfast & Bru...  
Soul Food, Chicken Shop, Restaurants, Comfort ...  
Ice Cream & Frozen Yogurt, Food, Desserts, Caf...  
Japanese, Restaurants, Noodles, Ramen  
Ramen, Soup, Korean, Japanese, Asian Fusion, A...  
Restaurants, Asian Fusion  
Bars, Korean, Nightlife, Beer Bar, Restaurants...  
Restaurants, Sushi Bars  
Bars, Restaurants, Bakeries, Coffee & Tea, Nig...

## Eigenvector centrality

In [ ]:

```
eigenvector = nx.eigenvector_centrality(G)
sort_orders = sorted(eigenvector.items(), key=lambda eigenvector: eigenvector
# print(sort_orders)
top50 = sort_orders[:50]

dfEigenvector = pd.DataFrame(columns=['key', 'value', 'name', 'categories'])

print("Centralidade de proximidade")
for key,value in top50:
    cats = G.nodes[key]['categories'].split(",")
    categoriesString = []
    for cat in cats:
        categoriesString.append(allCategories.loc[int(cat)][ 'names' ])

    dfEigenvector.loc[key] = pd.Series({'key':key , 'value':round(value,6), 'name':G.nodes[key]['name'], 'categories':categoriesString})

dfEigenvector = dfEigenvector.set_index('key')
print(dfEigenvector)
# print(dfEigenvector.info())
# print(dfEigenvector.index)
dfEigenvector.to_csv('eigenvectorCentrality.csv', sep=',', encoding='utf-8')
```

Ao se comparar os tipos de centralidades e os valores calculados para o grafo, o primeiro lugar para todas as análises foi o local "Pai Northern Thai Kitchen", porém, os valores

alteram de acordo com cada centralidade, na centralidade de grau, proximidade e intermediação, esse local ficou com valores 0.045, 0.34 e 0.053 respectivamente, isso comprova que esse nó realmente é muito importante para a rede, pois é muito utilizado como conexões de menores caminhos, possui muitas conexões e funciona como ponte principal entre muitos pares de nós, entretanto, seu valor para a centralidade Eigenvector ficou baixo (mas maior em relação aos outros nós) o que deixa a entender que é um nó que acaba perdendo um pouco de importância para buscas, mas ainda sim é a melhor opção.

Para a centralidade de proximidade, muitos nós ficaram com valores razoavelmente altos, valores acima de 0,3, o que demonstra que são nós muito próximos uns dos outros, isso explica o centro mais populoso no centro do desenho do grafo (ver imagem abaixo).

Os usuários não demonstraram nenhum local com conexão importante entre dois outros locais, que é o caso da intermediação, o maior valor foi de 0.05 e 0.01 para Pai Northern Thai Kitchen e Seven Lives Tacos Y Mariscos respectivamente, o que demonstra valores muito baixos.

## Communities

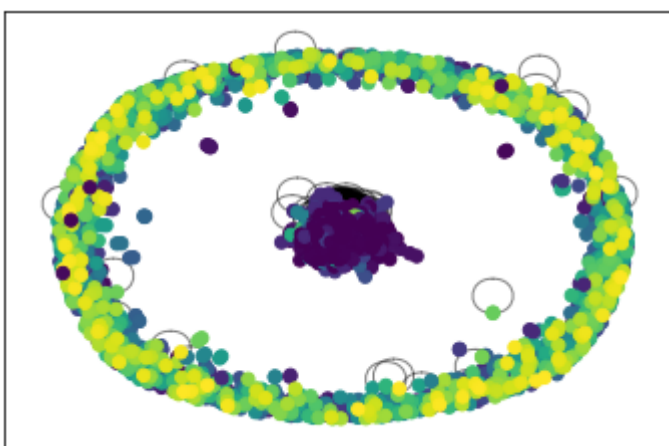
### Louvain Algorithm

In [12]:

```
partition = community_louvain.best_partition(G)

# draw the graph
pos = nx.spring_layout(G)

# color the nodes according to their partition
cmap = cm.get_cmap('viridis', max(partition.values()) + 1)
nx.draw_networkx_nodes(G, pos, partition.keys(), node_size=40, cmap=cmap, node
nx.draw_networkx_edges(G, pos, alpha=0.5)
plt.show()
```



Com a aplicação do algoritmo de Louvain, foi possível detectar a divisão das comunidades, principalmente entre as do centro que não se conectaram com o anel externo, mas mesmo entre elas é possível perceber várias comunidades ao observar a tonalidade das cores e as inúmeras arestas.

