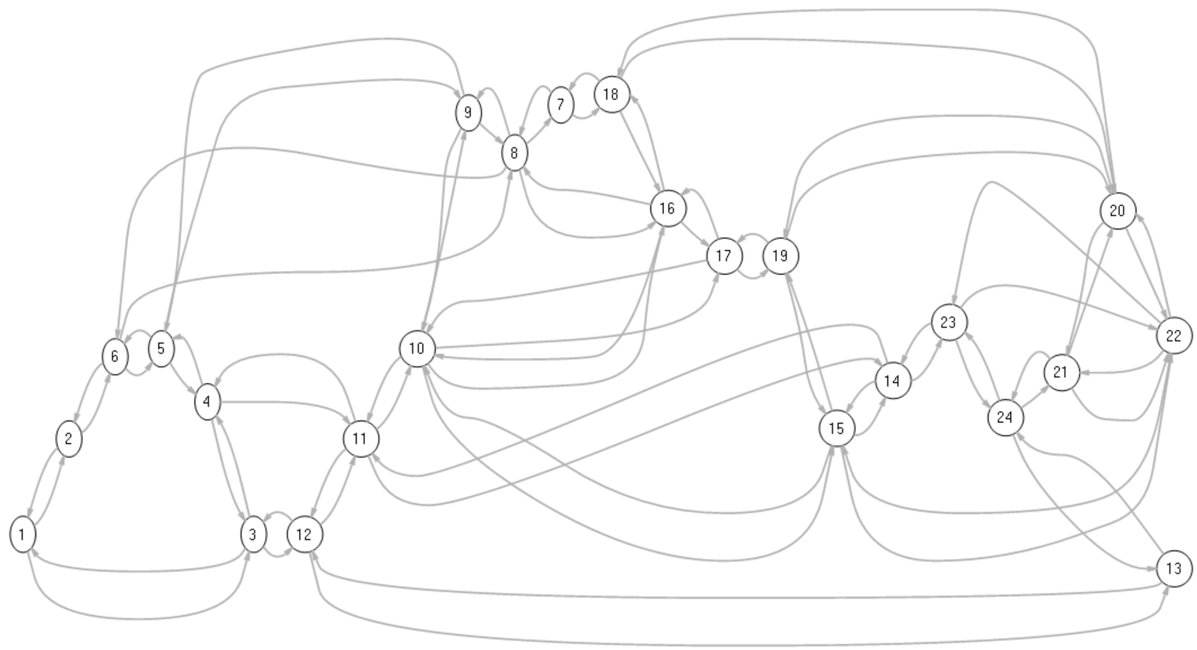
seSue Traffic Assignment

seSue is an open source tool to aid research on static path-based Stochastic User Equilibrium models.

1. The Network

In this tutorial, we will use the traffic network of the city of Sioux Falls.

The network consists of 24 nodes and 76 links.



There exist 528 OD pairs in the network.

Total demand is 360,600 units; and average demand per OD pair is about 683 units.

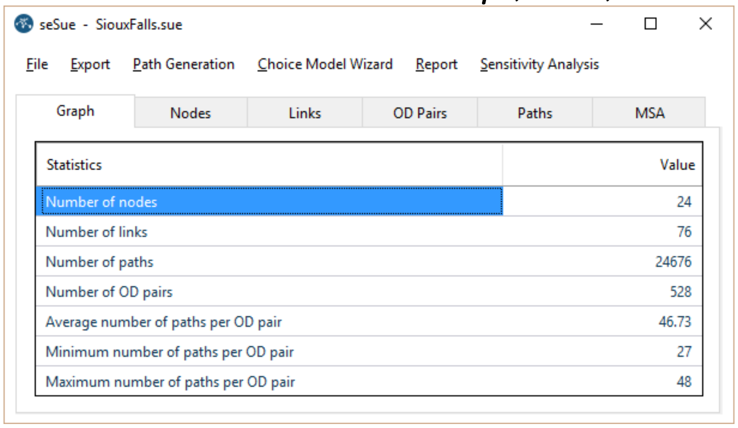
The demand will be assigned to a total of 24,676 routes; where average number of routes per OD pair is around 47.

STEP 1:

*Double click **SiouxFalls.sue** file to open the data file with seSue.*

There exist 6 tabs in the form.

*Check the information in tabs **Graph, Links, OD Pairs,** and **Paths**.*



2. User Equilibrium

In the first exercise, we will use User Equilibrium model to assign the demand to routes.

