

```

1 *****;
2 *** EXST7034 Homework Example ***;
3 *** Problem from Neter, Wasserman & Kuttner 1989, 13.92 ***;
4 *****;
5
6 dm'log;clear;output;clear';
7 options nodate nocenter nonumber ps=512 ls=99 nolabel;
8 ODS HTML style=minimal rs=none
9 ! body='C:\Geaghan\Current\EXST7034\Fall2005\SAS\TimeSeries01.html' ;
NOTE: Writing HTML Body file: C:\Geaghan\Current\EXST7034\Fall2005\SAS\TimeSeries01.html
10
11 DATA ONE; INFILE CARDS MISSOVER;
12     TITLE1 'EXST7034 - Homework Example NWK 13.9 : Microcomputer components';
13     LABEL X = 'Industry production (millions $)';
14     LABEL Y = 'Value of components used ($1000)';
15     INPUT Y X;          t+1;
16     X1 = LAG1(X);      LABEL X1 = 'X lagged 1 interval';
17     Y1 = LAG1(Y);      LABEL Y1 = 'Y lagged 1 interval';
18     CARDS;
NOTE: The data set WORK.ONE has 16 observations and 5 variables.
NOTE: DATA statement used (Total process time):
      real time          0.01 seconds
      cpu time           0.02 seconds
17     !          RUN;
34     ;
35     PROC PRINT DATA=ONE; VAR Y X t; TITLE2 'Raw Data Listing'; RUN;
NOTE: There were 16 observations read from the data set WORK.ONE.
NOTE: The PROCEDURE PRINT printed page 1.
NOTE: PROCEDURE PRINT used (Total process time):
      real time          0.10 seconds
      cpu time           0.02 seconds

```

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Raw Data Listing

Obs	Y	X	t
1	102.9	2.052	1
2	101.5	2.026	2
3	100.8	2.002	3
4	98.0	1.949	4
5	97.3	1.942	5
6	93.5	1.887	6
7	97.5	1.986	7
8	102.2	2.053	8
9	105.0	2.102	9
10	107.2	2.113	10
11	105.1	2.058	11
12	103.9	2.060	12
13	103.0	2.035	13
14	104.8	2.080	14
15	105.0	2.102	15
16	107.2	2.150	16

```

36     OPTIONS LS=99 PS=61;
37
38     PROC REG DATA=ONE; TITLE2 'Simple Linear regression';
39     MODEL Y = X / P R DW;
40     OUTPUT OUT=RESIDS PREDICTED=YHAT RESIDUAL=E; OPTIONS LS=99 PS=35;
41     RUN;
42
NOTE: The data set WORK.RESIDS has 16 observations and 7 variables.
NOTE: The PROCEDURE REG printed pages 2-5.
NOTE: PROCEDURE REG used (Total process time):
      real time          0.12 seconds
      cpu time           0.06 seconds

```

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Simple Linear regression

The REG Procedure

Model: MODEL1
Dependent Variable: Y

Number of Observations Read 16
Number of Observations Used 16

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	213.99470	213.99470	234.98	<.0001
Error	14	12.74967	0.91069		
Corrected Total	15	226.74437			

Root MSE 0.95430 R-Square 0.9438
Dependent Mean 102.18125 Adj R-Sq 0.9398
Coeff Var 0.93393

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	-7.73852	7.17464	-1.08	0.2990
X	1	53.95332	3.51967	15.33	<.0001

