After loading the adjacency list *vitevitch.adjlist*. Using the networkx and matplotlib.pyplot python libraries the following graph as shown in Figure 1 (See Appendix 1a for larger image) was outputted.

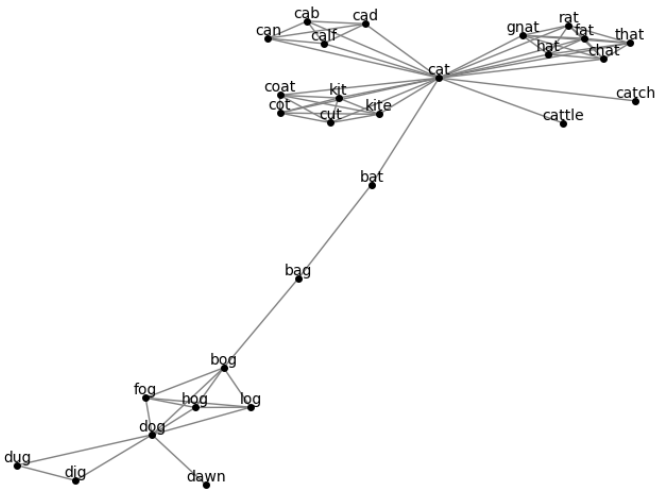


Figure 1: Phonological Network

After writing code which is available on Appendix 2 we were able to calculate the total number of nodes and edges, calculate the number of possible edges, density of the network, average degree of the network and find out what vertex have the highest and lowest degree. As well as see the frequency of degrees in the network.

The network consists of 65 edges and 28 nodes.The total possible edges in a undirected graph with 28 nodes is 378. The density and average density of our network is 0.17196 and 4.642857 respectively. The minimum degree of our network is 1 and the nodes labeled 'dawn', 'cattle', 'catch' all fit this criteria. The maximum degree is 18 and the node 'cat' fits this criteria. Figure 2 (See Appendix 1b for larger image) shows us a histogram of degree frequencies. The most common degree a node in our network has is 4.

The nodes themselves are connected based on their phonologically similarities. The edge represents one phoneme difference. Additionally from what we learned in lecture, words that have a high degree are often hard for people to recognize. If participants in a perceptual identification task or auditory lexical decision task they would respond to words with a lower degree more accurately, in the perceptual task and respond faster to words with a lower degree in a auditory decision task

