

AMERICAN UNIVERSITY of BEIRUT
SCHOOL of BUSINESS
BUSS 230

MID-TERM EXAM – March 25, 2004

NAME: _____ ID: _____

SECTION: _____ INSTRUCTOR: _____

ANSWER ALL QUESTIONS – TIME ALLOWED: 1 ½ hours

I. Multiple choice - (30 points). Please CIRCLE the correct answer

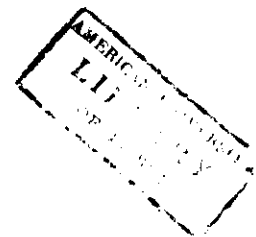
1. Naji earns \$50,000 business profit a year by selling donuts. He pays \$12,000 a year in rent to his uncle Nabih for the building in which the business is located. If Uncle Nabih gives him the building, then Naji's
 - a. Business profit will be unchanged.
 - b. Economic profit will be unchanged.
 - c. Implicit cost will decrease by \$12,000 a year.
 - d. Naji's revenues will increase by \$12,000 a year.
 - e. All of the above are correct.
2. Implicit cost is equal to:
 - a. Business profit minus economic profit.
 - b. Business profit plus economic profit.
 - c. Economic profit minus business profit.
 - d. Economic profit minus explicit costs.
 - e. Revenues minus explicit costs.
3. If a computer software company introduces a new program and finds that orders from wholesalers far exceed the number of units that are being produced,
 - a. There is an excess supply and price can be expected to fall.
 - b. There is an excess supply and price can be expected to rise.
 - c. There is an excess demand and price can be expected to fall.
 - d. There is an excess demand and price can be expected to rise.
 - e. There is a combination of excess demand and supply.
4. A firm's revenue function was estimated as $TR = 200Q - 20Q^2$. What would average revenue be when one unit of output is produced?
 - a. 180.
 - b. 160.
 - c. 20.
 - d. 200.
 - e. 220.
5. If marginal revenue is equal to zero, then
 - a. Total revenue is zero.
 - b. Average revenue is zero.

- c. Total profit is at a maximum or minimum.
d. Total revenue is at a maximum or a minimum.
e. Average revenue is at a maximum or minimum
6. When total revenue is at a maximum:
a. Profit is at a maximum.
b. Average revenue is at a maximum.
c. Marginal revenue is at a maximum.
d. Average revenue is equal to zero.
e. None of the above is correct.
7. The price of a firm's product increases from \$5 to \$6. As a result, the quantity demanded of the product declines from 600,000 to 500,000. The price elasticity of demand for the product is equal to:
a. -5.
b. -3.
c. -1.
d. $-1/3$.
e. $-1/5$.
8. If marginal revenue is \$20 when the price of the product is \$40, then the price elasticity of demand is:
a. -2.
b. -1.
c. -0.50.
d. -0.25.
e. 2.
9. If consumer income declines, then the demand for:
a. Normal goods will increase.
b. Inferior goods will increase.
c. The price of the good will increase.
d. Substitute goods will increase.
e. Complementary goods will increase.
10. Application of simple linear regression estimation to sales data yielded the following equation: $Q = 24 - 2P$. If the current product price is $P = 6$ and the quantity sold at that price is $Q = 10$, then the error (e) for the current time period is:
a. 4.
b. 2.
c. 0.
d. -2.
e. -4.
11. The adjusted value of the coefficient of determination:
a. Will increase if additional independent variables are added to the regression model.





