DATA 620 Week 3 Assignment - Graph Visualization

CLAUDIO, Mauricio

11 January 2024

---

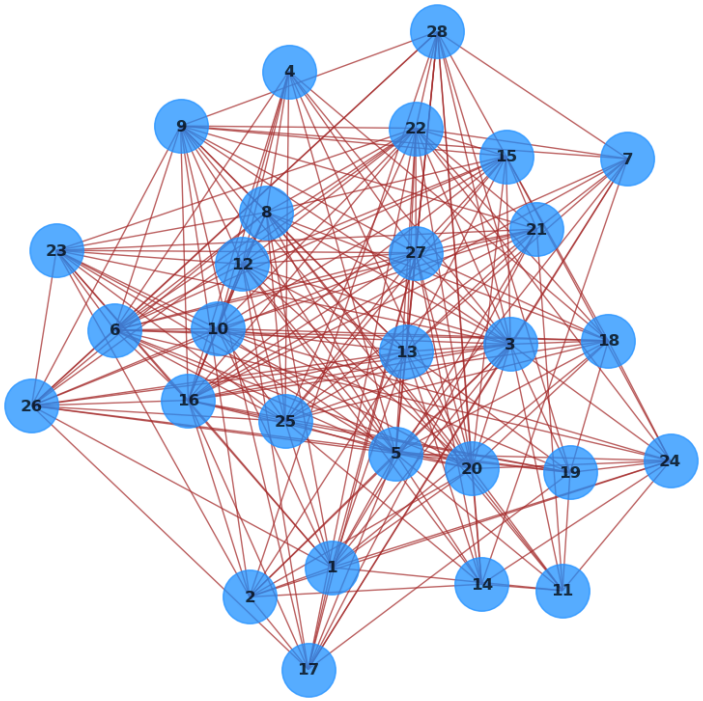
1. Load a graph dataset of your choosing from a text file or other source. If you take a large network dataset from the web (such as from Stanford Large Network Dataset Collection), please feel free at this point to load just a small subset of the nodes and edges.

We load the 2015 Macaque Grooming Bouts network dataset by Ryan A. Rossi and Nesreen K. Ahmed, available at Network Repository. An Interactive Scientific Network Data Repository. The dataset describes a network of grooming bouts in a troop of macquaques, showing who's was sitting with whom and who was grooming whom. The grooming network consists of 28 nodes/animals and 228 edges/grooming bouts.

In [163…
```
### Import libraries
import networkx as nx
import matplotlib.pyplot as plt

### Magical command
%matplotlib inline

### Load data
mac_grooming = nx.read_edgelist('mammalia-macaque-grooming-bouts.edges',
                      nodetype=int,
                      data=(('weight', int),))
```

In [230…
```
### Set figure size
plt.rcParams["figure.figsize"] = (8,8)

### Show number of Nodes & Edges
print(mac_grooming)

### Draw the network
nx.draw(mac_grooming,
        node_color="dodgerblue",
        node_size=1600,
        font_weight='bold',
        font_size = 12,
        edge_color="brown",
        alpha=0.75,
        with_labels=True)
```

```
Graph with 28 nodes and 228 edges
```



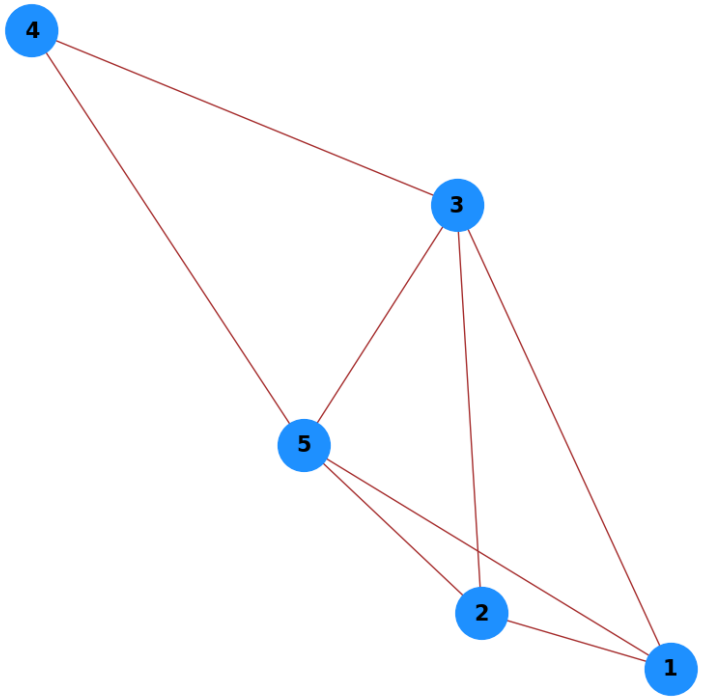
Network with only the first five nodes/animals

