CE434 Traffic Analysis and Design

<table>
<tr><td>2015 Feb 02</td><td>Marks 20</td><td>Time 40 mts</td><td colspan="2">Quiz 1</td><td colspan="9">Code A</td></tr>
<tr><td>Name</td><td colspan="2"></td><td>Roll No</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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Instructions: Write the final answer in the space provided. Use the backside for calculation and steps which should be shown for getting the marks. Do not use mobile, laptops, etc. and exchange of calculators, note books etc. are not permitted.

1. Write the two assumptions (premises) of Transportation-Activity-Flow system. (Marks: 2)

   [i] The total transportation system must be viewed as a single multi-modal system.

   [ii] Considerations of transportation system cannot be separated from considerations of social, economic, and political system of the region.

2. Consider a highway connecting city 1 and 2. The minimum travel time is 15 units and it increases by 0.1 units for every unit increase of the volume. The maximum demand for travel is 5000 trips and demand it decreases by 100 units for every unit increase in travel time. What will be the current flow and the travel time on the road? (Marks: 4)

   Steps:

   Eqn 1: t=15+0.1V
   Eqn 2: V=5000-0.1t

   Ans:Flow: ………318.2……….. Travel time: ……46.2…………..

3. If the observed headways at a given section of road are 1.7, 2.3, 1.5, 1.9, 2.9 and 3.2 and if we assume the inter arrival time of vehicles follow an exponential distribution, then find the probability of headway between 1.2 and 2.4 seconds. (Marks: 4)

   Steps:

   Mean headway = 2.25 and hence $\lambda = 1 / 2.25 = 0.444$

   Probability of headway between 1.2 and 2.4 sec = $e^{-1.2\times 0.444} - e^{-2.4\times 0.444}$

   Ans: ………0.242………..

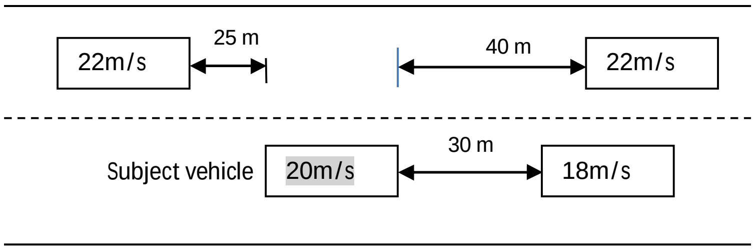
4. Using GM's car following model, assuming sensitivity coefficient, spacing exponent, speed exponent, reaction time, and update interval as 15, 1, 0.8, 1 and 0.5 respectively, find the accelerations at t = 2.5, 3.0 and 3.5. (Marks: 5)

t	L- a(t)	L-v(t)	L-x(t)	F-a(t)	F-v(t)	F-x(t)	dv	dx
1.0	0.0	16.0	44.0	0.000	16.000	16.000	0.000	28.000
1.5	-1.0	16.0	52.0	0.000	16.000	24.000	0.000	28.000
2.0	-1.0	15.5	59.9	0.000	16.000	32.000	-0.500	27.880
2.5	1.0	15.0	67.5	0.00	16.00	40.00	-1.00	27.50
3.0	1.0	15.5	75.1	-2.47	16.00	48.00	-0.50	27.13
3.5	0.0	16.0	83.0	-5.01	14.76	55.69	1.24	27.31

Steps:

5. For the given state of traffic in a midblock section of a two lane highway, predict which lane the subject vehicle will select in the next time interval. The sensitivity coefficient $\propto$ can be taken as 25, the speed exponent m can be taken as 1 and the distance exponent l can be taken as 2.

(Marks: 5)



Steps

$$a_{subject\ vehicle} = \frac{\propto v^m \Delta v}{\Delta x^l} = \frac{25\times 20^1\times(18-20)}{30^2} = -1.11\ \text{m/s}^2$$

$$U_{left\ lane}:\ a_{left\ lane} = \frac{\propto v^m \Delta v}{\Delta x^l} = \frac{25\times 20^1\times(22-20)}{40^2} = 0.625\ \text{m/s}^2$$

$$P(choosing\ left\ lane) = \frac{e^{0.625}}{e^{-1.11}+e^{0.625}} = 0.85$$

Ans: The vehicle will change to the left lane with a probability of 0.85 (and continue in the same lane with a probability 0.15).