AMERICAN UNIVERSITY of BEIRUT
SCHOOL of BUSINESS
BUSS 230

MID-TERM EXAM -- November 10, 2004

NAME: _____ ID: _____

SECTION: _____ INSTRUCTOR: _____

ANSWER ALL QUESTIONS -- TIME ALLOWED: 1 ½ hours

I. **Multiple choice - (30 points).** *On this sheet,* please circle the correct answer.

1. Which of the following is the best definition of ECONOMIC profit?
   a. Business profits minus implicit costs.
   b. Total revenue minus total explicit costs.
   c. Total revenue minus total implicit costs.
   d. Business profits minus explicit costs.
   e. Explicit costs minus implicit costs.

2. Which theory of profit holds that profits will be higher in industries characterized by a high degree of variability in their revenues or costs?
   a. Frictional theory.
   b. Monopoly theory.
   c. Volatility theory.
   d. Risk-bearing theory.
   e. Innovation theory.

3. During its current recession conditions, Lebanon is experiencing increased unemployment and below average growth in GDP. How would a recession be likely to affect the demand for cars?
   a. Demand will shift to the right.
   b. Demand will shift to the left.
   c. Demand will not shift but the quantity of cars sold per month will decrease.
   d. Demand will not shift but the quantity of cars sold per month will increase.
   e. No clear effect.

4. The marginal principle asserts that [illegible]
   a. [illegible]
   b. [illegible]
   c. [illegible]
   d. [illegible]
   e. Marginal cost will be [illegible]

5. If a firm's marginal revenue is greater than its marginal cost, then the firm should:
    a. Increase output to increase profit.
    b. Decrease output to increase profit.
    c. Keep output unchanged.
    d. Collect additional information before deciding what to do.

6. If a firm is producing a level of output where marginal cost is equal to marginal revenue, then:
    a. Profit is at a maximum if marginal cost has a negative slope and marginal revenue is horizontal.
    b. Profit is at a minimum if marginal cost has a negative slope and marginal revenue is horizontal.
    c. Profit is at a maximum if average revenue is greater than average cost.
    d. Profit is at a minimum if average revenue is greater than average cost
    e. Profit is at a minimum if marginal cost has a positive slope and marginal revenue is horizontal.

7. The price of a firm's product declines from $10 to $9. As a result, the quantity demanded of the product increases from 60,000 to 120,000. The arc price elasticity of demand for the good is equal to:
    a. -100
    b. -10
    c. -1.
    d. -0.1
    e. -0.01.

8. If the price elasticity of demand for a firm's product is -5.0 and the income elasticity of demand for the product is 2.5, the firm's total revenue from selling the product will be unchanged if a 1% decrease in consumer income is accompanied by a:
    a. 0.5% increase in product price
    b. 0.5% decrease in product price.
    c. 1% increase in product price.
    d. 2% decrease in product price.
    e. 2% increase in product price.

9. The price elasticity of demand for a good will be higher if:
    a. The good is broadly defined (e.g., the demand for fruit as opposed to the demand for peaches).
    b. [illegible] (e.g., the demand for peaches as opposed to the demand for fruit).
    c. [illegible]
    d. [illegible]
    e. [illegible]

10. The **<u>Identification Problem</u>** would **<u>not</u>** prevent estimation of a demand curve from price and quantity data if, over the time period sampled, the only thing that varied was:
    a. Supply of the good.
    b. Level of consumer income.
    c. Prices of substitutes and complements.
    d. Level of advertising expenditures.
    e. Consumer tastes.
11. The **Durbin-Watson Statistic** is used to test for:
    a. Multicollinearity.
    b. Autocorrelation.
    c. Heteroskedasticity.
    d. Significance of individual parameters in a regression.
    e. Significance of the overall regression.
12. One advantage of estimating a function in which all variables have been transformed into their natural logarithms is that:
    a. The estimated coefficients measure the respective elasticity.
    b. Problems of autocorrelation are eliminated
    c. Problems of multicollinearity between the independent variables are eliminated.
    d. The coefficients are easier to estimate in this case.
    e. None of the above is correct.

