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?

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:

$$Auto: U_A = -0.46 - 0.35T_1 - 0.08T_2 - 0.005C$$

$$Auto: U_T = -0.07 - 0.05T_1 - 0.15T_2 - 0.005C$$

Where, $T_1 = Total\ Travel\ Time\ (minutes), T_2 = waiting\ time\ (minutes), C = cost\ (cents)$

The travel characteristics between two zones are as follows:

	Auto	Transit
T_1	20	30
T_2	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.

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.