Index No: ____________

UNIVERSITI SAINS MALAYSIA

Final Examination
Academic Session 2007/2008

April 2008

JKE 316E – Quantitative Economics
[Ekonomi Kuantitatif]

Duration : 3 hours
[Masa : 3 jam]

INSTRUCTIONS TO CANDIDATES

- The paper consists of **EIGHTEEN** pages, Appendix A (formula) and Appendix B (Table Z, t and F).
- Answer ALL questions. You may answer **either** in Bahasa Malaysia or in English.
- Write your answer in the space provided only.

ARAHAN

*Sila pastikan bahawa kertas peperiksaan ini mengandungi **LAPAN BELAS** muka surat yang bercetak, Lampiran A (Formula) dan Lampiran B (Jadual Z, t dan F), sebelum anda memulakan peperiksaan.*

*Jawab SEMUA soalan. Anda dibenarkan menjawab soalan **sama ada** dalam Bahasa Malaysia atau Bahasa Inggeris.*

Tulis jawapan anda di ruangan yang disediakan.

Angka Giliran: ______________________________

Pusat Peperiksaan: __________________________

Tarikh Peperiksaan: _________________________

1. Write short notes on:
(Tulis nota ringkas tentang:)

(3 marks)
(3 markah)

(a) Type I error
(Ralat I)

(3 marks)
(3 markah)

(b) Type II error
(Ralat II)

(8 marks)
(8 markah)

(c) Stratified random sampling
(Persampelan rawak strata)

(d) Measures of variability
(Pengukuran serakan)

(8 marks)
(8 markah)

(e) Measures of central location
(Pengukuran kecenderungan tengah)

(8 marks)
(8 markah)

2. (a) Describe the process of hypotheses testing by using:
(Huraikan proses ujian hipotesis dengan menggunakan:)

(i) P – value (5 marks)
(Nilai P) *(5 markah)*

(ii) Critical value (5 marks)
(Nilai genting) *(5 markah)*

(b) A battery manufacturer advertises that, on average, the battery can be used for more than 5,000 hours. To test the claim, a consumer group took a random sample of 100 batteries and found that the average usability of the battery is 5,065 hours. Given the standard deviation is 400 hours, determine whether the claim can be substantiated. Use 5% significant level.

(15 marks)

(Sebuah kilang bateri telah membuat iklan yang menunjukkan kadar purata bateri yang dikeluarkannya boleh digunakan lebih daripada 5,000 jam. Untuk menguji dakwaan ini, sebuah persatuan pengguna telah mengambil satu sampel rawak 100 bateri dan mendapati kadar purata penggunaannya ialah 5,065 jam. Dengan sisihan piawai 400 jam, tentukan yang dakwaan pengilang bateri itu dapat disokong. Gunakan paras keertian 5%.)

(15 markah)

3. (a) Complete the following ANOVA table by writing the correct figures in the shaded cells only. (7 marks)

(Lengkapkan jadual ANOVA di bawah dengan menulis angka yang betul di petak yang dikelabukan) *(7 markah)*

Source	df	Sum of Squares	Mean Squares	F
Treatments			50	
Blocks	6	50		
Error	12			
Total	20	175		

(b) The size sample (n) for the study was __________. (1 marks)
(Saiz sampel (n) kajian ialah ________.) *(1 markah)*

(c) Test to determine whether the treatment means differ. (Use $\alpha = .05$) (4 marks)

(Uji sama ada min olahan adalah berbeza. (Guna $\alpha = .05$)) *(4 markah)*

(d) Test to determine whether the block means differ. (Use $\alpha = .05$)

(4 marks)

(Uji sama ada min blok adalah berbeza. (Guna $\alpha = .05$))

(4 markah)

(e) Explain when ANOVA is applicable. (4 marks)

(Jelaskan bila ANOVA sesuai digunakan.) *(4 markah)*

4. The estimated relationship between the quantity demanded for nasi lemak and selected independent variables is shown by this equation:
(Persamaan di bawah menunjukkan hubungan antara kuantiti nasi lemak yang diminta dengan pemboleh ubah bebas terpilih.)