13. The following linear trend equation was estimated from a time-series consisting of 5 years of quarterly data: **$S_t = -25 + 10T$.** Seasonal adjustment factors were estimated using the ratio-to-trend method and resulted in 0.80, 0.90, 1.10, and 1.20 for quarters I, II, III, and IV, respectively. What would be the forecast value for the II quarter of the forecast year that follows the past observations?
    a. 157.5
    b. 175.5
    c. 198.0
    d. 220.0
    e. 250.0

14. The root-mean-square error is a measure of:
    a. Sample size.
    b. Deviations from the mean in a regression.
    c. Moving average periods.
    d. Exponential smoothing.
    e. Forecast accuracy.

15. [illegible]
    a. [illegible]
    b. [illegible] method
    c. [illegible]
    d. [illegible] smoothing [illegible]
    e. Dummy variables.

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 the answer.

1. The value of a firm under unconstrained optimization would be greater than its value under constrained optimization.
2. Sales taxes paid by a retail firm to the government are an example of **implicit costs** of doing business.
3. An individual consumer's demand function is formulated on the assumption that the price of the good is unchanged while all other determinants of demand are allowed to vary.
4. If price elasticity of demand increases, then the firm's **marginal revenue** will increase also.
5. For normal goods, the **income elasticity of demand** is positive.
6. If the quantity sold of a commodity increases following an increase in the price of the commodity, then this **does not** indicate that the demand curve for the commodity slopes upward.
7. The "**Y intercept**" of a linear function is equal to the value of "X" when "Y" is equal to zero.
8. The **coefficient of determination** obtained in a regression estimate is calculated as the ratio of the explained errors in the Y variable divided by the total errors in the X variable.
9. The greater the number of periods used in calculating a "**moving average**", the more sensitive the forecast is to the most recent observation.
10. The **weight (w)** that is used to calculate an exponential smoothing forecast defines the contribution of the most recent observation to the forecast.

III. Problem (15 points). An automobile manufacturer produces two types of cars: regular sedans (**S**) and 4-wheel drive jeeps (**J**) at its only factory. Its profits depend on the mix of cars produced and are indicated by the following profit function:

$$\Rightarrow P = 60{,}000\,S + 30{,}000\,J - 12.5\,S^2 - 7.5\,J^2 + 15\,SJ$$

a. **For 5 points**. What is the combination of S and J that maximizes profits if there are no constraints on production?

b. **For 10 points**. Assuming that the factory has a production capacity of 16,500. Would this affect the profit-maximizing combination of cars produced? Show how you reached your conclusion.

IV. Problem ([illegible] points). A major food products company estimated demand for a popular cereal using a multiple linear regression. The estimation was done by using quarterly observations over the period January 19[illegible]6 – December 200[illegible], and the following regression results were [illegible] (the standard error for each coefficient is [illegible]):

$$\Rightarrow Q_c = 2.[illegible] - 0.25\,P_c + 0.5[illegible]\,I + 0.[illegible]\,P_s - [illegible].10\,T$$

(1.0[illegible]) (0.1[illegible]) (0.[illegible]) (0.16) ([illegible])

where: Q_t = sales of cereal in time period t; P_t = unit price of cereal ($); I = per capita income (in 000$), P_{ft} = price of a related food product ($) and T = Time. The R-square value of the regression was 0.80, and the calculated D-W value was 1.55.

a. **For 5 points**. Are the signs of the coefficients of the independent variables in conformity with theoretical expectations? Explain your answer.
b. **For 5 points**. Which of the independent variables (if any) appear to be statistically significant (at the 5% level) in explaining sales of cereal?
c. **For 5 points**. What proportion of the total variation in sales is explained by the regression equation? **In addition**, Calculate the F- statistic, conduct an F-test and interpret its meaning.
d. **For 5 points**. What conclusions can be drawn from the results about the possible presence of autocorrelation?

