

## 2.2.1: SAS - Residual Diagnostics

Dr. Bean – Stat 5100

Example: (The Toluca Company data from Handout #2).

```

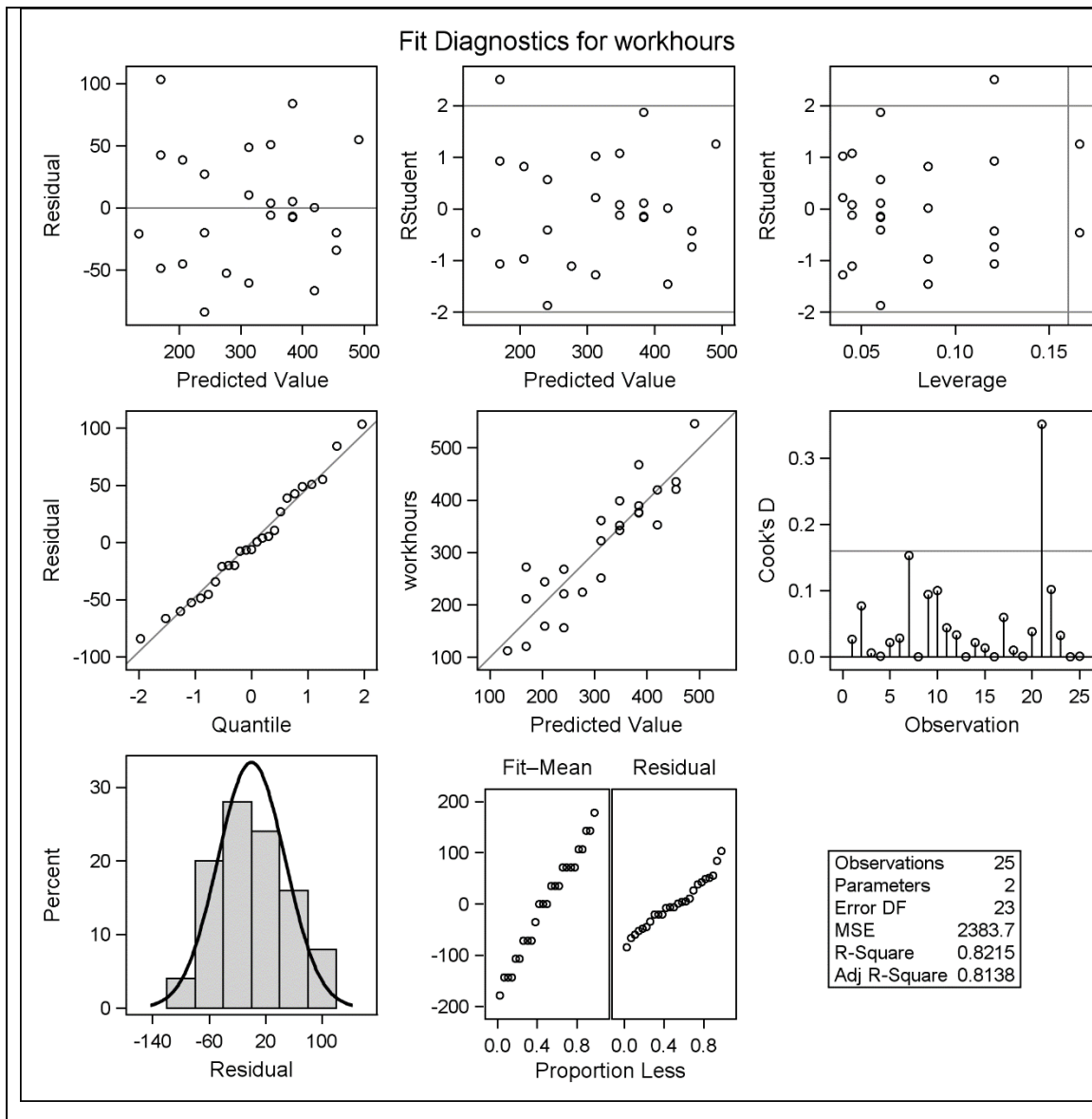
/* Input Toluca data (recall Ch. 1 example) */
data toluca; input lotsize workhours @@; cards;
    80 399 30 121 50 221 90 376 70 361 60 224
    120 546 80 352 100 353 50 157 40 160 70 252
    90 389 20 113 110 435 100 420 30 212 50 268