Durbin-Watson D 0.857
Number of Observations 16
1st Order Autocorrelation 0.527

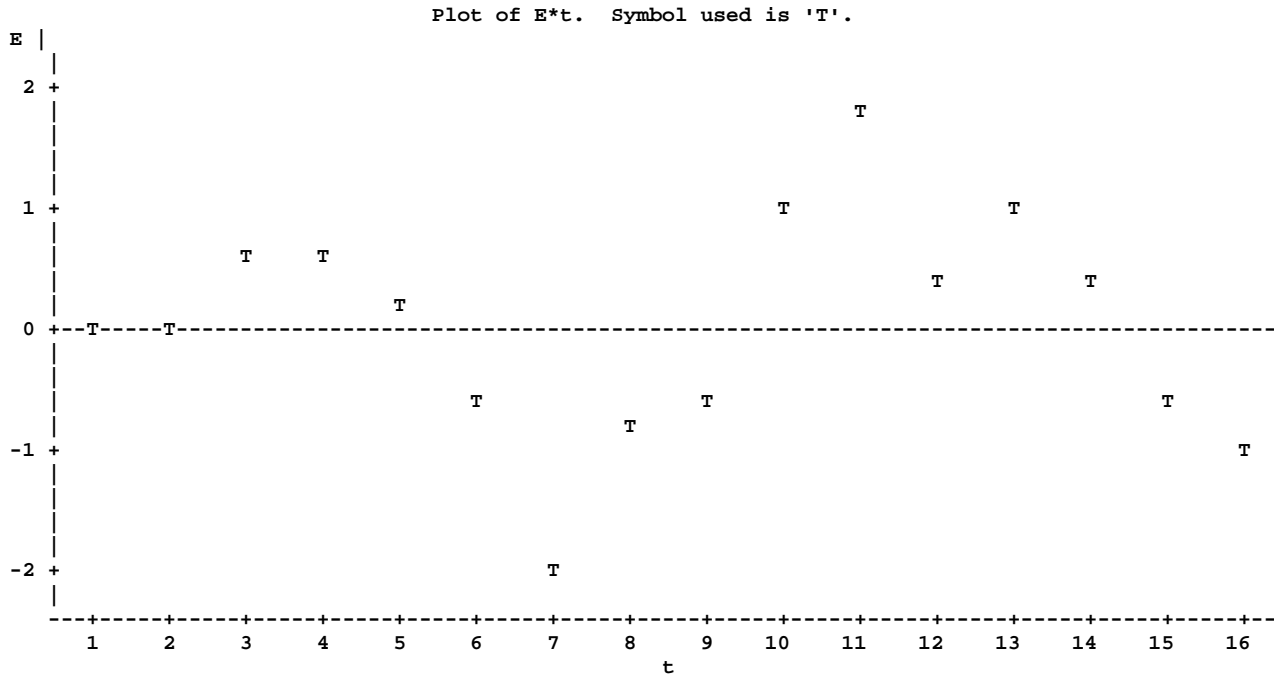
OutputStatistics

Obs	Dependent Variable	Predicted Value	Std Error Mean Predict	Residual	Std Error Residual	Student Residual	-2	-1	0	1	2	Cook's D
1	102.9000	102.9737	0.2441	-0.0737	0.923	-0.0799						0.000
2	101.5000	101.5709	0.2419	-0.0709	0.923	-0.0768						0.000
3	100.8000	100.2760	0.2690	0.5240	0.916	0.572						0.014
4	98.0000	97.4165	0.3918	0.5835	0.870	0.671				*		0.046
5	97.3000	97.0388	0.4117	0.2612	0.861	0.303						0.011
6	93.5000	94.0714	0.5804	-0.5714	0.758	-0.754			*			0.167
7	97.5000	99.4128	0.2992	-1.9128	0.906	-2.111			****			0.243
8	102.2000	103.0276	0.2449	-0.8276	0.922	-0.897			*			0.028
9	105.0000	105.6714	0.3298	-0.6714	0.896	-0.750			*			0.038
10	107.2000	106.2648	0.3576	0.9352	0.885	1.057			**			0.091
11	105.1000	103.2974	0.2494	1.8026	0.921	1.957			***			0.140
12	103.9000	103.4053	0.2516	0.4947	0.921	0.537			*			0.011
13	103.0000	102.0565	0.2387	0.9435	0.924	1.021			**			0.035
14	104.8000	104.4844	0.2819	0.3156	0.912	0.346						0.006
15	105.0000	105.6714	0.3298	-0.6714	0.896	-0.750			*			0.038
16	107.2000	108.2611	0.4628	-1.0611	0.835	-1.271			**			0.249

Sum of Residuals 0
Sum of Squared Residuals 12.74967
Predicted Residual SS (PRESS) 16.46858

43 PROC PLOT DATA=RESIDS; PLOT E*t='T' / VREF=0; RUN;
NOTE: There were 16 observations read from the data set WORK.RESIDS.
NOTE: The PROCEDURE PLOT printed page 6.
NOTE: PROCEDURE PLOT used (Total process time):
real time 0.07 seconds
cpu time 0.00 seconds

