UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	TRANSPORTATION ENGINEERING
COURSE CODE	:	BFT 4033 / BFT 40303
PROGRAMME	:	4 BFF
EXAMINATION DATE	:	DECEMBER 2012/JANUARY 2013
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **FOUR (4)** QUESTIONS ONLY 2. ATTACH **APPENDIX I** WITH YOUR ANSWER BOOKLET

THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

Q1 (a) Referring to Figure **Q1**, answer the following:

(i) Name the diagram of that figure and draw the maximum space mean speed on the diagram.

(2 marks)

(ii) Explain the situation occurs at A, B, C and D.

(4 marks)

(iii) Illustrate the diagrams that show the relationships between speed - density and speed - flow.

(4 marks)

(b) After a survey was done at 20 zones of residential areas, an analyst in transportation planning came up with the following regression equations. Discuss the relationship between the dependent variable and the independent variables of all equations below.

$$Y = 50.5 + 0.80X_1 \; ; R^2 = 0.95$$
$$Y = 308 + 0.79X_2 \; ; R^2 = 0.88$$
$$Y = 52.7 + 0.85X_2 + 1.75X_3 \; ; R^2 = 0.98$$
$$Y = -105 + 1.38X_2 - 0.4X_3 + 0.1X_4 \; ; R^2 = 0.97$$

Where, Y = trips produces
X_1 = total population
X_2 = less income population
X_3 = high income population
X_4 = school children

(15 marks)

Q2 (a) Consider a residential area and two shopping centres as the possible destinations, from 7:00 to 8:00 P.M. on friday night, 900 vehicle-based shopping trips leave the residential area for the two shopping centres. A joint shopping-trip mode-destination choice logit model (choice of either auto or bus) is estimated, giving the following coefficients:

Variable	Auto coefficient	Bus coefficient
Auto constant	0.6	0.0
Travel time (minutes)	-0.3	-0.3
Commercial floor space (in thousands of m^2)	0.12	0.12

Initial travel times to shopping centres 1 and 2 in minutes are as follow:

	By auto	By bus
Travel times to shopping centre 1	8	14
Travel times to shopping centre 2	15	22

If the shopping centre 2 has 40,000 m^2 of commercial floor space and shopping centre 1 has 25,000 m^2, analyze the distribution of friday night shopping trips by destination and mode.

(12 marks)

(b) Based on Figure **Q2** and Table **Q2**,

(i) Construct the minimum path tree.

(4 marks)

(ii) Analyze the aggregate of volumes.

(9 marks)

Q3 (a) One segment of a Class I two-lane highway is on rolling terrain and has an hourly volume of 500 veh/h with peak hour factor (PHF) of 0.94, and the traffic stream contains 5% large trucks, 2% buses, and 6% recreational vehicles. For these conditions, determine the analysis flow rate for Average Travel Speed (ATS) and Percent Time-Spent-Following (PTSF).

(17 marks)

(b) Explain why capacity is the heart of transportation issues.

(8 marks)

Q4 (a) Traffic Impact Assessment (TIA) is an important tool used to determine the traffic impact of a development and involves many parties.

(i) Name the main parties involved in the TIA process.

(3 marks)

(ii) Discuss the role of each party.

(8 marks)

(b) List the steps required in a TIA.

(8 marks)

(c) The final TIA report shall contain details of items such as Executive Summary and Introduction. Beside than these items, describe **THREE (3)** others.

(6 marks)

Q5 (a) Transportation facilities are classified into two categories of flow which are uninterrupted and interrupted. Define and give **TWO (2)** examples for both facilities.

(4 marks)

(b) Relationship between speed and density obtained from actual data is as follows:

$$v = 27.7 \ln (142/k)$$

Analyze:

(i) Jam density, k_j

(3 marks)

(ii) Speed and density at capacity

(4 marks)

(iii) Capacity or maximum flow, q_{max}.

(2 marks)

(c) Explain shockwave event by using the funnel effect analogy.

(6 marks)

(d) Briefly explain the technical difference of terms Origins and Destinations (OD) and Productions and Attractions (PA).

(2 marks)

(e) Discuss **TWO (2)** ways of how heavy vehicles affect traffic flow.

(4 marks)

- END OF QUESTION -

S1 (a) Merujuk kepada Rajah **Q1**, jawab soalan-soalan berikut:

(i) Namakan rajah tersebut dan lukiskan laju purata ruang maksimum pada rajah tersebut.

(2 markah)

(ii) Terangkan situasi yang berlaku pada A, B, C dan D.

(4 markah)

(iii) Lukiskan rajah yang menunjukkan hubungan laju – ketumpatan dan laju – aliran bagi sesebuah aliran trafik.