STEP 2:

*Open the **OD Pairs** tab. The **choice model** column displays the assigned choice model to each OD pair (currently they may be **null**).*

Note that different choice models may be assigned to different OD pairs in traffic assignment problems.

*Click **Deterministic** in the **Choice Model Wizard** menu.*

*Make sure that **Apply** field in all OD pairs are checked (if they are not checked double-click to select all).*

*Click **Finish**.*

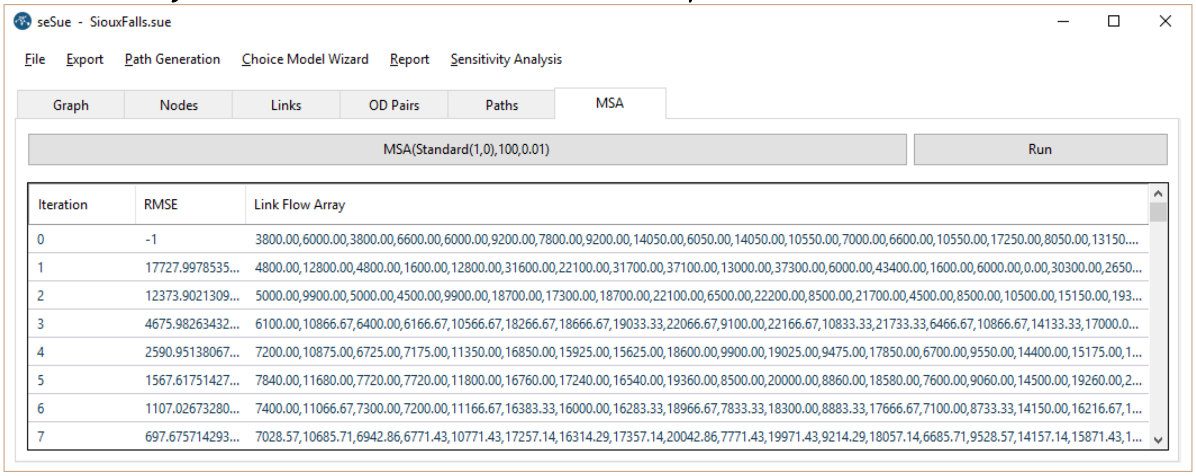
*The **choice model** column in **OD Pairs** tab will be updated as **Det(max),** which stands for deterministic utility maximization (or equivalently User Equilibrium).*

STEP 3:

*Go to the **MSA** (method of successive averages) tab.*

*Click **Run**.*

The MSA algorithm will be run to solve the UE problem.

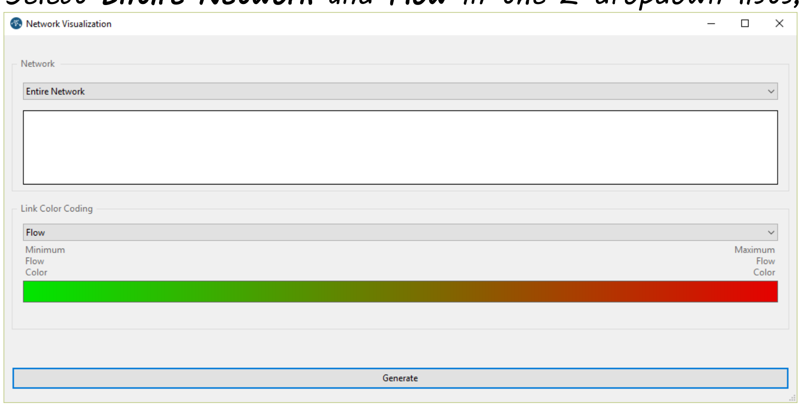


*In order to observe the equilibrium link flows and link costs, click **SUE View** tab on the left in the **Links** tab.*

STEP 4:

*In order to observe the UE link flows, click **Network Visualization** in the **Report** tab.*

*Select **Entire Network** and **Flow** in the 2 dropdown lists; and click **Generate**.*