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Simple Linear regression

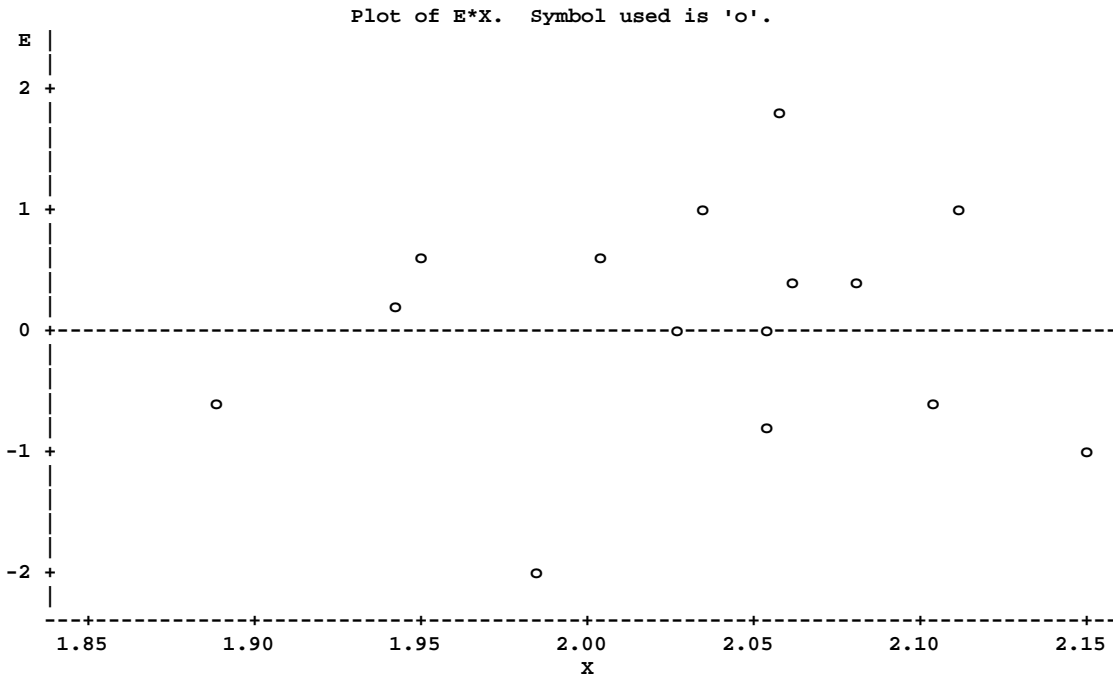


```

44      PROC PLOT DATA=RESIDS; PLOT E*X='o' / VREF=0; RUN;
45      OPTIONS LS=99 PS=61;
NOTE: There were 16 observations read from the data set WORK.RESIDS.
NOTE: The PROCEDURE PLOT printed page 7.
NOTE: PROCEDURE PLOT used (Total process time):
      real time      0.07 seconds
      cpu time       0.00 seconds

```

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Simple Linear regression



NOTE: 1 obs hidden.

```

47      DATA RESIDS; SET RESIDS; E1 = LAG1(E); RUN;
NOTE: There were 16 observations read from the data set WORK.RESIDS.
NOTE: The data set WORK.RESIDS has 16 observations and 8 variables.
NOTE: DATA statement used (Total process time):
      real time          0.01 seconds
      cpu time           0.02 seconds
49      PROC REG DATA=RESIDS OUTEST=PARM1; TITLE2 'Cochrane-Orcutt : Step 1';
50      MODEL E = E1 / NOINT;
51      RUN;
NOTE: The data set WORK.PARM1 has 1 observations and 6 variables.
NOTE: The PROCEDURE REG printed page 8.
NOTE: PROCEDURE REG used (Total process time):
      real time          0.11 seconds
      cpu time           0.07 seconds

```

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Cochrane-Orcutt : Step 1

The REG Procedure
Model: MODEL1
Dependent Variable: E

Number of Observations Read	16
Number of Observations Used	15
Number of Observations with Missing Values	1

NOTE: No intercept in model. R-Square is redefined.

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3.88881	3.88881	6.15	0.0265
Error	14	8.85543	0.63253		
Uncorrected Total	15	12.74424			

Root MSE	0.79532	R-Square	0.3051
Dependent Mean	0.00491	Adj R-Sq	0.2555
Coeff Var	16189		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
E1	1	0.57841	0.23328	2.48	0.0265

```

53      DATA TWOA; SET ONE; RHO1=0.578411; YA=Y-Y1*RHO1; XA=X-X1*RHO1;
54      RUN;
NOTE: Missing values were generated as a result of performing an operation on missing values.
      Each place is given by: (Number of times) at (Line):(Column).
      1 at 53:43  1 at 53:57
NOTE: There were 16 observations read from the data set WORK.ONE.
NOTE: The data set WORK.TWOA has 16 observations and 8 variables.
NOTE: DATA statement used (Total process time):
      real time          0.00 seconds
      cpu time           0.01 seconds
55      PROC REG DATA=TWOA; TITLE2 'Cochrane-Orcutt : Step 2';
56      MODEL YA = XA / R DW; OUTPUT OUT=RESIDS P=YHAT R=E;
57      RUN;
58
NOTE: The data set WORK.RESIDS has 16 observations and 10 variables.
NOTE: The PROCEDURE REG printed pages 9-11.
NOTE: PROCEDURE REG used (Total process time):
      real time          0.16 seconds
      cpu time           0.06 seconds