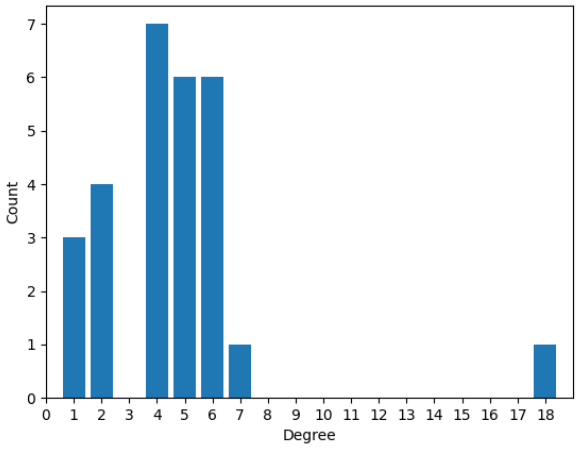
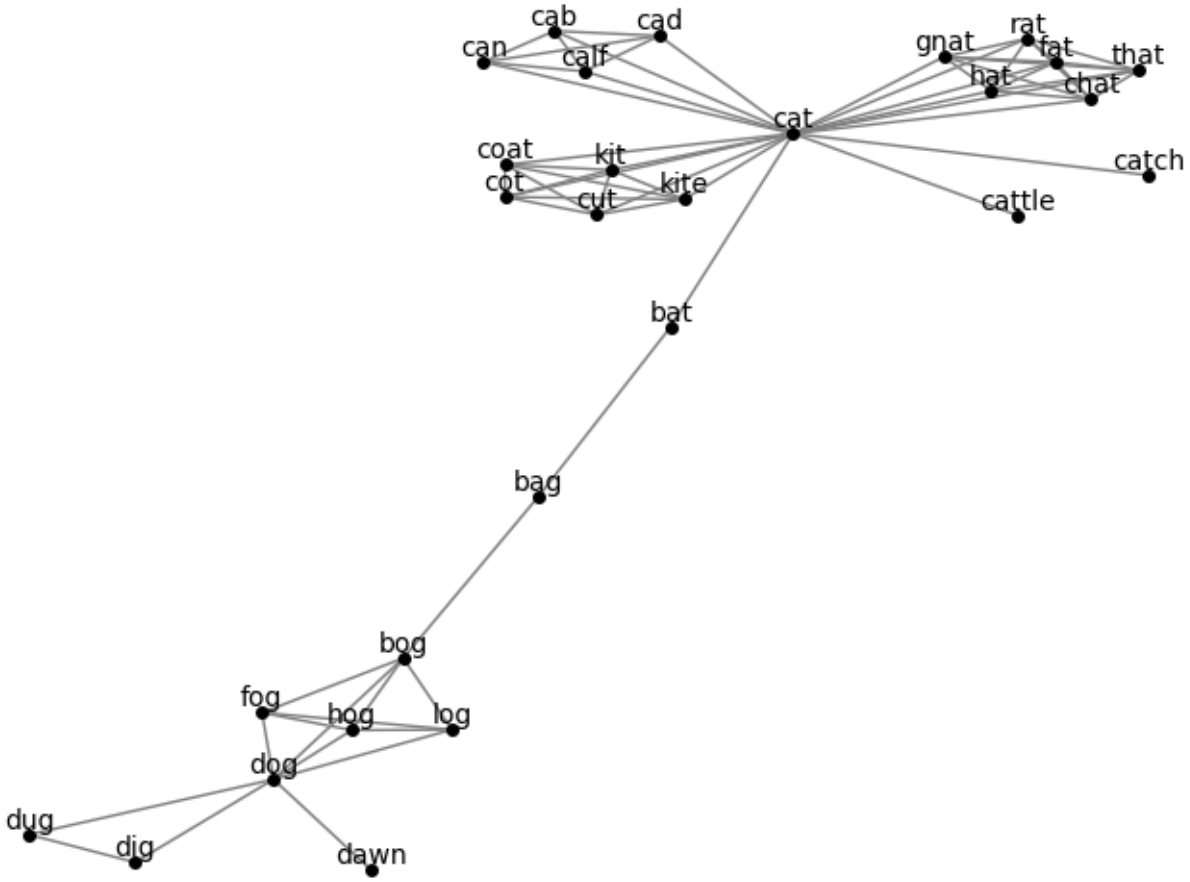
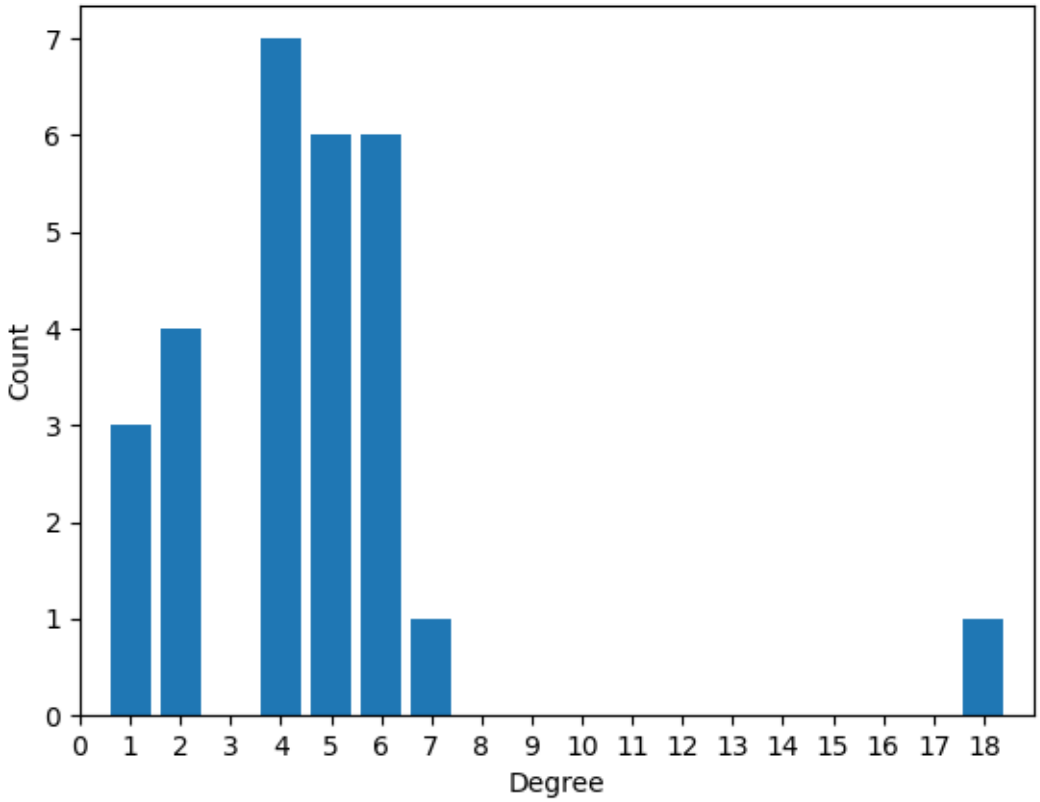


