AMERICAN UNIVERSITY of BEIRUT
OLAYAN SCHOOL of BUSINESS
BUSS 230

MID-TERM EXAM – April 4, 2005

NAME: _____ ID: _____

SECTION: _____ INSTRUCTOR: _____

ANSWER ALL QUESTIONS – TIME ALLOWED: 1 ½ hours

I. <u>Multiple choices - (20 points)</u>. On this sheet, please <u>circle</u> the correct answer. A correct answer is worth 2 points.

1. The modern theory of the firm holds that firms behave in a way that is designed to maximize:
   a. Profit.
   b. Wealth.
   c. Monopoly power.
   d. Total revenue.
2. Unionized workers may be able to negotiate with management for higher wages during periods of economic prosperity. Suppose that workers at automobile assembly plants successfully negotiated a significant increase in their wages. How would the new wage level be likely to affect the market supply of new cars?
   a. Supply will shift to the right.
   b. Supply will shift to the left.
   c. Supply will not shift, but the quantity of cars produced per month will decrease.
   d. Supply will not shift, but the quantity of cars produced per month will increase.

3. Use the information about Marginal Revenue (MR) that is presented below to determine the Total Revenue when output is equal to 6 units.

Output:	1	2	3	4	5	6	7	8	9
MR:	50	45	40	35	30	25	20	15	10

   a. 25.
   b. 39.
   c. 150.
   d. 225.

4. If <u>both</u> average cost (AC) and marginal cost (MC) are **U-shaped**, then:
   a. AC will reach a minimum at a level of output that is less than that at which MC reaches a minimum.
   b. The total cost curve will be a straight line.
   c. AC will reach a minimum at a level of output that is greater than that at which MC reaches a minimum.
   d. Both AC and MC will reach a minimum at the same level of output.

5. If marginal revenue is $23 when the price of a product is $30, then the price elasticity of demand is:
    a. –2.
    b. –1.
    c. – 0.50.
    d. None of the above.

6. If consumer income declines, then the demand for:
    a. Normal goods will increase.
    b. Inferior goods will increase.
    c. Substitute goods will increase.
    d. Complementary goods will increase.

7. A simple linear regression analysis based on a data set of 20 observations yielded the following estimated equation:

    $$\mathbf{Q = 120 - 3.6\ P}$$

    If the coefficient of determination is 0.81, then the correlation coefficient is equal to:

    a. 0.81.
    b. –0.81.
    c. –0.90.
    d. 0.90.

8. The application of multiple regression analysis to a time-series data set yielded a calculated Durbin-Watson statistic of 1.00. If the lower test value at the 1% level is 1.28 and the upper value is 1.51, then there is evidence that:
    a. Multicollinearity is present.
    b. Multicollinearity is absent.
    c. Autocorrelation is present.
    d. Autocorrelation is absent.

9. Regression analysis was used to estimate the following seasonal forecasting equation:

    $$\mathbf{S_t = 124 + 18\ D_1 - 46\ D_2 - 28\ D_3 + 2.5\ T}$$

    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; D_3 is a dummy variable that is equal to one in the third quarter and zero otherwise. Forecast the level of sales in the fourth quarter of time period ten.

    a. 149.
    b. 180.
    c. 205.
    d. None of the above.

10. If regression analysis is used to estimate the linear relation between the natural logarithm of the variable to be forecasted and ***Time***, then the slope estimate is equal to:
    a. The linear trend.
    b. The natural logarithm of the rate of growth.
    c. The natural logarithm of one plus the rate of growth.
    d. The natural logarithm of the square root of the rate of growth.

II. <u>True/False – 20 points</u>. **On your blue book, label each of the following statements as either T (true) or F (false) and briefly justify the answer. You will receive no credit for a correct answer not accompanied by a justification or one that is accompanied by a wrong justification**

1. An increase in the uncertainty associated with a firm's cash flows will cause a decrease in the **discount rate** applied to valuing the firm.
2. Businesses are **taxed** on the basis of their economic profit.
3. If a marginal value is greater than its corresponding average value, the marginal value must be **decreasing**.
4. A firm's **total profit is at a maximum** when the firm's average revenue curve is above its marginal cost curve and the vertical distance that separates the two is at a maximum.
5. If the price elasticity of demand for a firm's output is inelastic, then the firm could **increase its revenue** by reducing price.
6. Demand for diamonds is not as **income elastic** as the demand for bread since diamonds are not necessary for sustaining life.
7. If the linear function $\mathbf{Y = a + b\,X}$ that is plotted on a graph passes through the origin of the graph, then $b = 0$.
8. For a given sample size, the more independent variables are incorporated in a regression model, the more **degrees of freedom** the relevant t-distribution has.
9. The **ratio-to-trend method** is used to estimate a linear trend equation.
10. The use of an estimated demand equation to forecast price is an example of **econometric forecasting**.