```

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Cochrane-Orcutt : Step 2

The REG Procedure

Model: MODEL1
Dependent Variable: YA

Number of Observations Read 16
Number of Observations Used 15
Number of Observations with Missing Values 1

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	89.88963	89.88963	137.16	<.0001
Error	13	8.51994	0.65538		
Corrected Total	14	98.40957			

Root MSE 0.80956 R-Square 0.9134
Dependent Mean 43.22410 Adj R-Sq 0.9068
Coeff Var 1.87293

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	-0.69432	3.75588	-0.18	0.8562
XA	1	50.93322	4.34904	11.71	<.0001

Durbin-Watson D 1.475
Number of Observations 15
1st Order Autocorrelation 0.252

OutputStatistics

Obs	Variable	Dependent Value	Predicted Value	Std Error Mean Predict	Residual	Std Error Residual	Student Residual	Cook's D
1
2	41.9815	42.0438	0.2321	-0.0623	0.776	-0.0803	0.000	
3	42.0913	41.5873	0.2514	0.5039	0.770	0.655	0.023	
4	39.6962	39.5949	0.3738	0.1012	0.718	0.141	0.003	
5	40.6157	40.7998	0.2942	-0.1841	0.754	-0.244	0.005	
6	37.2206	38.2047	0.4768	-0.9841	0.654	-1.504	0.601	
7	43.4186	44.8674	0.2518	-1.4488	0.769	-1.883	0.190	
8	45.8049	45.3634	0.2776	0.4416	0.760	0.581	0.022	
9	45.8864	45.8852	0.3087	0.001160	0.748	0.00155	0.000	
10	46.4668	45.0019	0.2583	1.4649	0.767	1.909	0.207	
11	43.0943	41.8766	0.2386	1.2178	0.774	1.574	0.118	
12	43.1090	43.5987	0.2115	-0.4897	0.781	-0.627	0.014	
13	42.9031	42.2665	0.2245	0.6366	0.778	0.818	0.028	
14	45.2237	45.2950	0.2738	-0.0713	0.762	-0.0936	0.001	
15	44.3825	45.0898	0.2628	-0.7073	0.766	-0.924	0.050	
16	46.4668	46.8865	0.3761	-0.4196	0.717	-0.585	0.047	
Sum of Residuals				0				
Sum of Squared Residuals				8.51994				
Predicted Residual SS (PRESS)				11.57945				

```
59 DATA TWOB; SET TWOA; YA1 = LAG1(YA); XA1 = LAG1(XA);
60 RHO2=0.252; YB=YA-YA1*RHO2; XB=XA-XA1*RHO2;
61 RUN;
```

NOTE: Missing values were generated as a result of performing an operation on missing values.
Each place is given by: (Number of times) at (Line):(Column).
2 at 60:27 2 at 60:43

NOTE: There were 16 observations read from the data set WORK.TWOA.

NOTE: The data set WORK.TWOB has 16 observations and 13 variables.

NOTE: DATA statement used (Total process time):

real time 0.00 seconds
cpu time 0.01 seconds

```

63      PROC REG  DATA=TWOB; TITLE2 'Cochrane-Orcutt : Step 2+';
64      MODEL YB = XB / R DW; OUTPUT OUT=RESIDS P=YHAT R=E;
65      RUN;
NOTE: The data set WORK.RESIDS has 16 observations and 15 variables.
NOTE: The PROCEDURE REG printed pages 12-14.
NOTE: PROCEDURE REG used (Total process time):
      real time          0.09 seconds
      cpu time           0.05 seconds

```

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Cochrane-Orcutt : Step 2+

The REG Procedure
Model: MODEL1
Dependent Variable: YB

Number of Observations Read 16
Number of Observations Used 14
Number of Observations with Missing Values 2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	68.95168	68.95168	104.62	<.0001
Error	12	7.90867	0.65906		
Corrected Total	13	76.86035			

Root MSE	0.81182	R-Square	0.8971
Dependent Mean	32.47875	Adj R-Sq	0.8885
Coeff Var	2.49955		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.38040	3.14562	0.12	0.9057
XB	1	49.53977	4.84331	10.23	<.0001

