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淡江大學八十九學年度碩士班招生考試試題

系別：產業經濟學系　　科目：計量經濟學

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本試題雙面印製

請將答案寫在答案紙上， 在試題紙上作答， 不予計分。

1. (24%) 最小平方法參數估計式與其變異數之矩陣型式計算公式爲何? 各自如何導出? 何謂高斯馬可夫定理 (Gauss-Markov theorem)? 計量經濟學介紹此定理之目的爲何?

2. (10%) 在您進入本所攻讀碩士學位並參與研究工作時， 您所分析的資料也許嚴重違反常態性 (Normality) 假設。 請問在這種情況下， 最小平方法是否仍適用? 請說明理由。 若改用最大概似 (Maximum Likelihood) 法是否會得到較佳參數估計值 (Estimate)?

3. (12%) What is the Slutsky theorem? If plim $x_n = c$ and plim $y_n = d$, calculate the following values by using the Slutsky theorem.

   a. plim(x_n+y_n),

   b. plim$(x_n y_n)$,

   c. plim$(\frac{x_n}{y_n})$.

4. (15%) Calculate the regression of income of parents on children's grade-point average in Table 1 and compare it with the regression of children's grade-point average on income of parents. Why are two results different?

Table 1 Children's Grade-Point Average and Family Income

Y (grade-point average)	X (income of parents in $1,000)
4.0	21.0
3.0	15.0
3.5	15.0
2.0	9.0
3.0	12.0
3.5	18.0
2.5	6.0
2.5	12.0

5. (39%) An attempt was made to explain the demand for bituminous coal (COAL) as a function of the Federal Reserve Board index of iron and steel production (FIS), the Federal Reserve Board index of electrical utility production (FEU), the

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wholesale price index for coal (PCOAL), and the wholesale price index for natural gas (PGAS). The quantity demanded of bituminous coal has been seasonally adjusted, and the adjusted series was used to perform a linear regression on the explanatory variables listed above. The time series ran monthly from January 1965 to December 1972. The output from the original regression is as follows (with *t* statistics in parentheses):

$$\hat{COAL} = 12.262 + 92.34FIS + 118.57FEU - 48.90PCOAL + 118.91PGAS$$

$$(3.51) \quad (6.46) \quad (7.14) \quad (-3.82) \quad (3.18)$$

$$R^2 = 0.692 \quad F = 51.0 \quad \text{DW} = 0.95$$

a. (2%) Calculate the standard error of the estimated coefficient corresponding to FEU.
b. (6%) Are the *t* statistics significant? Show the null hypotheses and the alternative hypotheses when you use the *t* statistics.
c. (12%) How do we get the value of R^2? What does it mean? What is the main weakness of R^2? How do we correct for the weakness?
d. (6%) Is the *F* statistic significant (see Table 2)? Show the null hypothesis and the alternative hypothesis when you use the *F* statistic.
e. (8%) How do we calculate the DW statistic? What does the value of DW mean (see Table 3)? Show the null hypothesis and the alternative hypothesis when you use the DW statistic.
f. (5%) If the model is modified and the new output is as the following, can we still use the DW statistic? Why?

$$\hat{COAL}(t) = 12.262 + 13.3\,\hat{COAL}(t\text{-}1) + 92.34FIS(t) + 118.57FEU(t) -$$

$$48.90PCOAL(t) + 118.91PGAS(t)$$

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TABLE 3
FIVE PERCENT SIGNIFICANCE POINTS OF d_l AND d_u FOR DURBIN-WATSON TEST†