PROBLEMS (60 POINTS). Answer all problems on the blue book and show all calculations.

III. <u>Problem (20 points)</u>. A firm's demand function is: $Q = 16 - P$, and its total cost function is defined as $TC = 3 + Q + 0.25\,Q^2$.

a. <u>For 10 points</u>. Determine in ***<u>two alternative ways</u>*** the optimal level of output that yields a maximum profit.
b. <u>For 5 points</u>. Calculate the average revenue and the marginal revenue at the optimal level of output.
c. <u>For 5 points</u>. Calculate the average cost and the marginal cost at the optimal level of output.

IV. Problem (20 points). The demand for good Z was estimated in linear form as:

$$Q_z = 19 - 3.5\,P_z - 1.6\,P_y + 0.3\,I + 0.15\,A$$

Where Q_z is quantity demanded of Z per month, P_z is product price, P_y is the price of a related good, I is consumer income, and A is advertising expenditure per month. Assume that currently P_z = \$19, P_y = \$3, I = \$153, and A = \$320.

a. **For 5 points.** Calculate the own price elasticity of demand. Is demand elastic, inelastic, or unit elastic? Explain.
b. **For 5 points.** Suppose the firm's marginal cost is \$5 at all levels of output. Is the firm maximizing profits at the current price level? Clearly explain your answer.
c. **For 5 points.** Calculate the point income elasticity of demand. Is the good normal or inferior? Is it a necessity or a luxury? Explain.
d. **For 5 points.** Suppose that next month, P_z is expected to increase by 6%, Income is expected to rise by 10%, and P_y and Advertising are expected to be unchanged. Using *the already estimated elasticities of demand*, calculate the expected percentage change in Q_z.

V. Problem (20 points). Annual consumption of Coca Cola in the US was estimated by regressing consumption in each of 44 states during the year 2000 against: (P) price per case of 6 cans expressed in \$, (I) income per capita in units of thousand dollars, and (T) mean annual temperature in degrees Fahrenheit, and resulted in the following:

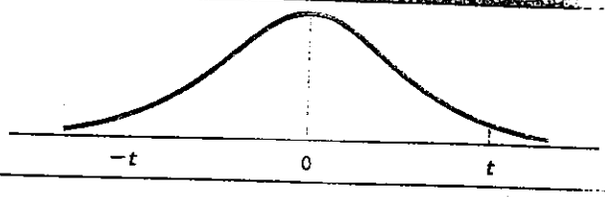
$$\underset{}{Q} = \underset{(4.0)}{440.5} - \underset{(-5.5)}{210.1}\,P + \underset{(2.7)}{0.9}\,I + \underset{(4.6)}{3.0}\,T$$

R-Square was 0.735. The numbers shown in parentheses below the respective coefficients are the ***calculated t-values*** of each.

a. **For 4 points.** Test the hypothesis that the coefficients of the *independent variables* are significantly different from zero at 5%.
b. **For 4 points.** How much of the deviation of the dependent variable is explained by the regression? Conduct an F-test of the results (at the 5% level) and explain what the test indicates.
c. **For 4 points.** What is the price elasticity of demand when the price of a case is \$2, income per capita is 18, and mean temperature is 55?
d. **For 4 points.** Suppose Coca Cola decided to increase price per case by 5% in 2001, that income per capita was expected to grow by 2%, and that mean temperature was expected to be unchanged, calculate the likely change in Coca Cola's revenues in 2001.
e. **For 2 points.** What estimation problems may arise from incorporating the ***price of Pepsi*** as an additional independent variable in the regression?
f. **For 2 points.** Given the nature of the data set, would one expect to find ***autocorrelation*** in the regression whose results are shown above?