We subset the first five nodes/animals from the full network. From visual inspection, we see that there are eight (8) edges in the five-node network.

In [167…
```
### Subset data
macs_sub = mac_grooming.subgraph([1,2,3,4,5])

### Set figure size
plt.rcParams["figure.figsize"] = (8,8)

### Show number of Nodes & Edges
print(macs_sub)
```

```
### Plot subset
nx.draw(macs_sub,
        node_color="dodgerblue",
        node_size=1500,
        font_weight='bold',
        font_size = 16,
        edge_color="brown",
        #alpha=0.8,
        with_labels=True)
```

```
Graph with 5 nodes and 8 edges
```



2. Create basic analysis on the graph, including the graph's diameter, and at least one other metric of your choosing. You may either code the functions by hand (to build your intuition and insight), or use functions in an existing package.

The **diameter** of a graph is the maximum eccentricity of its vertices, while the **radius** of a graph is the minimum eccentricity. Thus if the radius and diameter are equal, each vertex has the same eccentricity. Hence each vertex is a central vertex and the network is 'self-centered'.

Network Diameter

In [168…
```
nx.diameter(mac_grooming)
```

Out[168…
```
2
```

Network Radius

In [169…
```
nx.radius(mac_grooming)
```

Out[169…
```
2
```

3. Use a visualization tool of your choice (NetworkX, Gephi, Pyvis, etc.) to display information.

Degree represents the number of connections of each node. The degree by node and degree distribution are shown below.

In [212…
```
deg = nx.degree(mac_grooming)
print(deg)
```

```
[(1, 17), (2, 12), (3, 24), (5, 23), (8, 18), (10, 17), (11, 10), (13, 20), (16, 2
2), (17, 13), (18, 15), (20, 19), (21, 14), (23, 15), (24, 13), (25, 19), (26, 16),
(27, 20), (9, 17), (14, 11), (28, 14), (4, 11), (6, 19), (7, 11), (12, 17), (15, 1
6), (19, 12), (22, 21)]
```

Mean degree / connections per node

In [238…
```
import statistics as stat
stat.mean(dict(deg).values())
```

Out[238…
```
16.285714285714285
```

Standard deviation of mean degree

In [240…
```
stat.stdev(dict(deg).values())
```

Out[240…
```
3.895459302136678
```

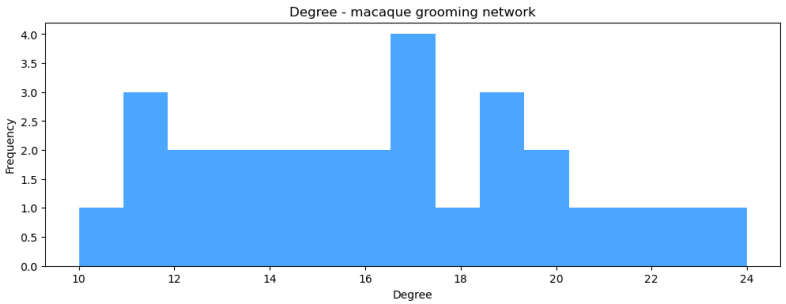
Distribution of node degree / connections

In [225…

```
plt.figure(figsize=(12,4))
plt.hist(dict(deg).values(), 15,
         color="dodgerblue",
         alpha = 0.8)
plt.xlabel('Degree') ; plt.ylabel('Frequency') ; plt.title('Degree - macaque groomi
```

Out[225…

```
Text(0.5, 1.0, 'Degree - macaque grooming network')
```



In [ ]:

4. Please record a short video (~ 5 minutes), and submit a link to the video in advance of our meet-up.

Video link.