	$k = 1$		$k = 2$		$k = 3$		$k = 4$		$k = 5$	
N	d_l	d_u	d_l	d_u	d_l	d_u	d_l	d_u	d_l	d_u
15	1.08	1.36	.95	1.54	.82	1.75	.69	1.97	.56	2.21
16	1.10	1.37	.98	1.54	.86	1.73	.74	1.93	.62	2.15
17	1.13	1.38	1.02	1.54	.90	1.71	.78	1.90	.67	2.10
18	1.16	1.39	1.05	1.53	.93	1.69	.82	1.87	.71	2.06
19	1.18	1.40	1.08	1.53	.97	1.68	.86	1.85	.75	2.02
20	1.20	1.41	1.10	1.54	1.00	1.68	.90	1.83	.79	1.99
21	1.22	1.42	1.13	1.54	1.03	1.67	.93	1.81	.83	1.96
22	1.24	1.43	1.15	1.54	1.05	1.66	.96	1.80	.86	1.94
23	1.26	1.44	1.17	1.54	1.08	1.66	.99	1.79	.90	1.92
24	1.27	1.45	1.19	1.55	1.10	1.66	1.01	1.78	.93	1.90
25	1.29	1.45	1.21	1.55	1.12	1.66	1.04	1.77	.95	1.89
26	1.30	1.46	1.22	1.55	1.14	1.65	1.06	1.76	.98	1.88
27	1.32	1.47	1.24	1.56	1.16	1.65	1.08	1.76	1.01	1.86
28	1.33	1.48	1.26	1.56	1.18	1.65	1.10	1.75	1.03	1.85
29	1.34	1.48	1.27	1.56	1.20	1.65	1.12	1.74	1.05	1.84
30	1.35	1.49	1.28	1.57	1.21	1.65	1.14	1.74	1.07	1.83
31	1.36	1.50	1.30	1.57	1.23	1.65	1.16	1.74	1.09	1.83
32	1.37	1.50	1.31	1.57	1.24	1.65	1.18	1.73	1.11	1.82
33	1.38	1.51	1.32	1.58	1.26	1.65	1.19	1.73	1.13	1.81
34	1.39	1.51	1.33	1.58	1.27	1.65	1.21	1.73	1.15	1.81
35	1.40	1.52	1.34	1.53	1.28	1.65	1.22	1.73	1.16	1.80
36	1.41	1.52	1.35	1.59	1.29	1.65	1.24	1.73	1.18	1.80
37	1.42	1.53	1.36	1.59	1.31	1.66	1.25	1.72	1.19	1.80
38	1.43	1.54	1.37	1.59	1.32	1.66	1.26	1.72	1.21	1.79
39	1.43	1.54	1.38	1.60	1.33	1.66	1.27	1.72	1.22	1.79
40	1.44	1.54	1.39	1.60	1.34	1.66	1.29	1.72	1.23	1.79
45	1.48	1.57	1.43	1.62	1.38	1.67	1.34	1.72	1.29	1.78
50	1.50	1.59	1.46	1.63	1.42	1.67	1.38	1.72	1.34	1.77
55	1.53	1.60	1.49	1.64	1.45	1.68	1.41	1.72	1.38	1.77
60	1.55	1.62	1.51	1.65	1.48	1.69	1.44	1.73	1.41	1.77
65	1.57	1.63	1.54	1.66	1.50	1.70	1.47	1.73	1.44	1.77
70	1.58	1.64	1.55	1.67	1.52	1.70	1.49	1.74	1.46	1.77
75	1.60	1.65	1.57	1.68	1.54	1.71	1.51	1.74	1.49	1.77
80	1.61	1.66	1.59	1.69	1.56	1.72	1.53	1.74	1.51	1.77
85	1.62	1.67	1.60	1.70	1.57	1.72	1.55	1.75	1.52	1.77
90	1.63	1.68	1.61	1.70	1.59	1.73	1.57	1.75	1.54	1.78
95	1.64	1.69	1.62	1.71	1.60	1.73	1.58	1.75	1.56	1.78
100	1.65	1.69	1.63	1.72	1.61	1.74	1.59	1.76	1.57	1.78

† N = number of observations; k = number of explanatory variables (excluding the constant term).

Source: Reprinted with permission from J. Durbin and G. S. Watson, "Testing for Serial Correlation in Least Squares Regression," *Biometrika*, vol. 38, pp. 159–177, 1951.

TABLE 2
F DISTRIBUTION, 5 PERCENT SIGNIFICANCE

Degrees of freedom for denominator	Degrees of freedom for numerator								
	1	2	3	4	5	6	7	8	9
1	161	200	216	225	230	234	237	239	241
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4
3	10.1	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	2.48
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
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	2.18	2.09	2.02	1.96
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88

Source: Reproduced with the permission of the Biometrika Trustees from M. Merrington and C. M. Thompson, "Tables of Percentage Points of the Inverted Beta (F) Distribution," *Biometrika*, vol. 33, p. 73, 1943.