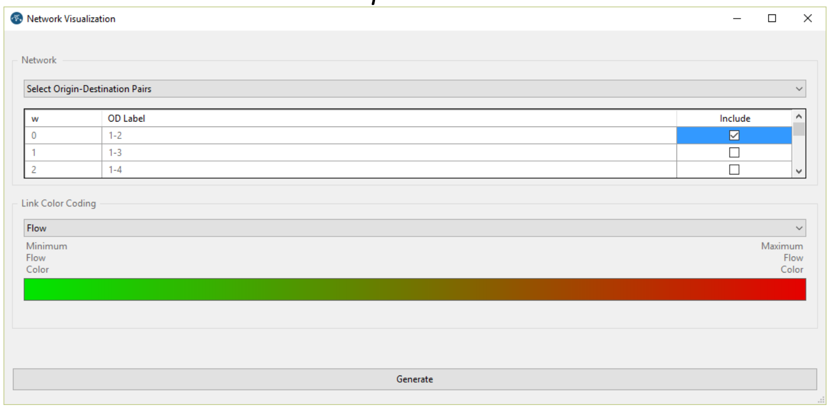
*Click the save button in the generated form and save the image as **UE.JPG**.*

STEP 5:

*In order to observe the UE link flows, click **Network Visualization** in the **Report** tab.*

*Select **Select Origin-Destination Pairs** in the 1st dropdown list; and check OD pair (1,2).*

*Select **Flow** in the 2nd dropdown list.*



*Click the save button in the generated form and save the image as **UE_OD.JPG**.*

3. Stochastic User Equilibrium with MNL(0.1)

Secondly, we will solve the traffic assignment problem by using stochastic user equilibrium (SUE) model.

We will use multinomial logit as the underlying discrete choice model with a dispersion parameter of $\theta_w = 0.1$; i.e., MNL(0.1).

Recall MNL route choice probability expression:

$$p_{kw} = \frac{\exp[-\theta_w c_{kw}]}{\sum_{l \in K_w} \exp[-\theta_w c_{lw}]}$$

STEP 6:

*Click **Logit** in the **Choice Model Wizard** menu.*

*Double-click to check the **Apply** field of all OD pairs (all will be updated as MNL(0.1)).*

*Click **Next** to proceed to the **Settings** tab.*

*Make sure that **Value** of the **Dispersion (theta)** parameter is 0.1; and click **Next** to go to the **Dispersion** tab.*

*Click **Next** to proceed to the **Correction** tab.*

*Click **Finish** to assign MNL(0.1) to all OD pairs.*

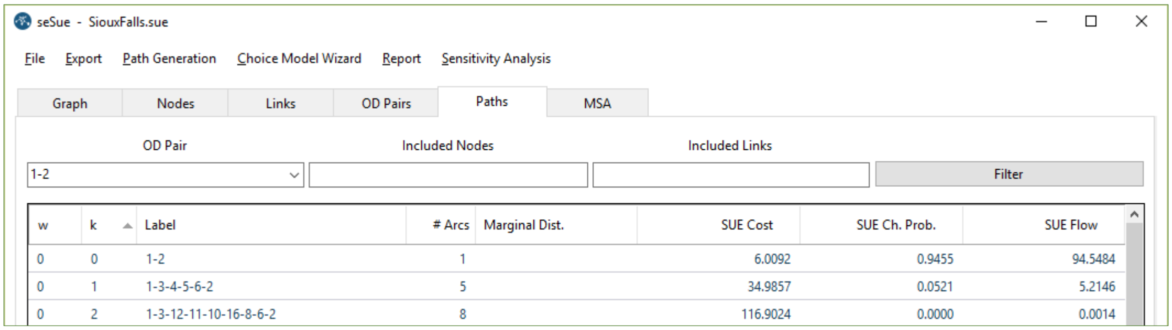
*The **choice model** column in **OD Pairs** tab will be updated as **Logit(0.1, [...])**, which stands for MNL(0.1).*

STEP 7:

Repeat Step 3.

*Go to **Paths** tab.*

*Check the choice probabilities for the selected OD pair **(1,2)** with a demand of 100.*



w	k	Label	# Arcs	Marginal Dist.	SUE Cost	SUE Ch. Prob.	SUE Flow
0	0	1-2	1		6.0092	0.9455	94.5484
0	1	1-3-4-5-6-2	5		34.9857	0.0521	5.2146
0	2	1-3-12-11-10-16-8-6-2	8		116.9024	0.0000	0.0014

Note that about 99.8% of the demand is assigned to the first two (minimum cost) routes.

STEP 8:

*Repeat Step 3 and save the image as **SUE1.JPG**.*

*Repeat Step 4 and save the image as **SUE1_OD.JPG**.*

4. Stochastic User Equilibrium with MNL(0.0001)

Finally, we will solve the traffic assignment problem by using stochastic user equilibrium (SUE) model with multinomial logit as the underlying discrete choice model with a dispersion parameter of $\theta_w = 0.0001$; i.e., MNL(0.0001).