- b. Is equal to the proportion of the sum of the squared deviations of the dependent variable from its mean that is explained by the regression model.
 - c. Is greater than the proportion of the sum of the squared deviations of the dependent variable from its mean that is explained by the regression model.
 - d. Is smaller than the proportion of the sum of the squared deviations of the dependent variable from its mean that is explained by the regression model.
 - e. Is greater than the unadjusted coefficient of determination.
12. Autocorrelation refers to a situation in which:
- a. Successive error terms derived from the application of regression estimation to time series data are correlated.
 - b. Successive error terms derived from the application of regression estimation to cross-sectional data are correlated
 - c. There is a high degree of correlation between two or more of the independent variables included in a multiple regression model.
 - d. The dependent variable is automatically correlated with the independent variable(s) in a regression model.
 - e. The application of a multiple regression model yields estimates that are nonlinear in form.
13. Regression was used to estimate the following seasonal forecasting equation: $S_t = 124 + 2.5 T + 18 D_1 - 46 D_2 - 28 D_3$. Where D_1 is a dummy variable that is equal to one in the first quarter and zero otherwise, D_2 is a dummy variable that is equal to one in the second quarter and zero otherwise, and D_3 is a dummy variable that is equal to one in the third quarter and zero otherwise. What would be the forecast for S_t in the second quarter of time period 10?
- a. 25.0
 - b. 95.0
 - c. 103.0
 - d. 149.0
 - e. None of the above is correct.
14. The first step in time-series based forecasting is to:
- a. Identify relevant correlated variables.
 - b. Plot the data on a graph.
 - c. Calculate a moving average of the observations.
 - d. Perform preliminary regression calculations.
 - e. Identify the seasonal pattern in the observations.
15. The use of a smoothing technique is appropriate when:
- a. Random behavior is the primary source of variation.
 - b. Seasonality is present.
 - c. Data indicate the presence of cyclical fluctuations.
 - d. Data exhibit a minor downward trend.
 - e. Data exhibit a minor upward trend.



II. **True/False – (20 points).** ON YOUR BLUE BOOK, label each of the following statements as either T (true) or F (false) and briefly justify your answer.

1. Business profit is equal to total revenue minus total costs.
2. The monopoly theory of profit argues that restricted entry into an industry tends to keep profits low.
3. Total cost is equal to marginal cost plus average cost.
4. A firm's total profit reaches a maximum when total cost is at a minimum.
5. If the independent individual consumer demand curves for a good are added together vertically, the result constitutes the market demand curve for the good.
6. The cross-price elasticity of demand measures the percentage change in the demand for one good that results from a one percent change in the quantity demanded of another good.
7. For a given sample size, the more independent variables are incorporated in a regression estimate, the more degrees of freedom the relevant t-distribution has.
8. The Durbin-Watson statistic is used to test the significance of the errors in estimating the dependent (Y) variable.
9. The long-run increase or decrease in time-series data is referred to as the secular trend.
10. The use of a leading indicators to forecast time-series data is an example of econometric forecasting.

III. **Problem (15 points).** A firm produces two commodities: X and Y. It has estimated its profit function to be:

$$\text{Profit} = 144x - 3x^2 - xy - 2y^2 + 116y - 35$$

- a. **For 6 points.** Determine the output of each commodity at which profit is maximized.
- b. **For 3 points.** Determine the amount of profit at the optimum output combination
- c. **For 6 points.** What would be the output combination that maximizes profit after a fire destroyed one of the firm's buildings and reduced its maximum production capacity to 36 units?

IV. **Problem (20 points).** Demand for coffee in the United States was estimated from 32 Quarterly observations over the period January 1995 – December 2002 and resulted in the following regression:

$$\longrightarrow Q_t = 2.50 - 0.25 P_t + 0.50 I_t + 0.40 P_{rt} - 0.10 T,$$

where Q = quantity consumed of coffee per capita (in pounds); P = unit price of coffee (\$ per pound); I = per capita income (in 000\$); Pr = price of a related good (\$ per pound); and T = Time.

The calculated t-statistics for the independent variables were, respectively: (-2.25), (2.10), (1.00), and (3.00).

The R-square value was 0.80, and the calculated D-W value was 1.85.

- a. **For 4 points.** Are the signs of the coefficients of the independent variables in conformity with theoretical expectations? Explain your answer.
- b. **For 4 points.** Test the statistical significance of the coefficients of the independent variables at the 5% level of significance.
- c. **For 4 points.** What is your interpretation of the R-square coefficient? Conduct an F-test and interpret its meaning.
- d. **For 4 points.** Conduct a D-W test and interpret its meaning.
- e. **For 3 points.** Assuming that $P = 2.00$, $I = 20.00$, and $Pr = 1.00$ in the second quarter of 2003, what would be your forecast for per capita consumption of coffee during that quarter?