$$Y = 40.2 - 0.15X_1 + 0.03X_2 - 0.06X_3 + 3.51X_4$$

Standard error in parenthesis *(Ralat piawai dalam kurungan)*	(11.9)	(0.07)	(3.6)	(0.05)	(1.5)

$R^2 = 0.87$ F= 38.49 n= 30

Y = Pack of nasi lemak (quantity sold or demanded)
(Bungkusan nasi lemak (kuantiti yang dijual atau diminta))

X_1 = Average price of a pack of nasi lemak (in RM)
(Harga purata sebungkus nasi lemak (RM))

X_2 = Average annual income (in thousands of RM)
(Pendapatan purata tahunan (ribu RM))

X_3 = Average price of a cup of teh tarik (in RM)
(Harga purata secawan teh tarik (RM))

X_4 = Location of warung (1 in the city and 0 outside city area)
(Lokasi warung (1 dalam bandar dan 0 di luar kawasan bandar))

(a) Compute the quantity demanded for nasi lemak when you are given the following values:
(Hitung jumlah kuantiti nasi lemak yang diminta jika anda diberi nilai berikut:)

X_1 = RM 2.00 per pack *(sebungkus)*
X_2 = RM 15,000 a year *(setahun)*
X_3 = RM 0.80 per cup *(secawan)*
X_4 = City area *(dalam bandar)*

(3 marks)
(3 markah)

(b) Provide interpretation to the $R^2 = 0.87$
(Beri tafsiran $R^2 = 0.87$)

(3 marks)
(3 markah)

(c) Conduct the F test and comment on it.
(Lakukan ujian F dan beri komen anda.)

(3 marks)
(3 markah)

(d) Test whether there is enough evidence to infer the existence of linear relationship between quantity of nasi lemak sold and: (Use 0.05 level of significance and two tail test)
(Uji sama ada terdapat bukti menunjukkan wujudnya hubungan linear antara kuantiti nasi lemak yang dijual dengan: (Guna paras keertian 0.05 dan ujian dua sisi))

(i) price of nasi lemak
(harga nasi lemak)

(2 marks)
(2 markah)

(ii) annual income
(pendapatan tahunan)

(2 marks)
(2 markah)

...11/-

(iii) price of a cup of teh tarik
(harga secawan the tarik)

(2 marks)
(2 markah)

(iv) location of warung
(lokasi warung)

(2 marks)
(2 markah)

(e) (i) What is multicollinearity?
(Apakah multikolineariti?)

(3 marks)
(3 markah)

(ii) What are the ways to overcome multicollinearity? (5 marks)
(Apakah cara untuk mengatasi multikolineariti?) *(5 markah)*

APPENDIX A

FORMULAS

Test statistic for μ.

Test statistic $Z = \dfrac{\overline{X} - \mu}{\sigma/\sqrt{n}}$

Test statistic $t = \dfrac{\overline{X} - \mu}{S/\sqrt{n}}$

Sample slope

$$b_1 = \frac{s_{xy}}{s_x^2}$$

Sample y-intercept

$$b_0 = \bar{y} - b_1\bar{x}$$

Sum of squares for error

$$SSE = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

Standard error of estimate

$$s_\varepsilon = \sqrt{\frac{SSE}{n-2}}$$

Test statistic for the slope

$$t = \frac{b_1 - \beta_1}{s_{b_1}}$$

Standard error of b_1

$$s_{b_1} = \frac{s_\varepsilon}{\sqrt{(n-1)s_x^2}}$$

Coefficient of determination

$$R^2 = \frac{s_{xy}^2}{s_x^2 s_y^2} = 1 - \frac{SSE}{\sum (y_i - \bar{y})^2}$$

Prediction interval

$$\hat{y} \pm t_{\alpha/2, n-2} s_\varepsilon \sqrt{1 + \frac{1}{n} + \frac{(x_g - \bar{x})^2}{(n-1)s_x^2}}$$

