**CE 34500: Transportation Engineering**

**Homework 5**

**Problem 1:** A study area consists of three zones –A, B, C. The trip generation model predicts the following trip productions and attractions: (35 points)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Zone** | **A** | **B** | **C** | **total** |
| **Trip production** | 170 | 400 | 330 | 900 |
| **Trip attraction** | 350 | 325 | 225 | 900 |

Travel time (minutes) between zones is given in the matrix below. For this problem, the F factor is taken as the inverse of the corresponding travel time. Also, for this example all *Kij* values are taken as 1.0.

|  |  |  |  |
| --- | --- | --- | --- |
| **Zone** | **A** | **B** | **C** |
| **A** | 7 | 4 | 5 |
| **B** | 4 | 5 | 8 |
| **C** | 5 | 8 | 3 |

Calculate trip distribution matrix.

**Problem 2:** Using the data provided in the Tables 1, 2 and 3, estimate trip distribution? (35 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 3:** The utility functions for auto and transit are as follows:

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

$$Auto:U\_{T}=-0.07-0.35T\_{1}-0.08T\_{2}-0.005C$$

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? (30 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 |