STEP 9:

*Click **Logit** in the **Choice Model Wizard** menu.*

*Double-click to check the **Apply** field of all OD pairs (all will be updated as MNL(0.0001)).*

*Click **Next** to proceed to the **Settings** tab.*

*Update the **Value** of the **Dispersion (theta)** parameter is 0.001; and click **Next** to go to the **Dispersion** tab.*

*Click **Next** to proceed to the **Correction** tab.*

*Click **Finish** to assign MNL(0.0001) to all OD pairs.*

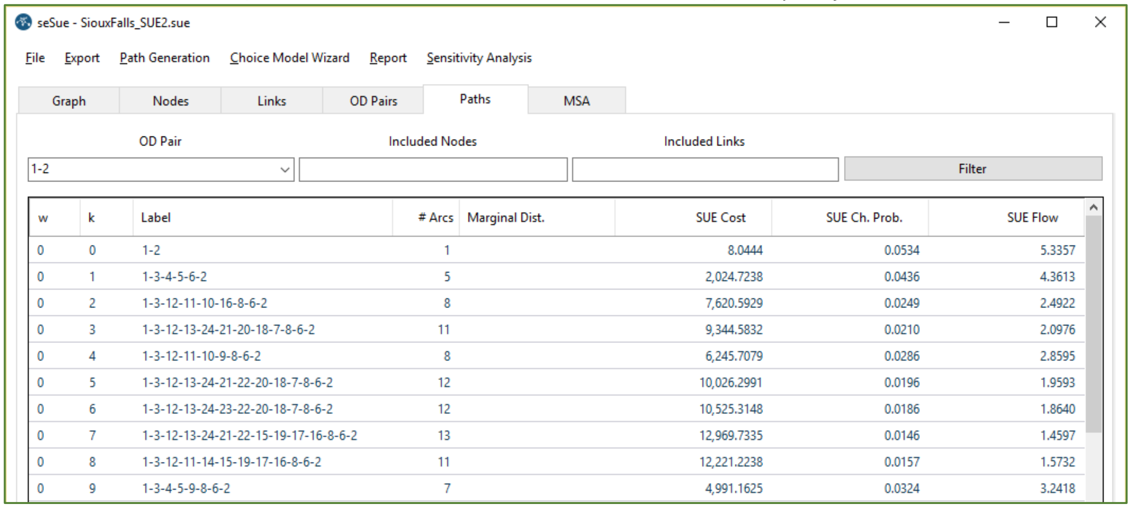
*The **choice model** column in **OD Pairs** tab will be updated as **Logit(0.0001, [...])**, which stands for MNL(0.0001).*

STEP 10:

Repeat Step 3.

*Go to **Paths** tab.*

*Check the choice probabilities for the selected OD pair **(1,2)** with a demand of 100.*



w	k	Label	# Arcs	Marginal Dist.	SUE Cost	SUE Ch. Prob.	SUE Flow
0	0	1-2	1		8.0444	0.0534	5.3357
0	1	1-3-4-5-6-2	5		2,024.7238	0.0436	4.3613
0	2	1-3-12-11-10-16-8-6-2	8		7,620.5929	0.0249	2.4922
0	3	1-3-12-13-24-21-20-18-7-8-6-2	11		9,344.5832	0.0210	2.0976
0	4	1-3-12-11-10-9-8-6-2	8		6,245.7079	0.0286	2.8595
0	5	1-3-12-13-24-21-22-20-18-7-8-6-2	12		10,026.2991	0.0196	1.9593
0	6	1-3-12-13-24-23-22-20-18-7-8-6-2	12		10,525.3148	0.0186	1.8640
0	7	1-3-12-13-24-21-22-15-19-17-16-8-6-2	13		12,969.7335	0.0146	1.4597
0	8	1-3-12-11-14-15-19-17-16-8-6-2	11		12,221.2238	0.0157	1.5732
0	9	1-3-4-5-9-8-6-2	7		4,991.1625	0.0324	3.2418

Note that MNL(0.0001) generates a more uniform distribution of the demand to the alternative routes than the MNL(0.1) (see Step 7).