Durbin-Watson D 1.856
Number of Observations 14
1st Order Autocorrelation 0.056

OutputStatistics

Obs	Dependent Variable	Predicted Value	Std Error Mean Predict	Residual	Std Error Residual	Student Residual	-2	-1	0	1	2	Cook's D
1	.	.	.	.	.	.						.
2	.	.	.	.	.	.						.
3	31.5119	31.0300	0.2591	0.4820	0.769	0.626				*		0.022
4	29.0892	29.2039	0.3868	-0.1148	0.714	-0.161						0.004
5	30.6123	30.8642	0.2683	-0.2519	0.766	-0.329						0.007
6	26.9854	28.0448	0.4848	-1.0593	0.651	-1.627			***			0.733
7	34.0390	35.1613	0.3404	-1.1223	0.737	-1.523			***			0.247
8	34.8634	34.0106	0.2636	0.8529	0.768	1.111			**			0.073
9	34.3436	34.3966	0.2868	-0.0531	0.759	-0.0699						0.000
10	34.9035	33.4096	0.2353	1.4939	0.777	1.923			***			0.169
11	31.3847	30.5862	0.2852	0.7985	0.760	1.051			**			0.078
12	32.2492	33.0273	0.2235	-0.7781	0.780	-0.997			*			0.041
13	32.0396	31.3094	0.2452	0.7302	0.774	0.944			*			0.045
14	34.4121	34.5816	0.2989	-0.1695	0.755	-0.225						0.004
15	32.9862	33.6397	0.2449	-0.6535	0.774	-0.844			*			0.036
16	35.2824	35.4375	0.3616	-0.1551	0.727	-0.213						0.006

Sum of Residuals 0
Sum of Squared Residuals 7.90867
Predicted Residual SS (PRESS) 11.30387

```

69      DATA THREE; SET ONE; Y10=Y-Y1*0.10; X10=X-X1*0.10;
70      Y20=Y-Y1*0.20; X20=X-X1*0.20;
71      Y30=Y-Y1*0.30; X30=X-X1*0.30;
72      Y40=Y-Y1*0.40; X40=X-X1*0.40;
73      Y50=Y-Y1*0.50; X50=X-X1*0.50;
74      Y55=Y-Y1*0.55; X55=X-X1*0.55;
75      Y58=Y-Y1*0.58; X58=X-X1*0.58;
76      Y60=Y-Y1*0.60; X60=X-X1*0.60;
77      Y61=Y-Y1*0.61; X61=X-X1*0.61;
78      Y62=Y-Y1*0.62; X62=X-X1*0.62;
79      Y63=Y-Y1*0.63; X63=X-X1*0.63;
80      Y64=Y-Y1*0.64; X64=X-X1*0.64;
81      Y65=Y-Y1*0.65; X65=X-X1*0.65;
82      Y66=Y-Y1*0.66; X66=X-X1*0.66;
83      Y68=Y-Y1*0.68; X68=X-X1*0.68;
84      Y70=Y-Y1*0.70; X70=X-X1*0.70;
85      Y75=Y-Y1*0.75; X75=X-X1*0.75;
86      Y80=Y-Y1*0.80; X80=X-X1*0.80;
87      Y85=Y-Y1*0.85; X85=X-X1*0.85;
88      Y90=Y-Y1*0.90; X90=X-X1*0.90;
89      Y92=Y-Y1*0.92; X92=X-X1*0.92;
90      Y94=Y-Y1*0.94; X94=X-X1*0.94;
91      Y95=Y-Y1*0.95; X95=X-X1*0.95;
92      Y96=Y-Y1*0.96; X96=X-X1*0.96;
93      Y97=Y-Y1*0.97; X97=X-X1*0.97;
94      RUN;

```

NOTE: Missing values were generated as a result of performing an operation on missing values.

Each place is given by: (Number of times) at (Line):(Column).

1 at 69:30	1 at 69:45	1 at 70:30	1 at 70:45	1 at 71:30	1 at 71:45	1 at 72:30
1 at 72:45	1 at 73:30	1 at 73:45	1 at 74:30	1 at 74:45	1 at 75:30	1 at 75:45
1 at 76:30	1 at 76:45	1 at 77:30	1 at 77:45	1 at 78:30	1 at 78:45	1 at 79:30
1 at 79:45	1 at 80:30	1 at 80:45	1 at 81:30	1 at 81:45	1 at 82:30	1 at 82:45
1 at 83:30	1 at 83:45	1 at 84:30	1 at 84:45	1 at 85:30	1 at 85:45	1 at 86:30
1 at 86:45	1 at 87:30	1 at 87:45	1 at 88:30	1 at 88:45	1 at 89:30	1 at 89:45
1 at 90:30	1 at 90:45	1 at 91:30	1 at 91:45	1 at 92:30	1 at 92:45	1 at 93:30
1 at 93:45						

NOTE: There were 16 observations read from the data set WORK.ONE.