(4 markah)

(b) Selepas sebuah tinjauan dilakukan di 20 buah kawasan penempatan, seorang penganalisa di dalam bidang perancangan pengangkutan telah menghasilkan persamaan regresi yang berkaitan. Bincangkan hubung kait di antara pembolehubah bersandar dengan pembolehubah tidak bersandar pada persamaan-persamaan yang berikut.

$$Y = 50.5 + 0.80X_1 \; ; \; R^2 = 0.95$$
$$Y = 308 + 0.79X_2 \; ; \; R^2 = 0.88$$
$$Y = 52.7 + 0.85X_2 + 1.75X_3 \; ; \; R^2 = 0.98$$
$$Y = -105 + 1.38X_2 - 0.4X_3 + 0.1X_4 \; ; \; R^2 = 0.97$$

Di mana,

Y = bilangan perjalanan terhasil
X_1 = jumlah populasi
X_2 = populasi berpendapatan rendah
X_3 = populasi berpendapatan tinggi
X_4 = kanak-kanak sekolah

(15 markah)

S2 (a) Dengan mengambilkira satu kawasan perumahan dengan dua pusat membeli-belah sebagai destinasi, dari jam 7:00 hingga 8:00 malam pada malam jumaat, 900 perjalanan membeli-belah berasaskan kenderaan telah meninggalkan kawasan perumahan untuk pergi ke destinasi masing-masing. Satu model logit bersama untuk pemilihan destinasi-mod perjalanan-membeli-belah telah dianggarkan dan memberikan pekali-pekali berikut:

Pembolehubah	Pekali Kereta	Pekali Bas
Pemalar Kereta	0.6	0.0
Masa Perjalanan (minit)	-0.3	-0.3
Ruang lantai komersil (dalam seribu m^2)	0.12	0.12

Masa perjalanan permulaan untuk pusat membeli-belah 1 dan 2 (dalam minit) adalah seperti berikut:

	Menggunakan Kereta	Menggunakan Bas
Masa perjalanan ke pusat membeli-belah 1	8	14
Masa perjalanan ke pusat membeli-belah 2	15	22

Sekiranya Pusat Membeli-belah 2 mempunyai keluasan ruang lantai komersil 40,000 m^2 dan Pusat Membeli-belah 1 mempunyai keluasan 25,000 m^2, analisiskan agihan perjalanan membeli-belah pada malam Sabtu tersebut mengikut destinasi dan mod.

(12 markah)

(b) Berdasarkan Rajah **Q2** dan Jadual **Q2**,

(i) Bina pokok laluan minimum.

(4 markah)

(ii) Analisiskan agregat isipadu.

(9 markah)

S3 (a) Satu segmen lebuh raya dua-lorong Kelas I berada di atas mukabumi beralun mempunyai isipadu jaman 500 kend/j dengan faktor jam puncak (PHF) ialah 0.94, dan aliran trafik terdiri daripada 5% lori besar, 2% bas, serta 6% kenderaan rekreasi. Berdasarkan keadaan-keadaan ini, tentukan kadar alir analisis untuk laju perjalanan purata (ATS) dan peratus masa mengekori (PTSF).

(17 markah)

(b) Terangkan mengapa kapasiti dikatakan sebagai nadi kepada isu-isu pengangkutan.

(8 markah)

S4 (a) Penilaian Impak Lalu Lintas (TIA) ialah satu kaedah penting untuk menentukan impak lalu lintas suatu pembangunan serta melibatkan pelbagai pihak.

(i) Namakan pihak utama yang terlibat di dalam proses TIA.

(3 markah)

(ii) Bincangkan peranan yang dimainkan setiap pihak tersebut.

(8 markah)

(b) Senaraikan langkah-langkah yang diperlukan di dalam suatu TIA.

(8 markah)

(c) Laporan akhir TIA mengandungi perincian beberapa perkara seperti Ringkasan Eksekutif dan Pendahuluan. Selain perkara-perkara ini, terangkan **TIGA (3)** perkara lain.

(6 markah)

S5 (a) Fasiliti pengangkutan dikelaskan kepada dua kategori aliran iaitu tidak terganggu dan terganggu. Berikan definisi beserta **DUA (2)** contoh untuk kedua-dua kategori ini.

(4 markah)

(b) Hubungan antara laju dan ketumpatan yang diperolehi berdasarkan data sebenar adalah seperti berikut:

$$v = 27.7 \ln (142/k)$$

Kirakan,

(i) Ketumpatan sesak, k_j

(3 markah)

(ii) Laju dan ketumpatan pada kadar alir maksimum

(4 markah)

(iii) Muatan atau kadar alir maksimum, q_{max}.

(2 markah)

(c) Terangkan kejadian gelombang kejutan menggunakan analogi kesan corong.

(6 markah)

(d) Terangkan secara ringkas perbezaan teknikal di antara terma Asalan dan Destinasi (OD) dengan Penghasilan dan Tarikan (PA).

(2 markah)

(e) Bincangkan **DUA (2)** cara bagaimana kenderaan berat memberi kesan kepada aliran trafik.

