Assignment 5

PART I: A stationary time-series Y of 450 observations can be adequately modeled by a second order autoregressive, AR(2), process. The autocorrelation and partial autocorrelation functions for the series Y are given below.

The ARIMA Procedure
Name of Variable = Y

Mean of Working Series	92.43435
Standard Deviation	7.827059
Number of Observations	450

Autocorrelations

Lag	Covariance	Correlation	-1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	24.905536	1.00000	|********************|
1	?????????	???????	| . |********** |
2	-1.130614	-.04540	| .* | . |
3	-7.824600	-.31417	| ****** | . |
4	????????	???????	| ***** | . |
5	-1.471459	-.05908	| . * | . |
6	3.246942	0.13037	| . |*** |
7	3.908247	0.15692	| . |*** |
8	1.479795	0.05942	| . |* . |
9	-0.558917	-.02244	| . | . |
10	-1.467693	-.05893	| . * | . |
11	-1.923781	-.07724	| .** | . |
12	-0.257916	-.01036	| . | . |
13	1.801163	0.07232	| . |* . |
14	2.762085	0.11090	| . |**. |
15	1.248438	0.04902	| . |* . |

Partial Autocorrelations

Lag	Correlation	-1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
1	0.54302	| . |********** |
2	-0.48256	| ********** | . |
3	-0.02881	| .* | . |
4	-0.05285	| .* | . |
5	0.06117	| . |*. |
6	0.03922	| . |*. |
7	-0.01704	| . | . |
8	-0.00644	| . | . |
9	0.03800	| . |*. |
10	-0.02538	| .* | . |
11	-0.05299	| .* | . |
12	0.08417	| . |** |
13	0.01445	| . | . |
14	0.05084	| . |*. |
15	0.02045	| . | . |

(a) Based on the output, discuss why it is appropriate to use an AR(2) process to model time-series Y. What is the estimate of autocorrelation at lag 1 for Y series ?

(b) Write down the Yule-Walker equations for Y based on the given output and information, and estimate the coefficients ϕ_1 and ϕ_2 for the AR(2) process.

(c) Estimate the constant term and write down the estimated AR(2) model for Y. Write down the estimated conditional mean for Y_t, that is, write down μ_t.

(d) Estimate the autocorrelation at lag 4 for Y series.

(e) Assume that an analyst incorrectly models the Y series using a fourth-order autoregressive process, that is, by an AR(4) process. What will be the analyst's estimate of the coefficient ϕ_4, that is, coefficient at lag 4, for that process ? Will ϕ_4 be statistically different than zero ? Discuss why or why not.

PART II: Monthly Change in Earnings Index for British Workers

In this assignment we will be interested in modeling the monthly change in earnings index (CEAR) for British workers over the period of January 1989 to October 2004 using a regression model. The time-series data is available in the file "UKEAR.TXT". The data consist of the following variables: Change in earnings index (CEAR), unemployment rate (UNEMP), inflation rate (INFL) and political party in power (PARTY). The independent variable PARTY takes a value 1 if the Labor party is in the government during a period and the value 0 if the Conservative party is in the government. In any statistical inference you can use a level of significance $\alpha = 0.05$.

(a) Estimate the regression model CEAR by using the other three variables as independent variables, that is, estimate the model

$$\text{CEAR}_t = \beta_0 + \beta_1 \text{UNEMP}_t + \beta_2 \text{INFL}_t + \beta_3 \text{PARTY}_t + \epsilon_t.$$

Discuss if all three variables are significant at $\alpha = 0.05$.

(b) Save the residuals from the estimated regression model and discuss why the residuals are not white noise.

(c) Analyze the autocorrelation function (ACF) and the partial correlation function (PACF) of the residual series from part (a) and based on your analysis identify an autoregressive (AR) process to model the residual series.

(d) Based on your analysis in part (c), estimate corrected regression model (according to the order of the AR process that you have identified) using PROC AUTOREG. In the PROC AUTOREG use METHOD=ULS in your MODEL statement.

(e) Save the residuals of the corrected model and analyze them to check whether they are white noise.

(f) Write down the estimated corrected model and discuss if all three variables are significant at $\alpha = 0.05$.

PLEASE SUBMIT YOUR TYPED REPORT (NO MORE THAN 6 PAGES INCLUDING <u>ONLY</u> THE RELEVANT SAS OUTPUT)