**CE 45000: Transport Policy and Planning**

**Due Tuesday, October 1, 2019**

**Problem 1:** Using the data provided in the Tables 1, 2 and 3, estimate trip distribution? (50 points)

**Table 1:** Trips Productions and Attractions of 5 Traffic Analysis Zones

|  |  |  |
| --- | --- | --- |
| TAZ | Productions | Attractions |
| 1 | 234 | 1080 |
| 2 | 76 | 531 |
| 3 | 602 | 76 |
| 4 | 432 | 47 |
| 5 | 472 | 82 |

**Table 2:** Travel Time Matrix

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| TAZ | 1 | 2 | 3 | 4 | 5 |
| 1 | 4 | 12 | 8 | 15 | 21 |
| 2 | 6 | 3 | 9 | 23 | 14 |
| 3 | 20 | 7 | 4 | 10 | 25 |
| 4 | 12 | 18 | 8 | 4 | 17 |
| 5 | 24 | 19 | 23 | 15 | 8 |

**Table 3:** Friction Factors at Different Travel Times

|  |  |
| --- | --- |
| Travel time (min) | Friction Factor |
| 3 | 87 |
| 4 | 45 |
| 7 | 29 |
| 10 | 18 |
| 15 | 10 |
| 20 | 6 |
| 25 | 4 |

**Problem 2:** The utility functions for auto and transit are as follows:

$$Auto:U\_{A}=-0.46-0.35T\_{1}-0.08T\_{2}-0.005C$$

$$Auto:U\_{T}=-0.07-0.35T\_{1}-0.15T\_{2}-0.005C$$

Where, $T\_{1}=Total Travel Time \left(minutes\right), T\_{2}=waiting time \left(minutes\right), C=cost \left(cents\right)$

The travel characteristics between two zones are as follows:

|  |  |  |
| --- | --- | --- |
|  | Auto | Transit |
| T1 | 20 | 30 |
| T2 | 8 | 6 |
| C | 320 | 100 |

Suppose rising fuel prices lead to an increase of certain amount. How much would you increase so that the mode shares will not be affected. (25 points)

**Solution:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  | **With an increase of 100 cents** |
|  | **Auto** | **Transit** |  |  | **Auto** | **Transit** |
| **T1** | 20 | 30 |  | **T1** | 20 | 30 |
| **T2** | 8 | 6 |  | **T2** | 8 | 6 |
| **C** | 320 | 100 |  | **C** | 420 | 200 |
| **U** | -9.7 | -11.55 |  | **U** | -10.2 | -12.05 |
| **P** | 0.86 | 0.14 |  | **P** | 0.86 | 0.14 |

**Problem 3:** Suppose, there are two routes to go to destination 2 from origin 1 (see following figure). One of them is freeway, and the other one is multilane highway. Estimate total system travel time when flows on freeway and multilane highway are 2200 and 2000 pc/h/ln respectively. (25 points)

Freeway, speed limit 70 mph

$$t=t\_{0}\left\{1+0.88\*\left(\frac{x}{2400}\right)^{10}\right\}$$

Distance= 120 miles

Distance= 100 miles

Multiline highway, speed limit 60 mph

$$t=t\_{0}\left\{1+0.83\*\left(\frac{x}{2300}\right)^{6}\right\}$$

2

1

**Solution:**

$$t\_{freeway}=t\_{0}\left\{1+0.88\*\left(\frac{x}{2400}\right)^{10}\right\}$$

$=\left(\frac{120}{70}\*60 min \right)\left\{ 1+0.88\*\left(\frac{2200}{2400}\right)^{10}\right\}=141 min$

$$t\_{multilane}=t\_{0}\left\{1+0.88\*\left(\frac{x}{2400}\right)^{10}\right\}$$

$=\left(\frac{100}{60}\*60 min \right)\left\{ 1+0.83\*\left(\frac{2000}{2300}\right)^{6}\right\}=136 min$

$$TSTT = 141\*2200+136\*2000=581899 min$$