Time Series Analysis,
Fall 2008
Test 2

Name:………………………………………

Do not use computers.

Group work is not allowed.

1 Find the Seasonal Index for July, August, and September of 1994.

Period		Sales	Seasonal Index
1994	January	154	
	February	96	
	March	73	
	April	49	
	May	36	
	June	59	
	July	95	
	August	169	
	September	210	
	October	278	
	November	298	*
	December	245	*
1999	January	200	*
	February	118	*
	March	90	*
	April	79	*
	May	78	*
	June	91	*
	July	167	
	August	169	
	September	289	
	October	347	
	November	375	
	December	203	

2 Find the Adjusted Seasonal Index

	Monthly Seasonal Indices						Adjusted Seasonal Index
	1994	1995	1996	1997	1998	1999	
January	----	1.208	1.202	1.272	1.411	1.431	
February	----	0.700	0.559	0.938	1.089	0.903	
March	----	0.524	0.564	0.785	0.800	0.613	
April	----	0.444	0.433	0.480	0.552	0.697	
May	----	0.424	0.365	0.488	0.503	0.396	
June	----	0.490	0.459	0.461	0.465	0.528	
July	0.639	0.904	0.598	0.681	0.603	----	
August	1.115	0.913	0.889	0.799	0.830	----	
September	1.371	1.560	1.346	1.272	1.128	----	
October	1.792	1.863	1.796	1.574	1.638	----	
November	1.884	2.012	1.867	1.697	1.695	----	
December	1.519	1.088	1.224	1.282	1.445	----	

3 Fill in the blanks using the multiplicative decomposition

Trend Line Equation $Y_t = 253.74 + 1.26t$.

Seasonal Indices

Period	Index
1	0.78
2	1.02
3	1.12
4	1.09

t	Year	Quarter	Sales	T	SCI	S	TCI	CI	C	I
1	1990	1	232.7							
2		2	309.2							
3		3	310.7							
4		4	293.0							
5	1991	1	205.1						*	*
6		2	234.4	*	*	*	*	*	*	*
*		3	285.4	*	*	*	*	*	*	*
*		4	258.7	*	*	*	*	*	*	*
*		*	*	*	*	*	*	*	*	*

4 Consider the following data:

X	Y
-4	0.5
-3	1.6
-2	2.3
-1	3.0
0	4.0
1	5.2
2	6.4
3	7.6
4	9.0

(a) Find the simple linear regression line.
(b) Construct the ANOVA table.
(c) Estimate σ^2.
(d) Find the standard error of the slope.
(e) Test whether the slope is equal to zero at 0.05 level of significance.
(f) Find the coefficient of determination.
(g) Find the correlation between X and Y.
(h) Estimate the fitted values.
(i) Estimate the errors.
(j) Forecast the value of Y for $X = 5.0$.
(k) Find the standard error of the forecast at $X = 5$.
(l) Construct a 95% prediction interval for Y when $X = 5.0$.
(m) Calculate sample autocorrelations and test for independence of the residuals.
(n) Plot the residuals verses the fitted values.
(o) Is the linear model appropriate? If not why?
(p) Find h_{11}.
(q) Find the adjusted R^2.

5 Consider the following data set.

Y	X1	X2
42	-1	-1
39	-1	-1
48	-1	1
51	-1	1
49	1	-1
53	1	-1
61	1	1
60	1	1

It is given to you that the individual simple linear regression fits are:
a) $\hat{Y} = 50.375 + 5.375X_1$ and b) $\hat{Y} = 50.375 + 4.625X_2$.

Everything you do from this point onwards will be about the following model:
c) $E(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$.

(a) Estimate the parameters of the multiple regression model $E(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$.

(b) Find h_{11}.

(c) Find the fitted values.

(d) Estimate the residuals.

(e) Construct the ANOVA table.

(f) Estimate σ^2.

(g) Test whether β_1=0 and β_2=0 simultaneously at 0.05 level of significance.

(h) Test whether β_1= 4 at 0.05 level of significance.

(i) Predict Y when X_1= 0.5 and X_2= 0.5.

(j) Construct a 95% prediction interval for Y when X_1= 0.5 and X_2= 0.5.

(k) Find the adjusted R^2.

(l) Find $Corr(X_1, X_2)$.

(m) Discuss multicollinearity for this data. Comment on the parameter estimates of the three models

(n) Find the studentized residual for the first observation.

6 Consider the following Model:

Y = Dependent variable
X = Independent variable

$$Z = \begin{cases} 1 \text{ for Group 1} \\ 0 \text{ for Group 2} \end{cases}$$

$XZ = X * Z$

Fit the model $E(Y) = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 XZ$

Fitted model is

$\hat{Y} = 33.8383 - 0.1015X + 8.1313Z - 0.0004XZ$

(a) Find the regression line for Group 1.
(b) Find the regression line for Group 2.
(c) What are you testing with $\beta_3 = 0$ verses $\beta_3 \neq 0$.
(d) What are you testing with $\beta_2 = 0$ verses $\beta_2 \neq 0$.