(10)

B.Sc. Engg. (CEE)/ 8th Sem.   11 March, 2024 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Semester Examination   Summer Semester: 2022-2023
Course No.: CEE 4855   Full Marks: 75
Course Title: Transportation Projects and Operation   Time: 1.5 hours

There are **3 (Three)** Questions. Answer **All** questions. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning. Assume values as necessary.

1(a) The trip generation model for a study area is given as below: (15)
       $$Y_i = \beta_0 + \beta_1(HHSize_i) + \beta_2(NumCars_i) + \beta_3(Income_i) + \varepsilon_i \qquad \varepsilon_i \sim N(0, \sigma^2)$$ CO1
       Rewrite the equation to fit as: dummy variable, dummy increment and spline formulation by   PO3
       converting the variable 'NumCars'.
       For all these new formulations, write down the null and alternative hypothesis for various
       transformations of 'NumCars' variable.

(b)   The following diagram illustrates the trips made by three people. Person 1 makes trips 1, 2, 3 and   (15)
       4; Person 2 makes trips 5, 6 and 7 whereas Person 3 is responsible for trips 8, 9 and 6. Represent   CO1
       the trips in OD and PA format in a table.   PO3
       [Hint: *The order of zones for each person represents the temporal distribution of the trips.*]

2(a) Consider the variables trips per household (Y), number of workers (X_1) and number of cars (X_2).   (5)
       Table below presents the results of successive steps of a stepwise model estimation; the last row   CO1
       also shows (in parenthesis) values for the t-ratio (equation 4.9). Assuming large sample size, the   PO3
       appropriate number of degrees of freedom (n − 2) is also a large number so the t-values may be
       compared with the critical value 1.645 for a 95% significance level on a one-tailed test (we know
       the null hypothesis is unilateral in this case i.e. Y should increase with both X_1 and X_2). Comment
       on the models.
       [Hint: *Are the models statistically significant? Which models can explain the trip generation the
       most? Are the values of intercepts logical? etc.*]

Page 1 of 3

Step	Equation	R^2
1	$Y = 2.36 \ X_1$ (8.2)	0.203
2	$Y = 1.80X_1 + 1.31X_2$ (8.2) (4.2)	0.325
3	$Y = 0.91 + 1.44X_1 + 1.07X_2$ (3.7) (8.2) (4.2)	0.384

(b) The mean trip rate, its variance and the number of observations for two household categories, obtained in a study undertaken 10 years ago and then again recently as shown below: (5) CO1 PO3

Old data	Household Category	
Variable (prior data)	1	2
Trip per day	8	5
No. of observations	65	300
Trip rate variance	65	15
Mean trip variance	0.98	0.05

New data	Household Category	
Variable (prior data)	1	2
Trip per day	12	6
No. of observations	30	30
Trip rate variance	144	36
Mean trip variance	4.8	1.2

Update your belief on mean trip rate and trip rate variance.
Necessary equations:

$$t_2 = \frac{n_1 S_{t_1}^2 t_1 + n_s S_t^2 t_s}{n_1 S_t^2 + n_s S_t^2}$$

$$\sigma_t^2 = \frac{S_t^2 \ S_t^2}{n_1 S_t^2 + n_s S_t^2}$$

3(a) Imagine a study consisting of three zones. Each zone in the base year generates 75, 85 and 120 and attracts 80, 100 and 100 trips. In the horizon year, they generate 95, 90 and 145 trips and attracts 110, 80 and 140 trips. The cost function is: (25) CO1 PO3

$$f(c_{ij}) = 1/c_{ij}^3$$

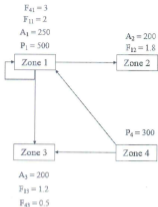and the associated costs to travel between the O-D pairs are:

1.0	1.2	1.4
1.2	1.0	1.7
1.4	1.7	1.0

Generate the horizon year trip matrix. Assume any values as needed. Show two complete iterations.

(b)   Produce PA matrix from the following data.

$F_{41} = 3$
$F_{11} = 2$
$A_1 = 250$
$P_1 = 500$

Zone 1

$A_2 = 200$
$F_{12} = 1.8$

Zone 2

$P_4 = 300$

Zone 3

Zone 4

$A_3 = 200$
$F_{33} = 1.2$
$F_{43} = 0.5$

Note that the area may consist of more than 4 zones, i.e., the summation of production and attraction need not match.

(10)
CO1
PO3