Confidence interval estimator of the expected value of y

$$\hat{y} \pm t_{\alpha/2, n-2} s_\varepsilon \sqrt{\frac{1}{n} + \frac{(x_g - \bar{x})^2}{(n-1)s_x^2}}$$

Sample coefficient of correlation

$$r = \frac{s_{xy}}{s_x s_y}$$

Test statistic for testing $\rho = 0$

$$t = r\sqrt{\frac{n-2}{1-r^2}}$$

Least Squares Line Coefficients

$$b_1 = \frac{s_{xy}}{s_x^2}$$

$$b_0 = \bar{y} - b_1\bar{x}$$

where

$$s_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{n - 1}$$

$$s_x^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n - 1}$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$\bar{y} = \frac{\sum_{i=1}^{n} y_i}{n}$$

FORMULAS

One-way analysis of variance

$$SST = \sum_{j=1}^{k} n_j(\bar{x}_j - \bar{\bar{x}})^2$$

$$SSE = \sum_{j=1}^{k} \sum_{i=1}^{n_j} (x_{ij} - \bar{x}_j)^2$$

$$MST = \frac{SST}{k-1}$$

$$MSE = \frac{SSE}{n-k}$$

$$F = \frac{MST}{MSE}$$

Two-way analysis of variance (randomized block design of experiment)

$$SS(Total) = \sum_{j=1}^{k} \sum_{i=1}^{b} (x_{ij} - \bar{\bar{x}})^2$$

$$SST = \sum_{i=1}^{k} b(\bar{x}[T]_j - \bar{\bar{x}})^2$$

$$SSB = \sum_{i=1}^{b} k(\bar{x}[B]_i - \bar{\bar{x}})^2$$

$$SSE = \sum_{j=1}^{k} \sum_{i=1}^{b} (x_{ij} - \bar{x}[T]_j - \bar{x}[B]_i + \bar{\bar{x}})^2$$

$$MST = \frac{SST}{k-1}$$

$$MSB = \frac{SSB}{b-1}$$

$$MSE = \frac{SSE}{n-k-b+1}$$

$$F = \frac{MST}{MSE}$$

$$F = \frac{MSB}{MSE}$$

Two-factor experiment

$$SS(Total) = \sum_{i=1}^{a} \sum_{j=1}^{b} \sum_{k=1}^{r} (x_{ijk} - \bar{\bar{x}})^2$$

$$SS(A) = rb \sum_{i=1}^{a} (\bar{x}[A]_i - \bar{\bar{x}})^2$$

$$SS(B) = ra \sum_{j=1}^{b} (\bar{x}[B]_j - \bar{\bar{x}})^2$$

$$SS(AB) = r \sum_{i=1}^{a} \sum_{j=1}^{b} (\bar{x}[AB]_{ij} - \bar{x}[A]_i - \bar{x}[B]_j + \bar{\bar{x}})^2$$

$$SSE = \sum_{i=1}^{a} \sum_{j=1}^{b} \sum_{k=1}^{r} (x_{ijk} - \bar{x}[AB]_{ij})^2$$

$$MS(A) = \frac{SS(A)}{a-1}$$

$$MS(B) = \frac{SS(B)}{b-1}$$

$$MS(AB) = \frac{SS(AB)}{(a-1)(b-1)}$$

$$F = \frac{MS(A)}{MSE}$$

$$F = \frac{MS(B)}{MSE}$$

$$F = \frac{MS(AB)}{MSE}$$

Least significant difference comparison method

$$LSD = t_{\alpha/2}\sqrt{MSE\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}$$

Tukey's multiple comparison method

$$\omega = q_\alpha(k, \nu)\sqrt{\frac{MSE}{n_g}}$$

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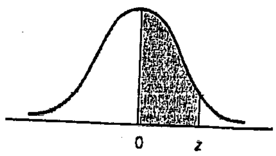
APPENDIX B

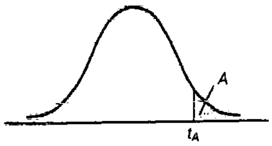
Table 3 Normal Probabilities



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

SOURCE: Abridged from Table 1 of A. Hald, *Statistical Tables and Formulas* (New York: Wiley & Sons, Inc.), 1952. Reproduced by permission of A. Hald and the publisher, John Wiley & Sons, Inc.