(4 markah)

- SOALAN TAMAT -

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APPENDIX I

Matric Card No. : ___ ___ ___ ___ ___ ___ ___ ___

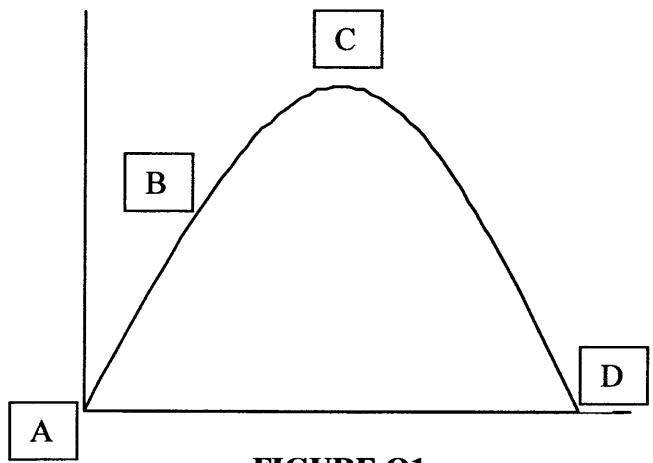

FIGURE Q1

A : _____

B : _____

C : _____

D : _____

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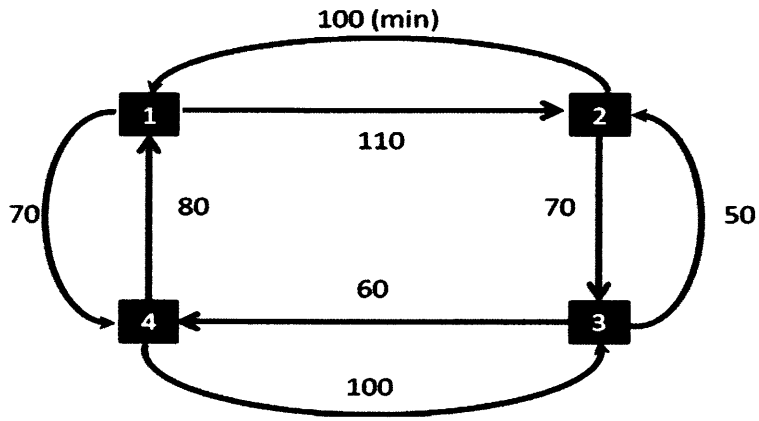

FIGURE Q2

TABLE **Q2**: Volume (veh/hr)

		To Node			
		1	2	3	4
From Node	1	0	500	750	350
	2	275	0	1050	475
	3	650	1870	0	950
	4	1250	350	2050	0

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TABLE 1: Grade Adjustment Factor (f_G) to Determine Average Travel Speed (ATS) on Two-Way and Directional Segments

Range of Two-Way Flow Rates (pc/h)	Range of Directional Flow Rates (pc/h)	Type of Terrain	
		Level	Rolling
0–600	0–300	1.00	0.71
> 600–1200	> 300–600	1.00	0.93
> 1200	> 600	1.00	0.99

TABLE 2: Grade Adjustment Factor (f_G) to Determine Percent Time-Spent-Following (PTSF) on Two-Way and Directional Segments

Range of Two-Way Flow Rates (pc/h)	Range of Directional Flow Rates (pc/h)	Type of Terrain	
		Level	Rolling
0–600	0–300	1.00	0.77
> 600–1200	> 300–600	1.00	0.94
> 1200	> 600	1.00	1.00

TABLE 3: Passenger-Car Equivalents for Trucks and RVs to Determine Average Travel Speed (ATS) on Two-Way and Directional Segments

Vehicle Type	Range of Two-Way Flow Rates (pc/h)	Range of Directional Flow Rates (pc/h)	Type of Terrain	
			Level	Rolling
Trucks, E_T	0–600	0–300	1.7	2.5
	> 600–1,200	> 300–600	1.2	1.9
	> 1,200	> 600	1.1	1.5
RVs, E_R	0–600	0–300	1.0	1.1
	> 600–1,200	> 300–600	1.0	1.1
	> 1,200	> 600	1.0	1.1

TABLE 4: Passenger-Car Equivalents for Trucks and RVs to Determine Percent Time-Spent-Following (PTSF) on Two-Way and Directional Segments

Vehicle Type	Range of Two-Way Flow Rates (pc/h)	Range of Directional Flow Rates (pc/h)	Type of Terrain	
			Level	Rolling
Trucks, E_T	0–600	0–300	1.1	1.8
	> 600–1,200	> 300–600	1.1	1.5
	> 1,200	> 600	1.0	1.0
RVs, E_R	0–600	0–300	1.0	1.0
	> 600–1,200	> 300–600	1.0	1.0
	> 1,200	> 600	1.0	1.0

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FORMULA

$$Probability\ of\ using\ mode\ i = \frac{e^{utility\ of\ mode\ i}}{\sum_{n=1}^{all\ modes} e^{utility\ of\ mode\ n}}$$

$$f_{HV} = \frac{1}{1 + P_T(E_T - 1) + P_R(E_R - 1)}$$

$$v_p = \frac{V}{PHF * f_G * f_{HV}}$$

$$e^{\ln x} = x$$

$$e^0 = 1$$