

Your name \_\_\_\_\_

Your Id No. (NOT Soc. Sec. no.) \_\_\_\_\_

Read the questions carefully and answer all points. For each part, confine your answers to the specific question. Marks will be taken off for irrelevant or redundant answers. Also, if you write the answers to one part in another part, you wouldn't get credit. Answers must be specific to the model in the problem. Simply copying down formulas from the index card without applying them to the problem will get you zero points. Don't use general terms such as "estimate basic model", "compute nRsquare statistic", "use weighted least squares", "compute p-value", etc. Clearly state exactly what they are FOR THE SPECIFIC QUESTION. Think of your answers as explaining to a Research Assistant exactly how to proceed.

**CHECK AND MAKE SURE THAT ALL 6 PAGES ARE LEGIBLE. IF ANY OF THEM IS MISSING, GET A NEW COPY.**

**ANYONE CHEATING IN THIS EXAM WILL GET AN F IN THE COURSE AND BE REFERRED TO THE PROVOST FOR DISCIPLINARY ACTION.**

**MAXIMUM NUMBER OF POINTS 50 + 30 + 10 = 90**

- I. Using annual data for Turkey for 1960-1988 (29 observations) the following estimated double-log model was obtained (the log terms are elasticities).

$$\begin{aligned}\ln(\hat{Q}) = & -4.997 + 5.404 D86 + 0.732 \ln(Y) - 0.241 D82 \times \ln(Y) - 0.371 \ln(P) \\ & + 0.500 D82 \times \ln(P) - 0.828 D86 \times \ln(P) - 1.537 D82 \times \ln(ED) \\ & + 5.246 D86 \times \ln(ED)\end{aligned}$$

where

**Q** = Cigarette consumption per adult (kg), the dependent variable

**Y** = Per capita real GNP in 1968 prices ( in Turkish liras),

**P** = Real price of cigarettes in Turkey liras per kg

**ED** = Ratio of enrollments in middle and high schools to the population 12-17 years old

**D82** = 1 for 1982 onward, 0 before 1982

**D86** = 1 for 1986 onward, 0 before 1986

**I.1 (27 points)**

Write down the numerical values of the elasticities of demand for income (Y), price (P), and education (ED) for each of the three periods (enter them in the following table). Pay close attention to the way the dummy variables are defined.

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Variable	1960-81	1982-85	1986-88
Y			
P			
ED			

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**I.2 (5 points)**

In the above table, point out the signs of coefficients that are counter-intuitive and explain why you think so. (you need not offer explanations as to why the signs are wrong.)

You want to use the Lagrange-multiplier test to check the model for second-order auto-correlation with the error term

$$u_t = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \varepsilon_t$$

**I.3 (3 points)**

What is the null hypothesis that you would use?

**I.4 (9 points)**

**Describe step by step how you will carry out the Breusch-Godfrey LM test at the 5 percent level (give numerical values where known). Specifically what regressions you will run, how you will compute the test-statistic, its distribution, and the criterion to reject the null hypothesis. Give full details with your answer being specific to the model in Page 1. ESL commands are acceptable here. Note that this part refers only to testing and not to any estimation.**

**I.5 (6 points)**

**The unadjusted  $R^2$  for the auxiliary regression for the LM test was 0.235. Use this .3 to carry out the test for AR(2) at the 5% level. What do you conclude about serial correlation? Show all your work.**

**II.**

Consider the "desired" savings function  $S_t^* = \alpha + \beta Y_t$ , where  $S_t^*$  is desired saving and  $Y_t$  is actual disposable income. Because  $S_t^*$  is unknown, consumers use the partial adjustment rule as follows.

$$S_t = S_{t-1} + \lambda (S_{t-1}^* - S_{t-1})$$

You have data on  $S_t$  and  $Y_t$  for  $t = 1, 2, \dots, n$ , but none on  $S_t^*$ .

**II.1 (6 points)**

State the signs you expect for  $\alpha$ ,  $\beta$ , and  $\lambda$ , and explain why you think so.

**II.2 (6 points)**

Derive an estimable relation with  $S_t$  as the dependent variable. Add the error term  $u_t$  at the end.

**II.3 (9 points)**

State all the assumptions on  $u_t$  that will make the OLS estimates of the parameters in the model that you obtained in II.2, consistent. Are the estimates unbiased also? Define the terms "consistent" and "unbiased", and carefully justify your answers. You are cautioned that points will be taken off for stating unneeded assumptions.

**II.4 (9 points)**

Suppose the estimates of the model in II.2 are denoted by  $\hat{\beta}_1, \hat{\beta}_2$ , etc. Carefully explain how you can obtain estimates of  $\alpha, \beta$ , and  $\lambda$  in terms of the  $\hat{\beta}$ s.

**III. (10 points)**

Consider the model  $P_t = \alpha + \beta S_t + u_t$ , where P is profits of a company at time t and S is sales. You have quarterly data for 15 years (60 observations). Also, you have found that the model has significant fourth-order autocorrelation with

$$u_t = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \rho_3 u_{t-3} + \rho_4 u_{t-4} + \varepsilon_t$$

Describe step by step how you will apply the Generalized Cochrane-Orcutt (CORC) iterative procedure. You are not asked how to test for AR(4), just how to estimate the unknown parameters using Generalized CORC. Your answer must be specific to the above model and must not include ESL commands.