    90 377 110 421 30 273 90 468 40 244 80 342
    70 323
;
run;

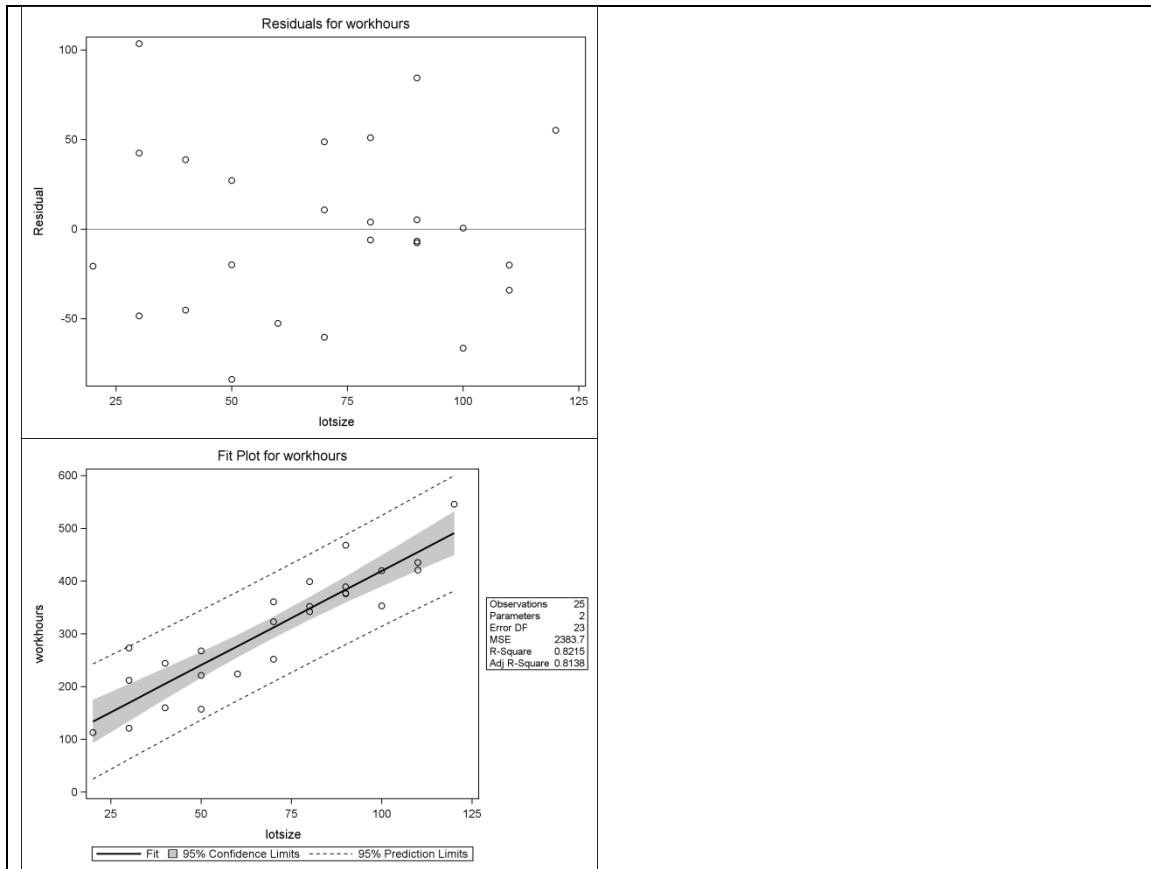
/* Now fit simple linear model with Y=workhours and X=lotsize,
   with residuals and predicted values saved in data set
   tolucaout */
proc reg data=toluca;
    model workhours = lotsize;
    output out=tolucaout r=resid p=pred;
    titlel 'Simple linear model';
run;