### K-clique Algorithm (k=4)

```
In [15]: kclique = k_clique_communities(G,4)
kclique = list(kclique)
# print(kclique[0])

print(str(len(kclique)) + " clusters")

# for each cluster
for cluster in kclique:
    # for each item inside cluster
    for item in cluster:
        cats = G.nodes[item]['categories'].split(",")
        categories = []
        for cat in cats:
            categories.append(allCategories.loc[int(cat)]['names'])

        # remove duplicates in categories
        res = []
        for i in categories:
            if i not in res:
                res.append(i)
        print("Categories: " + ", ".join(res))
```

144 clusters

Categories: Pizza, Restaurants, Italian, Salad, Gluten-Free

Categories: Italian, Pizza, Restaurants

Categories: Vegetarian, Vegan, Restaurants, Chinese

Categories: Breakfast & Brunch, Canadian (New), Restaurants, Tapas Bars, Gluten-Free, Comfort Food, Vegan

Categories: Food, Chocolatiers & Shops, Ice Cream & Frozen Yogurt, Specialty Food, Desserts

Categories: Sandwiches, Restaurants

Categories: Nightlife, Steakhouses, Bars, Restaurants, Barbeque, Brazilian

Categories: Shopping Centers, Shopping, Fashion, Department Stores

Categories: Restaurants, Vietnamese

Categories: Canadian (New), Restaurants

Categories: Canadian (New), Restaurants

Categories: Thai, Restaurants

Categories: Restaurants, Cocktail Bars, Nightlife, Canadian (New), Bars

Categories: Restaurants, Thai

Categories: Cafes, Restaurants, Coffee & Tea, Sandwiches, Food

Categories: Thai, Restaurants, Vegan

Categories: Restaurants, Desserts, Sandwiches, Cafes, French, Coffee & Tea, Food, Breakfast & Brunch

Categories: Italian, Pizza, Restaurants

Categories: Sandwiches, Restaurants, Food, Bakeries

Categories: Thai, Asian Fusion, Food, Restaurants, Food Delivery Services

Categories: Food, Coffee & Tea

Categories: Canadian (New), American (Traditional), Japanese, Korean, Restaurants, Asian Fusion, Steakhouses, American (New), Seafood

Categories: Hotels & Travel, Event Planning & Services, Hotels

Categories: Restaurants, Indian

Categories: Venues & Event Spaces, Event Planning & Services, Comfort Food, Breakfast & Brunch, American (New), Restaurants, Vegetarian, Canadian (New)

Categories: Creperies, Restaurants

Categories: Seafood, Restaurants, Mexican

Categories: Nightlife, Bars

Categories: Middle Eastern, Pakistani, Indian, Restaurants

Categories: Bars, Food, BeerWineSpirits, Local Flavor, Restaurants, Nightlife, Canadian (New), Wine Bars

Categories: Salad, Restaurants, Bars, Vegan, Nightlife, Tapas/Small Plates, Pizza, Vegetarian, Cocktail Bars

Categories: Shopping, UsedVintageConsignment, Fashion, Local Flavor, Farmers Market, Food

Categories: Shopping, UsedVintageConsignment, Fashion, Local Flavor, Farmers Market, Food

Categories: Shopping, UsedVintageConsignment, Fashion, Local Flavor, Farmers Market, Food

Categories: American (New), Restaurants, Canadian (New)

Categories: Ice Cream & Frozen Yogurt, Food, Desserts

Categories: Gluten-Free, Chicken Shop, Burgers, Fast Food, Comfort Food, Breakfast & Brunch, Restaurants, American (Traditional), Soul Food, Chicken Wings, Canadian (New), Waffles

Categories: Desserts, Food, Restaurants, Cafes

Categories: Restaurants, Food, Fast Food, Hot Dogs, Burgers

Categories: Thai, Food, Restaurants, Food Delivery Services

Categories: French, Food, Restaurants

Categories: Thai, Vietnamese, Restaurants, Gluten-Free

Categories: Restaurants, Caribbean, Middle Eastern

Categories: Korean, Restaurants

Categories: Bars, Nightlife, Restaurants, French

Categories: Bars, Venues & Event Spaces, Restaurants, Event Planning & Services, Nightlife, American (Traditional)

