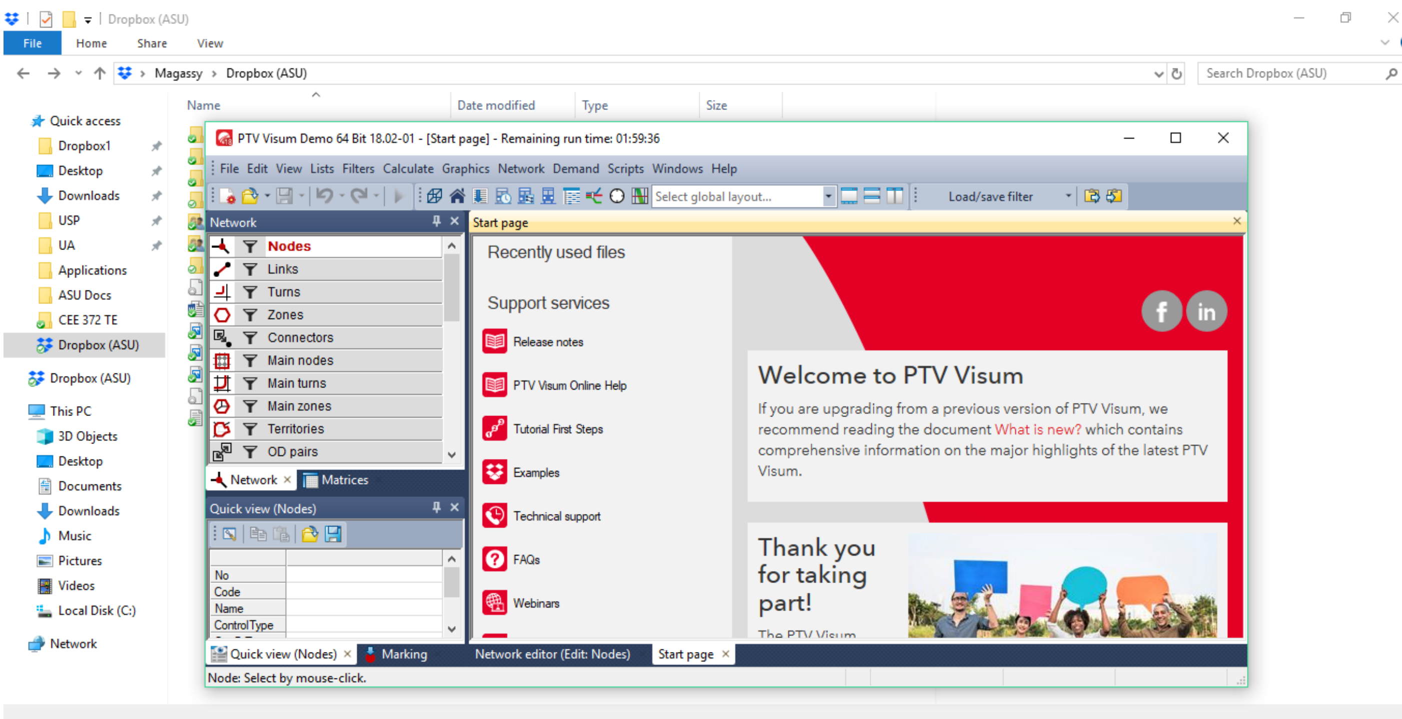
<u>Homework 5: Tassio Magassy</u>

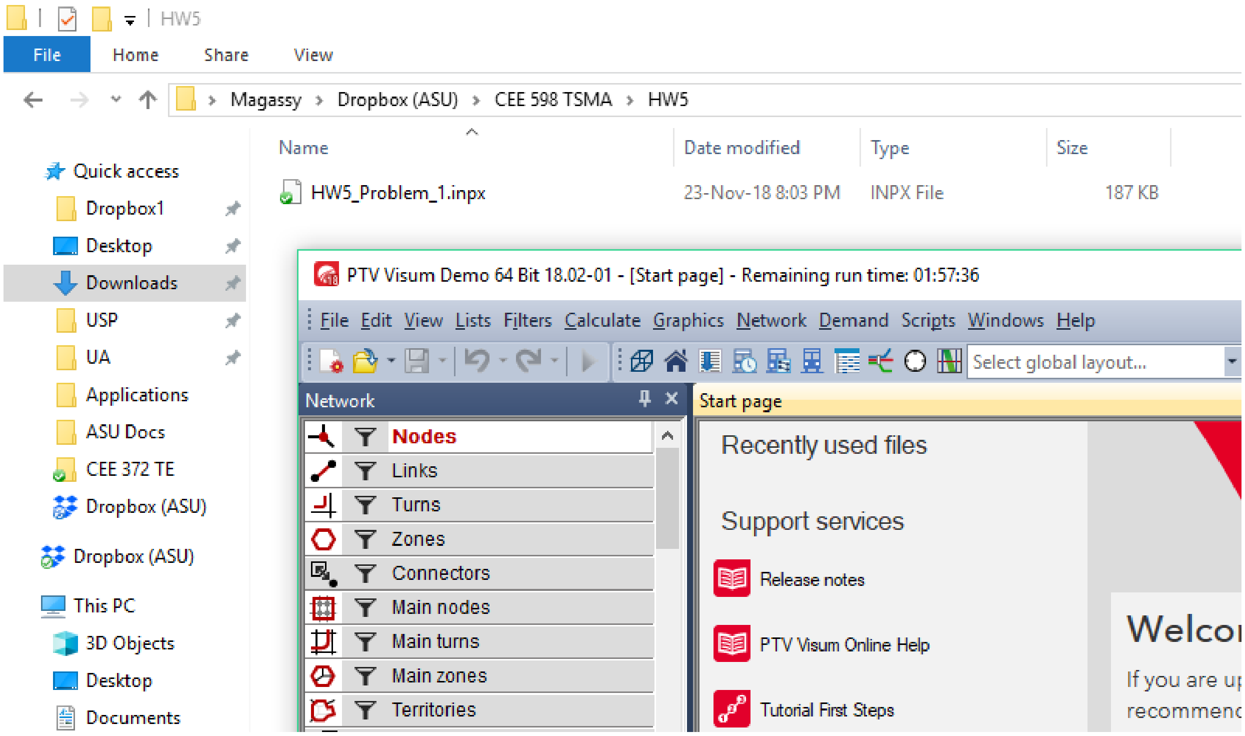
Question 1.1. Please download the vissim network at the following link:

After trying for a couple of times on different computers. The file .inpx could not open on the PVT Visum Demo 18. The file looked like could not be opened by the program. Here are some screenshots.

When I clicked on the file, this is what would open in the program:



Here is how the file was seen in my folder:



Even trying to open from the program it would not do anything.

2. Please provide the derivation process of how the GM-1 car-following model is equal to Greenberg's macroscopic speed-density model?

GM-3 car-following model:

$$\ddot{\mathbf{x}}_{\mathbf{n+1}}(\mathbf{t}+\Delta\mathbf{t}) = \frac{\alpha_0}{\mathbf{x_n(t)-x_{n+1}(t)}}[\dot{\mathbf{x}}_{\mathbf{n}}(\mathbf{t}) - \dot{\mathbf{x}}_{\mathbf{n+1}}(\mathbf{t})]$$

After integrating both sides of the equation:

$$\dot{x}_{n+1} = \alpha_0 \ln\left(x_n(t) - x_{n+1}(t)\right) + C_1$$