NOTE: The data set WORK.THREE has 16 observations and 55 variables.

NOTE: DATA statement used (Total process time):

```

real time      0.00 seconds
cpu time       0.01 seconds

```

```

95
96      PROC REG DATA=THREE outest=parms noprint;
97      TITLE2 'Hildreth - Lu procedure';
98      MODEL Y10 = X10 / DW;
99      MODEL Y20 = X20 / DW;
100     MODEL Y30 = X30 / DW;
101     MODEL Y40 = X40 / DW;
102     MODEL Y50 = X50 / DW;
103     MODEL Y55 = X55 / DW;
104     MODEL Y58 = X58 / DW;
105     MODEL Y60 = X60 / DW;
106     MODEL Y61 = X61 / DW;
107     MODEL Y62 = X62 / DW;
108     MODEL Y63 = X63 / DW;
109     MODEL Y64 = X64 / DW;
110     MODEL Y65 = X65 / DW;
111     MODEL Y66 = X66 / DW;
112     MODEL Y68 = X68 / DW;
113     MODEL Y70 = X70 / DW;
114     MODEL Y75 = X75 / DW;
115     MODEL Y80 = X80 / DW;
116     MODEL Y85 = X85 / DW;
117     MODEL Y90 = X90 / DW;
118     MODEL Y92 = X92 / DW;
119     MODEL Y94 = X94 / DW;
120     MODEL Y95 = X95 / DW;
121     MODEL Y96 = X96 / DW;
122     MODEL Y97 = X97 / DW;
123     RUN;

```

NOTE: The data set WORK.PARMS has 25 observations and 55 variables.

NOTE: PROCEDURE REG used (Total process time):

real time 0.09 seconds
cpu time 0.02 seconds

```
124 proc print data=parms;
125 var _MODEL_ _DEPVAR_ _RMSE_;
126 run;
```

NOTE: There were 25 observations read from the data set WORK.PARMS.

NOTE: The PROCEDURE PRINT printed page 15.

NOTE: PROCEDURE PRINT used (Total process time):

real time 0.05 seconds
cpu time 0.02 seconds

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Hildreth - Lu procedure

Obs	_MODEL_	_DEPVAR_	_RMSE_
1	MODEL1	Y10	0.94084
2	MODEL2	Y20	0.89794
3	MODEL3	Y30	0.86231
4	MODEL4	Y40	0.83489
5	MODEL5	Y50	0.81670
6	MODEL6	Y55	0.81139
7	MODEL7	Y58	0.80948
8	MODEL8	Y60	0.80876
9	MODEL9	Y61	0.80857
10	MODEL10	Y62	0.80849
11	MODEL11	Y63	0.80852
12	MODEL12	Y64	0.80867
13	MODEL13	Y65	0.80894
14	MODEL14	Y66	0.80932
15	MODEL15	Y68	0.81043
16	MODEL16	Y70	0.81202
17	MODEL17	Y75	0.81806
18	MODEL18	Y80	0.82710
19	MODEL19	Y85	0.83911
20	MODEL20	Y90	0.85400
21	MODEL21	Y92	0.86074
22	MODEL22	Y94	0.86791
23	MODEL23	Y95	0.87165
24	MODEL24	Y96	0.87550
25	MODEL25	Y97	0.87944

```
128 DATA FOUR; SET ONE; YF=Y-Y1; XF=X-X1; RUN;
```

NOTE: Missing values were generated as a result of performing an operation on missing values.

Each place is given by: (Number of times) at (Line):(Column).

1 at 128:25 1 at 128:34

NOTE: There were 16 observations read from the data set WORK.ONE.

NOTE: The data set WORK.FOUR has 16 observations and 7 variables.

NOTE: DATA statement used (Total process time):

real time 0.02 seconds
cpu time 0.03 seconds

```
129 PROC REG DATA=FOUR; TITLE2 'First Difference Procedure';
130 MODEL YF = XF / DW;
131 RUN;
```

NOTE: The PROCEDURE REG printed pages 16-17.

