Network Analytics

Group 4

November 21, 2016

Question 1

(a) **Incidence Matrix**

We read the data into using the `read_edgelist()` function and get the following incidence matrix.

	(a,b)	(a,d)	(d,b)	(d,e)	(b,e)	(b,c)	(c,d)
a	-1	-1	0	0	0	0	0
b	1	0	1	0	-1	-1	0
c	0	0	0	0	0	1	-1
d	0	1	-1	-1	0	0	1
e	0	0	0	1	1	0	0

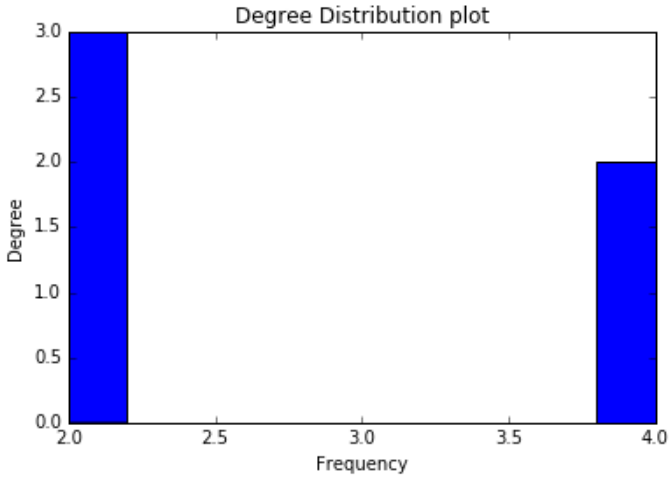
(b) **Shortest Path Matrix**

	a	b	c	d	e
a	0	5	15	3	6
b	inf	0	10	8	7
c	inf	6	0	-2	1
d	inf	8	18	0	3
e	inf	inf	inf	inf	0

(c) **Diameter**

Using the shortest path matrix above, we iterate through all values to find the maximum value while ignoring the ∞ values. The diameter of the graph is 18.

(d) **Degree Distribution**



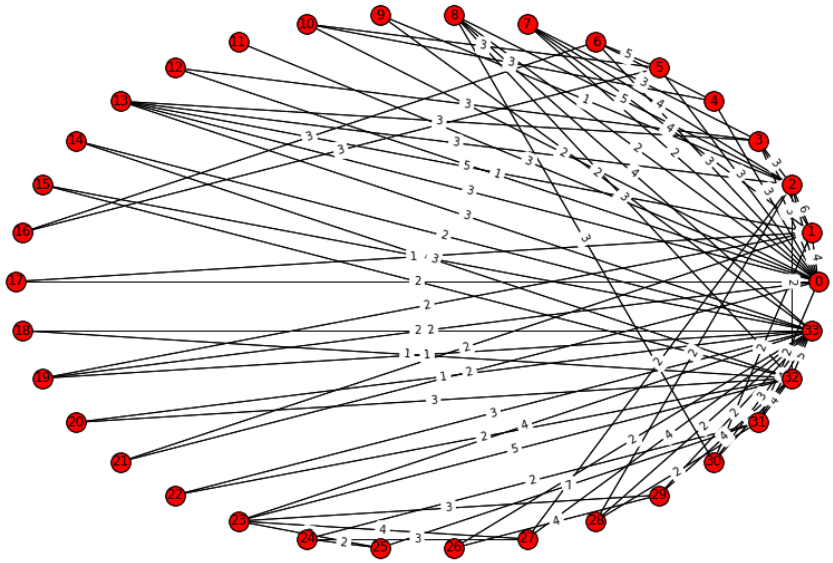
The support of the distribution is {2,4} with the probabilities,

$$\mathbb{P}(D = d) = \begin{cases} \frac{3}{5}, \text{if } d = 2 \\ \frac{2}{5}, \text{if } d = 4 \end{cases}$$

(e) **Connectedness**

Using the commands `print(nx.is_strongly_connected(G))` and `print(nx.is_weakly_connected(G))`, we check both weak and strong connectivity. We find that the graph is WEAKLY connected but not STRONGLY connected due to the directed edges.

Question 2



All nodes in the graph are somewhat connected to each other. When using the shell layout, we find that the algorithm only generates one concentric circle, indicating the strong links between each node pairwise. Thus, the graph is best represented using this layout to display the links between them.