V. **Problem (15 points).** The Beautiful Teeth Company sells an electric toothbrush for \$25. Its monthly sales have averaged 8,000 units over the last year. Recently, its closest competitor, Healthy Teeth, reduced the price of its own electric toothbrush from \$35 to \$30. As a result, Beautiful Teeth's sales declined by 1,500 unit a month.

- a. **For 5 points.** What is the arc cross elasticity of demand between the two toothbrushes? What does this indicate about the relationship between the two products?
- b. **For 5 points.** What price would Beautiful Teeth have to charge to sell the same number of units as it did before its competitor reduced its price? Assume that the competitor holds the price of its product unchanged at \$30.
- c. **For 5 points.** What is Beautiful Teeth's average monthly total revenue from the sale of electric toothbrushes before and after the competitor's price cut, including its reaction to that cut?

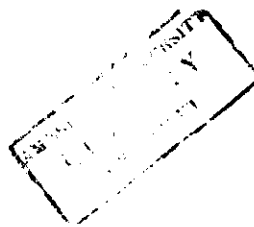


Table of "Students" Distribution—Value of t

Degrees of Freedom	Probability												
	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.05	0.02	0.01	0.001
1	0.158	0.325	0.510	0.727	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.619
2	0.142	0.289	0.445	0.617	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.598
3	0.137	0.277	0.424	0.584	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	12.924
4	0.134	0.271	0.414	0.569	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	0.132	0.267	0.408	0.559	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	6.869
6	0.131	0.265	0.404	0.553	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	0.130	0.263	0.402	0.549	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	5.408
8	0.130	0.262	0.399	0.546	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	0.129	0.261	0.398	0.543	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	0.129	0.260	0.397	0.542	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	0.129	0.260	0.396	0.540	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	0.128	0.259	0.395	0.539	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	0.128	0.259	0.394	0.538	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	0.128	0.258	0.393	0.537	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	0.128	0.258	0.393	0.536	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	0.128	0.258	0.392	0.535	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	0.128	0.257	0.392	0.534	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	0.127	0.257	0.392	0.534	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	0.127	0.257	0.391	0.533	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	0.127	0.257	0.391	0.533	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	0.127	0.257	0.391	0.532	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	0.127	0.256	0.390	0.532	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	0.127	0.256	0.390	0.532	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.767
24	0.127	0.256	0.390	0.531	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
25	0.127	0.256	0.390	0.531	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	0.127	0.256	0.390	0.531	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	0.127	0.256	0.389	0.531	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	0.127	0.256	0.389	0.530	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	0.127	0.256	0.389	0.530	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	0.127	0.256	0.389	0.530	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	0.126	0.255	0.388	0.529	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
60	0.126	0.254	0.387	0.527	0.679	0.848	1.046	1.296	1.671	2.000	2.390	2.660	3.460
120	0.126	0.254	0.386	0.526	0.677	0.845	1.041	1.289	1.658	1.980	2.358	2.617	3.373
∞	0.126	0.253	0.385	0.524	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291

Note: Probabilities given are for two-tailed tests. For example, a probability of .05 allows for .025 in one tail of the distribution and .025 in the other. Table 2 is taken from Table III of Fisher and Yates: *Statistical Tables for Biological, Agricultural and Medical Research*, published by Longman Group, Ltd., London (previously published by Oliver and Boyd, Edinburgh), and by permission of the authors and publishers.

