# MECH 6317.001 Project Proposal – Tanner Kogel

The following describes the network which I hope to create and analyze for the purposes of use in the Mech 6317 Dynamics of Complex Networks and Systems project.

## Network Description

The network that I wish to build for this project is actually two networks. The first being the network of Greyhound buses, where every node is a city, and an edge exists between two nodes if there exists a direct Greyhound bus route between those two cities. The second network is defined in the same way as the first, except instead of an edge’s existence being determined by a direct Greyhound bus route, it will be determined by a direct Amtrak route.

## Data Collection

The nodes of the graphs will be collected from the Wikipedia page for the [largest cities in the United States.](https://en.wikipedia.org/wiki/List_of_United_States_cities_by_population) The Greyhound route data will be found from the [Greyhound Route Map,](https://www.greyhound.com/bus-routes) and the Amtrak route data will be found from the [Amtrak Route Map.](https://www.amtrak.com/plan-your-trip.html)

## Links in case the above don’t work

Wikipedia: <https://en.wikipedia.org/wiki/List_of_United_States_cities_by_population>

Greyhound Route Map: <https://www.greyhound.com/bus-routes>

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The following describes the network which I hope to create and analyze for the purposes of use in the Mech 6317 Dynamics of Complex Networks and Systems project.

## Network Description

The first network I would like to build is a network where the nodes are train stations which are visited by Amtrak train routes. An edge exists between two nodes if there exists a route between the two stations, and the weight of the edge represents the number of routes that exist between those two stations. This graph will be undirected due to the nature of the train routes; although the directionality of travel suggests a directed graph because the train routes are traveled in both directions, the graph can be easily modeled as undirected since all edges would have counterparts in the opposite direction. Two subgraphs would then be created from the main Amtrak network. Both of these graphs would contain the same set of nodes, which are the list of United States cities with populations of 100,000 people or higher according to the 2020 Census. These nodes would have additional information attributed to them for use of computing assortativity. These graphs will be found in two different methods. The first method will be the ‘induced’ or ‘direct-route’ subgraph; in this case, if a train station is within a city that is not defined in the subgraph, all edges adjacent to the train station will be lost, hence only direct routes will be represented on the induced subgraph. In the non-induced or ‘destination’ subgraph, the nodes of the stations that fall in cities that are not defined are removed, but the their adjacent edges are held intact. For example, if a given route follows a path of New York -> … -> Boston, where … is a path of cities that are not defined in the subgraph, the induced subgraph would not add any connection between New York and Boston, but the non-induced subgraph would add an edge between them.

## Data Collection

The nodes of the graphs will be collected from the Wikipedia page for the [largest cities in the United States.](https://en.wikipedia.org/wiki/List_of_United_States_cities_by_population) The Amtrak route data will be found from [Amtrak Routes.](https://www.amtrak.com/routes.html)

## Links in case the above don’t work

Amtrak Route Map: <https://www.amtrak.com/routes.html>