Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

COURSE NAME	:	TRANSPORTATION SYSTEM AND PLANNING
COURSE CODE	:	CNR 10103
PROGRAMME CODE	:	CNR
EXAMINATION DATE	:	JANUARY / FEBRUARY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS. 2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **OPEN BOOK**.

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 **(a)** Study of zone areas in Johor is represented by **SIX (6)** traffic zones. The zones characteristics are shown in **Table Q1(a)**. Develop a linear regression equation (y) and calculate correlation , r (r^2) that represent the zone characteristics.

(i) Develope a linear regression equation (y) represent the zone characteristics

(3 marks)

(ii) Write correlation r (r^2) of the equation

(2 marks)

(b) The State Government of Johor is planning to construct several public transport facilities. **Table Q1(b)(i)** shows each model of trip generation AM and PM peak of each facility. **Table Q1(b)(ii)** shows the number of units based on survey data in the year 2018. It is known that the unit growth rate of each facility is 15% per year.

(i) Formulate total trips T, trips pcu/veh., "In" and "Out" of each facility of AM peak in 2021.

(10 marks)

(ii) Formulate total trips T, trips pcu/veh., "In" and "Out" of each facility of PM peak in 2021.

(10 marks)

Q2 A four-zone of Pagoh district has characteristics as in **Table Q2(a)**. The district zone are shown in **Figure Q2**. The zone model is identified as Multiple Nuclei Model. The travel times (in minutes) between zones are in **Table Q2(b)**. An exponent of 2.5 can be used based on study and investigation with similar size of other cities. The Pagoh district is likely to grow by 15% overall within 15 years.

(a) Explain briefly the theory of Multiple Nuclei Model

(2 marks)

(b) Sketch the common design of zone model by Multiple Nuclei

(3 marks)

(c) Formulate and find accessibility index of each zone, A_i

(8 marks)

(d) Determine the development potential of each zone, D_i

(6 marks)

(e) Determine the population allocated to each zone, G_i

(6 marks)

Q3 The Four (4) – stages travel demand forecasting is the fundamental concept of transportation demand – supply planning. It allows the engineer to predict the volume of traffic in the future, whether that element is an existing highway or a potential light-rail route. The district has been divided into three (3) traffic zones. An origin-destination survey was conducted and yielded the number of trips between each zone as shown in the **Table Q3(a)**. Travel times between zones were also determined as in **Table 3(b)**. Socioeconomic adjustment factor of $K_{ij} = 1.2$ and travel time factors are defined as in **Table Q3(c)**.

(a) Explain briefly **FOUR (4)** – stages travel demand forecasting process by giving an example for each stage with the sketch.

(4 marks)

(b) Apply Gravity Model to find the number of trip distributions between zone i and j, T_{ij} for 1-iteration only.

(16 marks)

(c) Interpret and write the results of Computed Attractions, Given Attractions and Productions by using a table and briefly comments on the results.

(5 marks)

Q4 Public transit company has predicted a demand function connecting patronage (Q) and price per ride (P) within certain limits as

$$Q = 2125 - 1000\,P$$

where Q is person-trips/day and P is the price (RM/ride). The company has the following options to increase the total revenue:

- **Option a**: attracting additional riders by rescheduling and rerouting the service and thus changing the demand function to

$$Q = 2150 - 1000\,P$$

- **Option b**: Encouraging more riders onto the system by reducing the fare from RM 1.30 to RM 1.00.

(a) Apply the demand function to find additional revenue due to option a.

(7 marks)

(b) Formulate the reducing fare to find additional revenue due to option b.

(10 marks)

(c) Briefly comment on which option is better and sketch the demand function graph of initial condition and option a.

(8 marks)

– END OF QUESTIONS –

Table Q1(a): Zones characteristics

Zone	1	2	3	4	5	6
Trip Production (*y*)	700	550	950	750	850	390
Car Ownership (*x*)	350	300	700	715	280	230

Table Q1(b)(i): Trip Generation Model

	Land use	Peak	Figures	Var.	In (%)	Out (%)	pcu/veh
		AM	$T = 0.75x + 22.6$	Units	29	71	0.90
		PM	$T = 0.53x + 80.1$	Units	61	39	0.87
		AM	$T = 8.06x + 11.9$	Units	59	41	0.90
		PM	$T = 10.68x + 34.7$	Units	52	48	0.87
		AM	$T = 1.89x - 20.9$	Units	42	58	0.88
		PM	$T = 0.53x - 23.1$	Units	56	44	0.91
		AM	$T = 0.26x$	Students	70	30	0.92
		PM	$T = 0.23x$	Students	46	54	0.91
		AM	$T = 0.19x$	Students	73	27	0.95
		PM	$T = 0.17x$	Students	41	59	0.96

Table Q1(b)(ii): Number of units (x) of each facilities

Year 2017			
	Land use	**Var.**	**Unit (x)**
1	Terrace house	Units	155
2	Semi Detached house	Units	55
3	Bungalow house	Units	30
4	Shop house	Units	35
5	Primary School	Students	1600
6	Secondary School	Students	750

Table Q2(a): Zone population

Zone	Total Existing Population	Holding Capacity (acres)
1	3000	300
2	2500	280
3	9000	500
4	4500	350

Table Q2(b): Travel times between zones (minutes)

From i	To j	1	2	3	4
1		5	10	12	15
2		10	4	9	20
3		12	9	3	14
4		15	20	14	6

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Table Q3(a): Existing trips of Productions - Attractions

Zone	1	2	3	Total
Productions	250	450	400	1100
Attractions	395	280	425	1100

Table Q3(b): Travel times between zones

Zone	1	2	3
1	6	4	2
2	2	8	3
3	1	3	5

Table Q3(c): Adjustment factors based on travel times

Time (min)	1	2	3	4	5	6	7	8
Friction factor	82	52	50	41	39	26	20	13

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Figure Q2: Pagoh district zones