Categories: Japanese, Restaurants, Noodles

Categories: Shopping, BooksMagsMusicVideo, Restaurants, Cafes, Comic Books

Categories: Restaurants, Wine Bars, Pizza, Arts & Entertainment, Italian, Bars, Wineries, Nightlife, Food

Categories: Restaurants, Coffee & Tea, Cafes, Food

Categories: Juice Bars & Smoothies, Breakfast & Brunch, Restaurants, Food

Categories: American (Traditional), Restaurants, Bars, Desserts, Food, Nightlife, Lounges, Steakhouses, Cocktail Bars

Categories: Fashion, Accessories, Shoe Stores, Shopping

Categories: Juice Bars & Smoothies, Breakfast & Brunch, Restaurants, Food

Categories: Desserts, Food, Restaurants, Bakeries, Cafes, Coffee & Tea, Japanese

Categories: Custom Cakes, Food, Cheese Shops, Specialty Food

Categories: Nightlife, Lounges, Restaurants, Bars, Cocktail Bars, American (Traditional)

Categories: Restaurants, Burgers

Categories: Chinese, Coffee & Tea, Tea Rooms, Desserts, Restaurants, Food

Categories: Restaurants, Cocktail Bars, Nightlife, Canadian (New), Bars

Categories: Restaurants, Breakfast & Brunch, Food, French, Desserts

Categories: Ice Cream & Frozen Yogurt, Food, Event Planning & Services, Caterers

Categories: Active Life, Arts & Entertainment, Party & Event Planning, Event Planning & Services, Escape Games, Arcades

Categories: Cafes, Specialty Food, Juice Bars & Smoothies, Asian Fusion, Food, Coffee & Tea, Creperies, Restaurants, Ethnic Food, Desserts

Categories: Food, Coffee & Tea, Grocery

Categories: Breakfast & Brunch, Sushi Bars, Japanese, Restaurants

Categories: Restaurants, Cocktail Bars, Nightlife, Canadian (New), Bars

Categories: Restaurants, Cocktail Bars, Nightlife, Canadian (New), Bars

Categories: Venues & Event Spaces, Event Planning & Services, Comfort Food, Breakfast & Brunch, American (New), Restaurants, Vegetarian, Canadian (New)

Categories: American (Traditional), Lounges, Restaurants, Bars, Mexican, Nightlife

Categories: Caribbean, Butcher, Restaurants, Food

Categories: Venues & Event Spaces, Event Planning & Services, Comfort Food, Breakfast & Brunch, American (New), Restaurants, Vegetarian, Canadian (New)

Categories: Venues & Event Spaces, Event Planning & Services, Comfort Food, Breakfast & Brunch, American (New), Restaurants, Vegetarian, Canadian (New)

Categories: Venues & Event Spaces, Hotels, Event Planning & Services, Hotels & Travel

Categories: Taiwanese, Restaurants, Chicken Shop, Chinese

Categories: Salad, Soup, Restaurants, Middle Eastern

Categories: Sandwiches, Restaurants, Cafes, Bubble Tea, Desserts, Food, Breakfast & Brunch