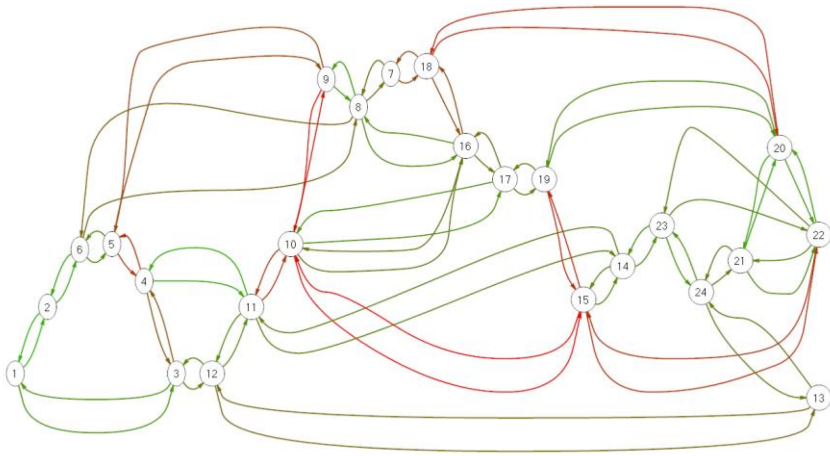
22 out of 47 routes have a choice probability that is greater than 2% in MNL(0.001), while this number is only 2 in MNL(0.1).

Note that as θ_w decreases, variance of the perception error increases.

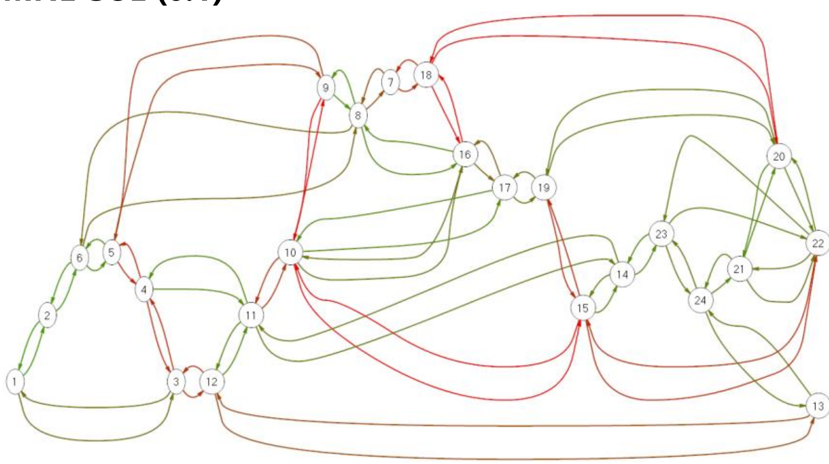
In MNL(0.001), the perception variance very large so that the differences between the SUE costs become less important. This results in a more uniform distribution of demand to the routes.

5. Comparison of the Aggregate Link Flows

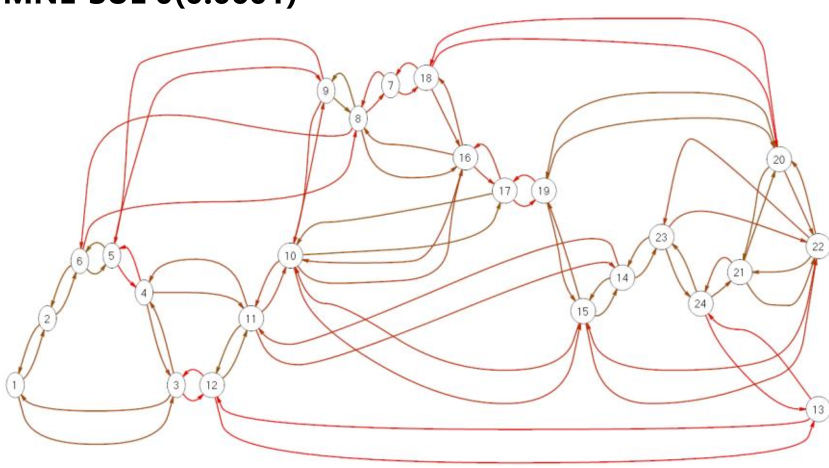
UE



MNL-SUE (0.1)



MNL-SUE 0(0.0001)



The average, minimum and maximum of link flows with three of the assignment models are summarized below:

	UE	MNL(0.1)	MNL(0.0001)
Average	11,567	14,477	30,783
Minimum	4,519	8,219	23,319
Maximum	23,221	25,068	44,987

STEP 11:

Comment on the network link flow diagrams of the 3 models; and on the values in the above table.