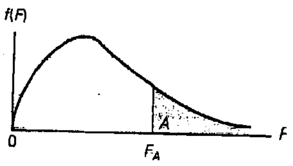
Table 4 Critical Values of t



DEGREES OF FREEDOM	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$	DEGREES OF FREEDOM	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$
1	3.078	6.314	12.706	31.821	63.657	24	1.318	1.711	2.064	2.492	2.797
2	1.886	2.920	4.303	6.965	9.925	25	1.316	1.708	2.060	2.485	2.787
3	1.638	2.353	3.182	4.541	5.841	26	1.315	1.706	2.056	2.479	2.779
4	1.533	2.132	2.776	3.747	4.604	27	1.314	1.703	2.052	2.473	2.771
5	1.476	2.015	2.571	3.365	4.032	28	1.313	1.701	2.048	2.467	2.763
6	1.440	1.943	2.447	3.143	3.707	29	1.311	1.699	2.045	2.462	2.756
7	1.415	1.895	2.365	2.998	3.499	30	1.310	1.697	2.042	2.457	2.750
8	1.397	1.860	2.306	2.896	3.355	35	1.306	1.690	2.030	2.438	2.724
9	1.383	1.833	2.262	2.821	3.250	40	1.303	1.684	2.021	2.423	2.705
10	1.372	1.812	2.228	2.764	3.169	45	1.301	1.679	2.014	2.412	2.690
11	1.363	1.796	2.201	2.718	3.106	50	1.299	1.676	2.009	2.403	2.678
12	1.356	1.782	2.179	2.681	3.055	60	1.296	1.671	2.000	2.390	2.660
13	1.350	1.771	2.160	2.650	3.012	70	1.294	1.667	1.994	2.381	2.648
14	1.345	1.761	2.145	2.624	2.977	80	1.292	1.664	1.990	2.374	2.639
15	1.341	1.753	2.131	2.602	2.947	90	1.291	1.662	1.987	2.369	2.632
16	1.337	1.746	2.120	2.583	2.921	100	1.290	1.660	1.984	2.364	2.626
17	1.333	1.740	2.110	2.567	2.898	120	1.289	1.658	1.980	2.358	2.617
18	1.330	1.734	2.101	2.552	2.878	140	1.288	1.656	1.977	2.353	2.611
19	1.328	1.729	2.093	2.539	2.861	160	1.287	1.654	1.975	2.350	2.607
20	1.325	1.725	2.086	2.528	2.845	180	1.286	1.653	1.973	2.347	2.603
21	1.323	1.721	2.080	2.518	2.831	200	1.286	1.653	1.972	2.345	2.601
22	1.321	1.717	2.074	2.508	2.819	∞	1.282	1.645	1.960	2.326	2.576
23	1.319	1.714	2.069	2.500	2.807						

SOURCE: From M. Merrington, "Table of Percentage Points of the t-Distribution," *Biometrika* 32 (1941): 300. Reproduced by permission of the Biometrika Trustees.

Table 6(a) Critical Values of *F*: *A* = .05



ν_2 \ ν_1	NUMERATOR DEGREES OF FREEDOM 1	2	3	4	5	6	7	8	9
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88

DENOMINATOR DEGREES OF FREEDOM

SOURCE: From M. Merrington and C. M. Thompson, "Tables of Percentage Points of the Inverted Beta (*F*)-Distribution," *Biometrika* 33 (1943): 73–88. Reproduced by permission of the Biometrika Trustees.

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