NOTE: PROCEDURE REG used (Total process time):

real time 0.16 seconds
cpu time 0.05 seconds

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
First Difference Procedure

The REG Procedure

Model: MODEL1
Dependent Variable: YF

Number of Observations Read 16
Number of Observations Used 15
Number of Observations with Missing Values 1

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	79.19651	79.19651	99.56	<.0001
Error	13	10.34082	0.79545		
Corrected Total	14	89.53733			

Root MSE 0.89188 R-Square 0.8845
Dependent Mean 0.28667 Adj R-Sq 0.8756
Coeff Var 311.12052

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	-0.03951	0.23259	-0.17	0.8677
XF	1	49.92510	5.00347	9.98	<.0001

Durbin-Watson D 1.754
Number of Observations 15
1st Order Autocorrelation 0.122

OutputStatistics

Obs	Dependent Variable		Std Error		Std Error		Student Residual	-2 -1 0 1 2					Cook's D
	Variable	Predicted Value	Mean	Predict	Residual	Residual							
1
2
3	31.5119	31.0300	0.2591	0.4820	0.769	0.626			*			0.022	
4	29.0892	29.2039	0.3868	-0.1148	0.714	-0.161						0.004	
5	30.6123	30.8642	0.2683	-0.2519	0.766	-0.329						0.007	
6	26.9854	28.0448	0.4848	-1.0593	0.651	-1.627		***				0.733	
7	34.0390	35.1613	0.3404	-1.1223	0.737	-1.523		***				0.247	
8	34.8634	34.0106	0.2636	0.8529	0.768	1.111			**			0.073	
9	34.3436	34.3966	0.2868	-0.0531	0.759	-0.0699						0.000	
10	34.9035	33.4096	0.2353	1.4939	0.777	1.923			***			0.169	
11	31.3847	30.5862	0.2852	0.7985	0.760	1.051			**			0.078	
12	32.2492	33.0273	0.2235	-0.7781	0.780	-0.997		*				0.041	
13	32.0396	31.3094	0.2452	0.7302	0.774	0.944			*			0.045	
14	34.4121	34.5816	0.2989	-0.1695	0.755	-0.225						0.004	
15	32.9862	33.6397	0.2449	-0.6535	0.774	-0.844		*				0.036	
16	35.2824	35.4375	0.3616	-0.1551	0.727	-0.213						0.006	

Sum of Residuals 0
Sum of Squared Residuals 7.90867
Predicted Residual SS (PRESS) 11.30387

```

133 proc autoreg data=one; title2 'Time series with SAS AUTOREG (lag of 1)';
134 model Y = X / nlag=1 method=ml;
135 output out=next1 p=yhat pm=pm r=r rm=rm ucl=ucl lcl=lcl
136 uclm=uclm lclm=lclm;
137 run;

```

NOTE: The data set WORK.NEXT1 has 16 observations and 13 variables.
NOTE: The PROCEDURE AUTOREG printed pages 18-19.
NOTE: PROCEDURE AUTOREG used (Total process time):
real time 0.14 seconds
cpu time 0.05 seconds

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Time series with SAS AUTOREG (lag of 1)

The AUTOREG Procedure

Dependent Variable Y

Ordinary Least Squares Estimates					
SSE	12.7496735	DFE			14
MSE	0.91069	Root MSE			0.95430
SBC	47.3178816	AIC			45.7727042
Regress R-Square	0.9438	Total R-Square			0.9438
Durbin-Watson	0.8566				

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	-7.7385	7.1746	-1.08	0.2990
X	1	53.9533	3.5197	15.33	<.0001

Estimates of 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	0.7969	1.000000	|																						*****
1	0.4202	0.527329	|																						*****

Preliminary MSE 0.5753

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.527329	0.235654	-2.24

Algorithm converged.

Maximum Likelihood Estimates					
SSE	8.51703426	DFE			13
MSE	0.65516	Root MSE			0.80942
SBC	44.0489416	AIC			41.7311754
Regress R-Square	0.9132	Total R-Square			0.9624
Durbin-Watson	1.4796				

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	-1.6062	9.4906	-0.17	0.8682
X	1	50.9161	4.6237	11.01	<.0001
AR1	1	-0.5819	0.2395	-2.43	0.0304

Autoregressive parameters assumed given.