The F-Distribution—Upper 5 Percent Points

δ_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	18.57	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

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Durbin-Watson Statistic for 1.5% Significance (one-tail) and 1% Significance (two-tail)

n	m = 1		m = 2		m = 3		m = 4		m = 5	
	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U
15	0.95	1.23	0.83	1.40	0.71	1.61	0.59	1.84	0.48	2.09
16	0.98	1.24	0.86	1.40	0.75	1.59	0.64	1.80	0.53	2.03
17	1.01	1.25	0.90	1.40	0.79	1.58	0.68	1.77	0.57	1.98
18	1.03	1.26	0.93	1.40	0.82	1.56	0.72	1.74	0.62	1.93
19	1.06	1.28	0.96	1.41	0.86	1.55	0.76	1.73	0.66	1.90
20	1.08	1.28	0.99	1.41	0.89	1.55	0.79	1.72	0.70	1.87
21	1.10	1.30	1.01	1.41	0.92	1.54	0.83	1.69	0.73	1.84
22	1.12	1.31	1.04	1.42	0.95	1.54	0.86	1.68	0.77	1.82
23	1.14	1.32	1.06	1.42	0.97	1.54	0.89	1.67	0.80	1.80
24	1.16	1.33	1.08	1.43	1.00	1.54	0.91	1.66	0.83	1.79
25	1.18	1.34	1.10	1.43	1.02	1.54	0.94	1.65	0.86	1.77
26	1.19	1.35	1.12	1.44	1.04	1.54	0.96	1.65	0.88	1.76
27	1.21	1.36	1.13	1.44	1.06	1.54	0.99	1.64	0.91	1.75
28	1.22	1.37	1.15	1.45	1.08	1.54	1.01	1.64	0.93	1.74
29	1.24	1.38	1.17	1.45	1.10	1.54	1.03	1.63	0.96	1.73
30	1.25	1.38	1.18	1.46	1.12	1.54	1.05	1.63	0.98	1.73
31	1.26	1.39	1.20	1.47	1.13	1.55	1.07	1.63	1.00	1.72
32	1.27	1.40	1.21	1.47	1.15	1.55	1.08	1.63	1.02	1.71
33	1.28	1.41	1.22	1.48	1.16	1.55	1.10	1.63	1.04	1.71
34	1.29	1.41	1.24	1.48	1.17	1.55	1.12	1.63	1.06	1.70
35	1.30	1.42	1.25	1.48	1.19	1.55	1.13	1.63	1.07	1.70
36	1.31	1.43	1.26	1.49	1.20	1.56	1.15	1.63	1.09	1.70
37	1.32	1.43	1.27	1.49	1.21	1.56	1.16	1.62	1.10	1.70
38	1.33	1.44	1.28	1.50	1.23	1.56	1.17	1.62	1.12	1.70
39	1.34	1.44	1.29	1.50	1.24	1.56	1.19	1.63	1.13	1.69
40	1.35	1.45	1.30	1.51	1.25	1.57	1.20	1.63	1.15	1.69
45	1.39	1.48	1.34	1.53	1.30	1.58	1.25	1.63	1.21	1.69
50	1.42	1.50	1.38	1.54	1.34	1.59	1.30	1.64	1.26	1.69
55	1.45	1.52	1.41	1.56	1.37	1.60	1.33	1.64	1.30	1.69
60	1.47	1.54	1.44	1.57	1.40	1.61	1.37	1.65	1.33	1.69
65	1.49	1.55	1.46	1.59	1.43	1.63	1.40	1.66	1.36	1.69
70	1.51	1.57	1.48	1.60	1.45	1.63	1.42	1.66	1.39	1.70
75	1.53	1.58	1.50	1.61	1.47	1.64	1.45	1.67	1.42	1.70
80	1.54	1.59	1.52	1.63	1.49	1.65	1.47	1.67	1.44	1.70
85	1.56	1.60	1.53	1.63	1.51	1.66	1.49	1.68	1.46	1.71
90	1.57	1.61	1.55	1.64	1.53	1.66	1.50	1.69	1.48	1.71
95	1.58	1.62	1.56	1.65	1.54	1.67	1.52	1.69	1.50	1.71
100	1.59	1.63	1.57	1.65	1.55	1.67	1.53	1.70	1.51	1.72

m = number of independent variables

n = number of observations

Source: From J. Durbin and G. S. Watson, "Testing for Serial Correlation in Least-Squares Regression," *Biometrika*, Vol. 38 (1951): 159-177. With the permission of the authors and the Trustees of *Biometrika*.