Categories: Food, Tea Rooms, Restaurants, Coffee & Tea, Cafes

Categories: Vegetarian, Restaurants, Cocktail Bars, Nightlife, Bars, Seafood

Categories: Italian, Restaurants, Bars, Cocktail Bars, Nightlife, Sandwiches

Categories: Japanese, Sushi Bars, Asian Fusion, Restaurants

Categories: Restaurants, Indian  
Categories: Restaurants, Southern, BeerWineSpirits, Food, Vegan  
Categories: Restaurants, Sandwiches  
Categories: Climbing, Active Life  
Categories: Mediterranean, Cooking Classes, Restaurants, Event Planning & Services, Shopping, Arts & Crafts, Greek, Fast Food, Caterers  
Categories: American (Traditional), Barbeque, Restaurants, Southern  
Categories: BeerWineSpirits, Nightlife, Sports Bars, Bars, Food, American (New), Canadian (New), Restaurants  
Categories: Gastropubs, Bars, Restaurants, Pubs, Nightlife  
Categories: Breweries, Food, Nightlife, Restaurants, Burgers, Bars  
Categories: Tapas/Small Plates, Mexican, Restaurants  
Categories: Restaurants, Nicaraguan, Latin American  
Categories: Vegetarian, Restaurants, Mexican, Latin American  
Categories: Canadian (New), American (Traditional), Japanese, Korean, Restaurants, Asian Fusion, Steakhouses, American (New), Seafood  
Categories: Bars, Wine Bars, Canadian (New), Nightlife, Restaurants  
Categories: Bars, Wine Bars, Canadian (New), Nightlife, Restaurants  
Categories: Restaurants, Greek, Korean  
Categories: Restaurants, Japanese  
Categories: Restaurants, Italian  
Categories: Italian, Pizza, Restaurants  
Categories: Canadian (New), Restaurants, American (Traditional)  
Categories: Dim Sum, Chinese, Restaurants, Seafood  
Categories: Tea Rooms, Food  
Categories: Tea Rooms, Food  
Categories: Desserts, Food, Restaurants, Cafes  
Categories: Sports Bars, Arcades, Restaurants, Canadian (New), Arts & Entertainment, Nightlife, Bars  
Categories: Fashion, Men's Clothing, Women's Clothing, Shopping  
Categories: Tapas/Small Plates, American (New), Breakfast & Brunch, Canadian (New), Restaurants  
Categories: Hot Pot, Specialty Food, Chinese, Restaurants, Do-It-Yourself Food, Ethnic Food, Food  
Categories: Seafood, Restaurants  
Categories: Venues & Event Spaces, Event Planning & Services, Comfort Food, Breakfast & Brunch, American (New), Restaurants, Vegetarian, Canadian (New)  
Categories: Food, Restaurants, Nightlife, Sandwiches, Chinese, Cocktail Bars, Cafes, Bars, Coffee & Tea  
Categories: Food Court, Restaurants, Caribbean  
Categories: Bars, Diners, Restaurants, Asian Fusion, Chinese, Dim Sum, Nightlife, Wine Bars  
Categories: Nightlife, Hawaiian, Restaurants, Bars, Cocktail Bars, Asian Fusion  
Categories: Canadian (New), Food, Specialty Food, Restaurants, Nightlife, Cocktail Bars, Bars  
Categories: Japanese, Sushi Bars, Asian Fusion, Restaurants  
Categories: Restaurants, Burgers  
Categories: Pizza, Restaurants, Italian, Salad, Gluten-Free  
Categories: Bars, Cocktail Bars, Canadian (New), Sports Bars, Mediterranean, Restaurants, Nightlife  
Categories: Coffee & Tea, Internet Cafes, Bars, Restaurants, Turkish, Food, Nightlife  
Categories: Japanese, Sushi Bars, Asian Fusion, Restaurants  
Categories: Escape Games, Arcades, Arts & Entertainment, Active Life  
Categories: Breakfast & Brunch, Diners, Restaurants  
Categories: Restaurants, Vietnamese  
Categories: Restaurants, Desserts, Salad, Food, Pizza, Burgers, American (Traditional)  
Categories: American (Traditional), Restaurants, Food, Nightlife, Pubs, Bars, Breweries  
Categories: Sushi Bars, Restaurants, Japanese  
Categories: Restaurants, Korean  
Categories: Food, Restaurants, French, Event Planning & Services, Venues & Event Spaces, Coffee & Tea, Cafes

Categories: Restaurants, Korean  
Categories: Restaurants, Sushi Bars  
Categories: Sandwiches, Restaurants, Asian Fusion, Food, Delicatessen, Vietnamese  
Categories: Breakfast & Brunch, Sushi Bars, Japanese, Restaurants  
Categories: Seafood, Restaurants, Mexican  
Categories: Nightlife, Lounges, Restaurants, Bars, Cocktail Bars, American (Traditional)  
Categories: Creperies, Restaurants  
Categories: Middle Eastern, Mediterranean, Food, Lebanese, Cafes, Restaurants, Bakeries  
Categories: Restaurants, Japanese  
Categories: Restaurants, Burgers  
Categories: Chinese, Dim Sum, Restaurants  
Categories: Social Clubs, Nightlife, Bars, Arts & Entertainment, Food, Lounges, BeerWineSpirits, Comedy Clubs, Dive Bars  
Categories: Breakfast & Brunch, Restaurants  
Categories: Local Flavor, Museums, Arts & Entertainment

Através dos 144 clusters encontrados após aplicar o algoritmo K-Clique, considerando cliques de tamanho 4, ao comparar as categorias, percebeu-se uma grande hegemonia por categorias de alimentação, com grande foco aos restaurantes, além disso, outros clusters interessantes se formaram e fazem total sentido, como o caso de bares e casas noturnas e também locais com opções veganas e vegetarianas.