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	-1.6062	8.9226	-0.18	0.8599
X	1	50.9161	4.3539	11.69	<.0001

```
139      proc print data=next1; title3 'Output listing'; run;
NOTE: There were 16 observations read from the data set WORK.NEXT1.
NOTE: The PROCEDURE PRINT printed page 20.
NOTE: PROCEDURE PRINT used (Total process time):
      real time          0.09 seconds
      cpu time           0.02 seconds
```

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Time series with SAS AUTOREG (lag of 1)
Output listing

Obs	yhat	r	lcl	ucl	lclm	uclm	pm	rm	X	Y	t	X1	Y1
1	102.874	0.02143	100.515	105.233	101.903	103.844	102.874	0.02635	2.052	102.9	1	.	.
2	101.565	-0.06517	99.551	103.580	100.550	102.550	101.550	-0.04984	2.026	101.5	2	2.052	102.9
3	100.299	0.50115	98.242	102.356	99.245	101.411	100.328	0.47215	2.002	100.8	3	2.026	101.5
4	97.904	0.09594	95.663	100.145	96.228	99.031	97.629	0.37071	1.949	98.0	4	2.002	100.8
5	97.489	-0.18861	95.215	99.762	95.820	98.726	97.273	0.02712	1.942	97.3	5	1.949	98.0
6	94.488	-0.98828	91.908	97.069	92.575	96.370	94.472	-0.97250	1.887	93.5	6	1.942	97.3
7	98.947	-1.44726	96.847	101.048	98.350	100.677	99.513	-2.01319	1.986	97.5	7	1.887	93.5
8	101.753	0.44698	99.753	103.753	101.954	103.895	102.925	-0.72457	2.053	102.2	8	1.986	97.5
9	104.998	0.00219	102.932	107.063	104.320	106.519	105.419	-0.41946	2.102	105.0	9	2.053	102.2
10	105.735	1.46456	103.640	107.831	104.825	107.134	105.980	1.22046	2.113	107.2	10	2.102	105.0
11	103.889	1.21062	101.888	105.891	102.206	104.152	103.179	1.92085	2.058	105.1	11	2.113	107.2
12	104.399	-0.49879	102.397	106.401	102.306	104.256	103.281	0.61902	2.060	103.9	12	2.058	105.1
13	102.368	0.63169	100.363	104.374	101.026	102.990	102.008	0.99192	2.035	103.0	13	2.060	103.9
14	104.877	-0.07654	102.855	106.898	103.285	105.314	104.299	0.50069	2.080	104.8	14	2.035	103.0
15	105.711	-0.71083	103.645	107.776	104.320	106.519	105.419	-0.41946	2.102	105.0	15	2.080	104.8
16	107.619	-0.41933	105.385	109.853	106.473	109.254	107.863	-0.66343	2.150	107.2	16	2.102	105.0

```
141      proc autoreg data=one; title2 'Time series with SAS AUTOREG (lag of 2)';
142          model Y = X / nlag=2 method=ml;
143      run;
NOTE: The PROCEDURE AUTOREG printed pages 21-22.
NOTE: PROCEDURE AUTOREG used (Total process time):
      real time          0.09 seconds
      cpu time           0.02 seconds
```

EXST7034 - Homework Example NWK 13.9 : Microcomputer components
Time series with SAS AUTOREG (lag of 2)

The AUTOREG Procedure

Dependent Variable Y

Ordinary Least Squares Estimates			
SSE	12.7496735	DFE	14
MSE	0.91069	Root MSE	0.95430
SBC	47.3178816	AIC	45.7727042
Regress R-Square	0.9438	Total R-Square	0.9438
Durbin-Watson	0.8566		

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	-7.7385	7.1746	-1.08	0.2990
X	1	53.9533	3.5197	15.33	<.0001

Estimates of 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	0.7969	1.000000	|																					*****
1	0.4202	0.527329	|																					*****
2	0.0217	0.027292	|																					*

Preliminary MSE 0.5058

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.710515	0.270697	-2.62
2	0.347383	0.270697	1.28

Algorithm converged.

Maximum Likelihood Estimates

SSE	7.30936834	DFE	12
MSE	0.60911	Root MSE	0.78046
SBC	44.6563512	AIC	41.5659963
Regress R-Square	0.9158	Total R-Square	0.9678
Durbin-Watson	2.1059		

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	-0.6679	9.0713	-0.07	0.9425
X	1	50.4755	4.4382	11.37	<.0001
AR1	1	-0.8052	0.2713	-2.97	0.0118
AR2	1	0.3418	0.2729	1.25	0.2342

Autoregressive parameters assumed given.

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	1	-0.6679	9.0286	-0.07	0.9422
X	1	50.4755	4.4181	11.42	<.0001