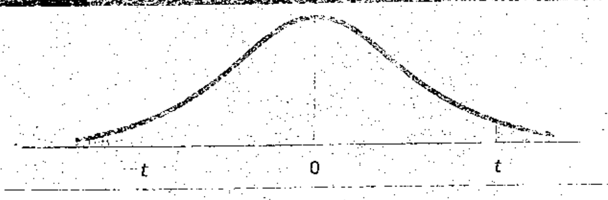
V. **Problem (15 points).** A discount department store sells patio and lawn furniture. Sales are seasonal, with higher sales during the spring and summer quarters and lower sales during the fall and winter quarters. The store developed the following quarterly sales forecasting model using data from 1995 - 2003:

$$Y_t = 8.25 + 0.125\,T - 2.75\,D_{1t} + 2.25\,D_{2t} + 3.50\,D_{3t}$$

Where Y_t = predicted sales in quarter t ($ million), D_{1t}, D_{2t}, and D_{3t} are dummy variables for the first (winter), second (spring), and third (summer) quarters, respectively.

a. For 5 points. What can be inferred from the regression estimates about the secular trend of sales of furniture?
b. For 5 points. Forecast the sales of furniture during the second and fourth quarters of 2004.
c. For 5 points. If the calculated F-statistic of the regression was 13.5, what would have been the calculated coefficient of determination (R-square) and would be your interpretation of that value?

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



Degree of Freedom	.80	.60	.40	.20	.10	.05	.02	.01
				Probabilities				
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	2.14[illegible]	2.624	2.97[illegible]
15	0.258	[illegible]	[illegible]	1.341	1.75[illegible]	[illegible]	[illegible]	[illegible]
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	[illegible]	0.532	0.858	1.321	1.717	2.074	[illegible]	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	2.0[illegible]	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	2.04[illegible]	2.462	2.756
30	0.256	0.530	0.854	1.310	1.697	2.042	[illegible]	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 $t = 2.070$, 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., 1963, published by Longman Group Ltd., London (previously by Oliver & Boyd, Edinburgh), by permission of the authors and publishers.

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Degrees of Freedom for Numerator

Degrees of Freedom for Denominator	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	2.49	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
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," *Biometrika*, vol. 33, 1943, p. 73.

TABLE C.4 Durbin-Watson Test: Critical Values of d_L and d_U for Significance Level $\alpha = .05$

	$k' = 1$		$k' = 2$		$k' = 3$		$k' = 4$		$k' = 5$	
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	0.95	1.54	0.82	1.75	0.69	1.97	0.56	2.21
16	1.10	1.37	0.98	1.54	0.86	1.73	0.74	1.93	0.62	2.15
17	1.13	1.38	1.02	1.54	0.90	1.71	0.78	1.90	0.67	2.10
18	1.16	1.39	1.05	1.53	0.93	1.69	0.82	1.87	0.71	2.06
19	1.18	1.40	1.08	1.53	0.97	1.68	0.86	1.85	0.75	2.02
20	1.20	1.41	1.10	1.54	1.00	1.68	0.90	1.83	0.79	1.99
21	1.22	1.42	1.13	1.54	1.03	1.67	0.93	1.81	0.83	1.96
22	1.24	1.43	1.15	1.54	1.05	1.66	0.96	1.80	0.86	1.94
23	1.26	1.44	1.17	1.54	1.08	1.66	0.99	1.79	0.90	1.92
24	1.27	1.45	1.19	1.55	1.10	1.66	1.01	1.78	0.93	1.90
25	1.29	1.45	1.21	1.55	1.12	1.66	1.04	1.77	0.95	1.89
26	1.30	1.46	1.22	1.55	1.14	1.65	1.06	1.76	0.98	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	1.58	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

Note: n = number of observations, k' = number of independent variables.

Source: J. Durbin and G. S. Watson, "Testing for Serial Correlation in Least Squares Regression," *Biometrika*, vol. 38, 1951, pp. 159–178. Reprinted with the permission of the authors and the trustees of *Biometrika*.