$x_n(t) - x_{n+1}(t)$ denotes the space between two vehicles, which we represent as $1/k$,

Re-writing the equation as

$$u = \alpha_0 \ln(1/k) + C_1$$

Let constant C_1 be substituted for $\alpha_0 ln C_2$, then

$$u = \alpha_0 \ln(C_2/k)$$

Now, when $k = k_j$, $u = 0$ (at jam density k=0)

We get,

$$0 = \alpha_0 \ln\left(C_2/k_j\right)$$

Solving for C_2,

$$C_2 = k_j$$

Finally, the equation can be written as

$$\mathbf{u = \alpha_0 ln\left(k_j/k\right)}$$

This is the Greenberg's macroscopic model logarithmic equation

3. Based on Little's law, please derive why Q=KV.

$$\bar{L}(t) = \frac{A(t)}{t} \times \bar{W}(t)$$

$\bar{L}(t)$ is number of vehicles on the roads, and $\bar{W}(t)$ as average travel time.

Assuming the length of the road is L:

$$\bar{L}(t)/L = \left(\frac{A(t)}{t} \times \bar{W}(t)\right)/L$$

By dividing both sides of the equation for Little's Law by L

$$\bar{L}(t)/L = K,$$

where K is density.

Again,

$$\frac{A(t)}{t} = Q$$, Q is the arrival rate/flow of vehicles.

$$\bar{W}(t)/L = 1/V,$$

V is the average speed of all vehicles.

So, combining we obtain,

$K = Q/V$, or $Q = KV$