Figure 2: Degree Frequency

Appendix 1a


cab
cad
can
calf
gnat
rat
fat
that
hat
chat
cat
coat
kit
catch
cot
kite
cut
cattle
bat
bag
bog
fog
hog
log
dog
dug
dig
dawn

Appendix 1b)



Appendix 2

```
import networkx as nx
import matplotlib.pyplot as plt  # Since we are not using a notebook we will import like this
import numpy as np

def main():
    graph = nx.read_adjlist('../Datasets/vitevitch.adjlist')
    nx.draw(graph,
            with_labels=True,
            node_color='black',
            node_size=18,
            font_size=8,
            verticalalignment='bottom',
            edge_color='grey')
    edges = number_of_edges(graph)
    nodes = number_of_nodes(graph)
    max_edges_possible = number_of_possible_edges(nodes)
    density = network_density(nodes, edges)
    max_degree = highest_degree(graph)
    min_degree = lowest_degree(graph)
    mean_degree = average_degree(nodes, edges)
    print(f"The number of edges in our graph is {edges}, and the number of nodes in our graph is {nodes}. \n"
          f"The max amount of edges possible in a undirected graph with {nodes} nodes is {max_edges_possible} \n"
          f"The density of our network is {density}. \n"
          f"The average density of our network is {mean_degree} \n"
          f"The nodes with the minimum degree are:")
    for nodes in min_degree:
        print(f"\t-{nodes} (degree of {graph.degree(nodes)})")
    print(f"The nodes with the maximum grades are: ")
    for nodes in max_degree:
        print(f"\t-{nodes} (degree of {graph.degree(nodes)})")
    plt.savefig('graph.png')
    plt.show()
    histogram_degrees(graph)

def histogram_degrees(G):
    all_degrees = nx.degree_histogram(G)
    axes = plt.gca()
    plt.bar([0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18], all_degrees)
    axes.set_xlim([0, 19])
    axes.xaxis.set_ticks(np.arange(0, 19, 1))
    plt.xlabel("Degree")
    plt.ylabel("Count")
    plt.savefig('histo.png')
    plt.show()

def number_of_edges(G):
    return G.number_of_edges()

def number_of_nodes(G):
    return G.number_of_nodes()

def number_of_possible_edges(N):
    max_edges = (N * (N - 1)) / 2
    return max_edges

def network_density(N, L):
    numerator = 2 * L
    denominator = N * (N - 1)
    return numerator / denominator

def highest_degree(G):
    max_value = 0
    nodes_with_max_value = []
    for node in G.nodes():
        if G.degree(node) > max_value:
            max_value = G.degree(node)

    for node in G.nodes():
        if G.degree(node) == max_value:
            nodes_with_max_value.append(node)
    return nodes_with_max_value

def lowest_degree(G):
    min_value = 1
    nodes_with_min_value = []
    for node in G.nodes():
        if G.degree(node) < min_value:
            min_value = G.degree(node)
    for node in G.nodes():
        if G.degree(node) == min_value:
            nodes_with_min_value.append(node)
    return nodes_with_min_value

def average_degree(N, L):
    return (2 * L) / N

if __name__ == '__main__':
    main()
```