t- distribution

TABLE C-2 Areas in the Tails of the t Distribution



Degree of Freedom	Probabilities							
	.80	.60	.40	.20	.10	.05	.02	.01
1	0.325	0.727	1.376	3.078	6.314	12.706	31.821	63.657
2	0.289	0.617	1.061	1.886	2.920	4.303	6.965	9.925
3	0.277	0.584	0.978	1.638	2.353	3.182	4.541	5.841
4	0.271	0.569	0.941	1.533	2.132	2.776	3.747	4.604
5	0.267	0.559	0.920	1.476	2.015	2.571	3.365	4.032
6	0.265	0.553	0.906	1.440	1.943	2.447	3.143	3.707
7	0.263	0.549	0.896	1.415	1.895	2.365	2.998	3.499
8	0.262	0.546	0.889	1.397	1.860	2.306	2.896	3.355
9	0.261	0.543	0.883	1.383	1.833	2.262	2.821	3.250
10	0.260	0.542	0.879	1.372	1.812	2.228	2.764	3.169
11	0.260	0.540	0.876	1.363	1.796	2.201	2.718	3.106
12	0.259	0.539	0.873	1.356	1.782	2.179	2.681	3.055
13	0.259	0.538	0.870	1.350	1.771	2.160	2.650	3.012
14	0.258	0.537	0.868	1.345	1.761	2.145	2.624	2.977
15	0.258	0.536	0.866	1.341	1.753	2.131	2.602	2.947
16	0.258	0.535	0.865	1.337	1.746	2.120	2.583	2.921
17	0.257	0.534	0.863	1.333	1.740	2.110	2.567	2.898
18	0.257	0.534	0.862	1.330	1.734	2.101	2.552	2.878
19	0.257	0.533	0.861	1.328	1.729	2.093	2.539	2.861
20	0.257	0.533	0.860	1.325	1.725	2.086	2.528	2.845
21	0.257	0.532	0.859	1.323	1.721	2.080	2.518	2.831
22	0.256	0.532	0.858	1.321	1.717	2.074	2.508	2.819
23	0.256	0.532	0.858	1.319	1.714	2.069	2.500	2.807
24	0.256	0.531	0.857	1.318	1.711	2.064	2.492	2.797
25	0.256	0.531	0.856	1.316	1.708	2.060	2.485	2.787
26	0.256	0.531	0.856	1.315	1.706	2.056	2.479	2.779
27	0.256	0.531	0.855	1.314	1.703	2.052	2.473	2.771
28	0.256	0.530	0.855	1.313	1.701	2.048	2.467	2.763
29	0.256	0.530	0.854	1.311	1.699	2.045	2.462	2.756
30	0.256	0.530	0.854	1.310	1.697	2.042	2.457	2.750
40	0.255	0.529	0.851	1.303	1.684	2.021	2.423	2.704
60	0.254	0.527	0.848	1.296	1.671	2.000	2.390	2.660
120	0.254	0.526	0.845	1.289	1.658	1.980	2.358	2.617
∞	0.253	0.524	0.842	1.282	1.645	1.960	2.326	2.576

Note: The probabilities given in the table are for two-tailed tests. Thus, a probability of 0.05 allows for 0.025 in each tail. For example, for the probability of 0.05 and 21 df, $t = 2.080$. This means that 2.5 percent of the area under the t distribution lies to the right of $t = 2.080$, and 2.5 percent to the left of $t = -2.080$.

Source: From table III of Fisher and Yates, *Statistical Tables for Biological, Agricultural and Medical Research*, 6th ed., 1974, published by Longman Group Ltd., London (previously by Oliver & Boyd, Edinburgh), by permission of the authors and publishers.

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·F distribution at 5% level.

TABLE C-3 F Distribution for 5 Percent Significance

Degrees of Freedom for Denominator	Degrees of Freedom for Numerator																		
	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161	200	216	225	230	234	237	239	241	242	244	246	248	249	250	251	252	253	254
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.5	19.5	19.5	19.5	19.5	19.5	19.5
3	10.1	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	4.37
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	2.48	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	2.39	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
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	2.18	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

Source: M. Merrington and C. M. Thompson, "Tables of Percentage Points of the Inverted Beta (*F*) Distribution," *Biometrica*, vol. 33, 1943, p. 73.