```

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	252378	252378	105.88	<.0001
Error	23	54825	2383.71562		
Corrected Total	24	307203			

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t
Intercept	1	62.36586	26.17743	2.38	0.0259
lotsize	1	3.57020	0.34697	10.29	<.0001

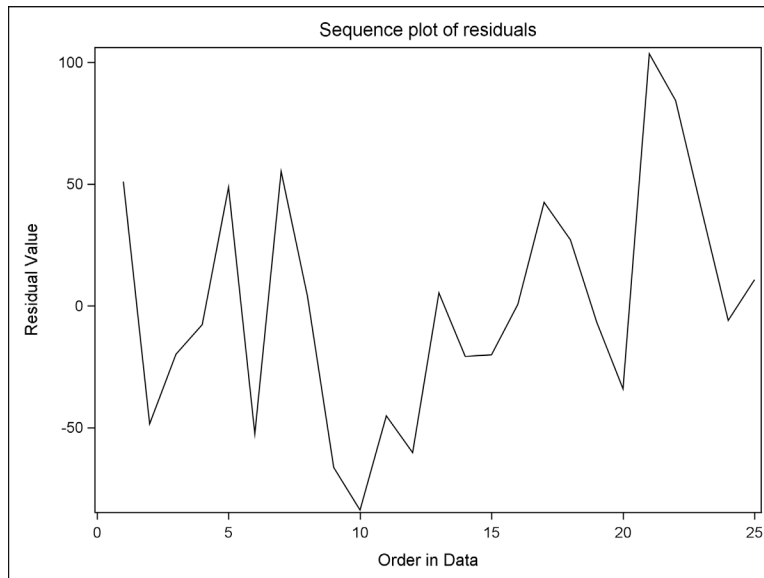




```

/* Look at sequence plot */
data temp; set tolucaout;
order = _n_;
proc sgplot data=temp;
series x=order y=resid / lineattrs=(pattern=solid);
axis label='Order in Data';
yaxis label='Residual Value';
title1 'Sequence plot of residuals';
run;

```



```

/***** Numerical Diagnostics *****/

/* F-test for lack of fit */
proc rsreg data=toluca;
model workhours = lotsize / lackfit covar=1 noopt;
title1 'F-test for lack of fit';
run;

```

Residual	DF	Sum of Squares	Mean Square	F Value	Pr > F
Lack of Fit	9	17245	1916.069540	0.71	0.6893
Pure Error	14	37581	2684.345238		
Total Error	23	54825	2383.715617		

```

/** Brown-Forsythe and Correlation Test of Normality (shortcut)
**/
/* Two [unused] ways to access shortcut:
    filename macrourl "C:\[filepath]\resid_num_diag.sas";
    %include macrourl;
*/
%macro resid_num_diag(dataset,datavar,label= ...

/*
This resid_num_diag.sas file provides a convenient shortcut
to obtaining numerical checks of residuals from
a fitted linear regression model.

The macro takes five arguments:
    dataset is the name of the data set
    datavar is the name of the variable in the data set
              for which numerical diagnostics are desired
              (usually a residual)
    label is a character string for detail in output
    predvar is the name of the variable (usually predicted
              value) on which to sort for the Brown-Forsythe test
              (t-statistic and p-value reported)
    predlabel is the character string for detail in output
              related to the predvar variable
*/

```

```

/* Call the shortcut: */
%resid_num_diag(dataset=tolucaout, datavar=resid,
  label='residual', predvar=pred, predlabel='predicted');

```

***P-value for Brown-Forsythe test of constant variance  
in residual vs. predicted***

Obs	t_BF	BF_pvalue
1	1.31648	0.20098

***Output for correlation test of normality of residual  
(Check text Table B.6 for threshold)***

<b>Pearson Correlation Coefficients, N = 25</b> <b>Prob &gt;  r  under H0: Rho=0</b>		
	resid	expectNorm
<b>resid</b>	1.00000	0.99151
residual		<.0001
<b>expectNorm</b>	0.99151	1.00000
	<.0001	