2.1.1: SAS: Simple Linear Regression

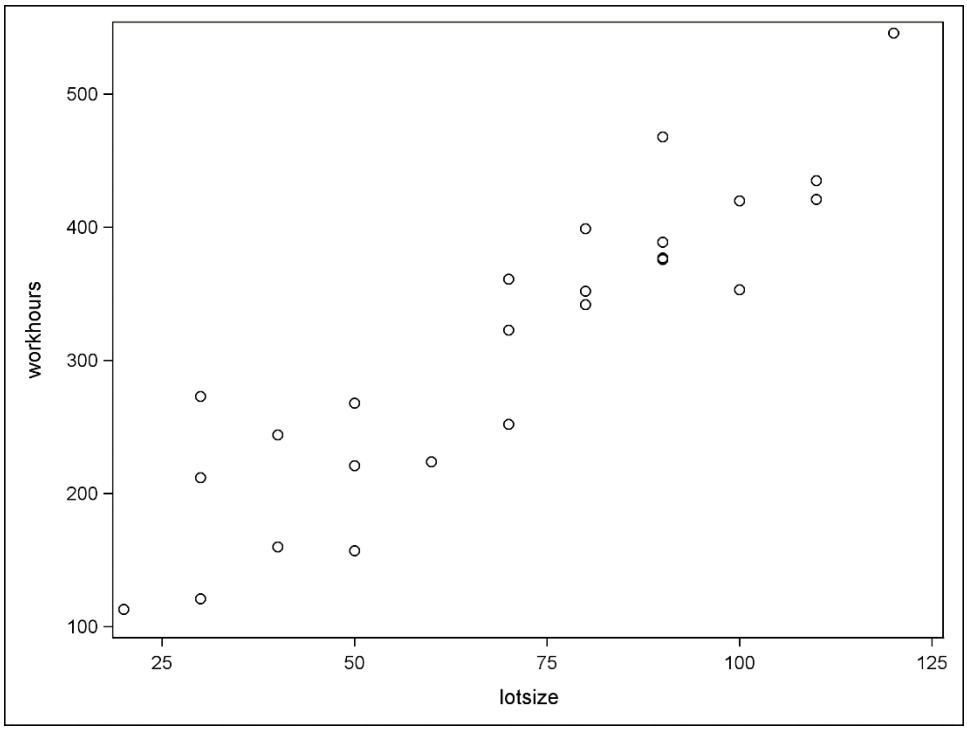
Dr. Bean – Stat 5100

Example: The Toluca Company makes replacement parts for refrigeration equipment. For a certain part, it takes some time to set up the production process, and then the production of a given lot size can begin. As part of a cost improvement program, the company wished to better understand the relationship between the lot size (X) and the total work hours (Y). Data were reported for 25 representative lots of varying size.

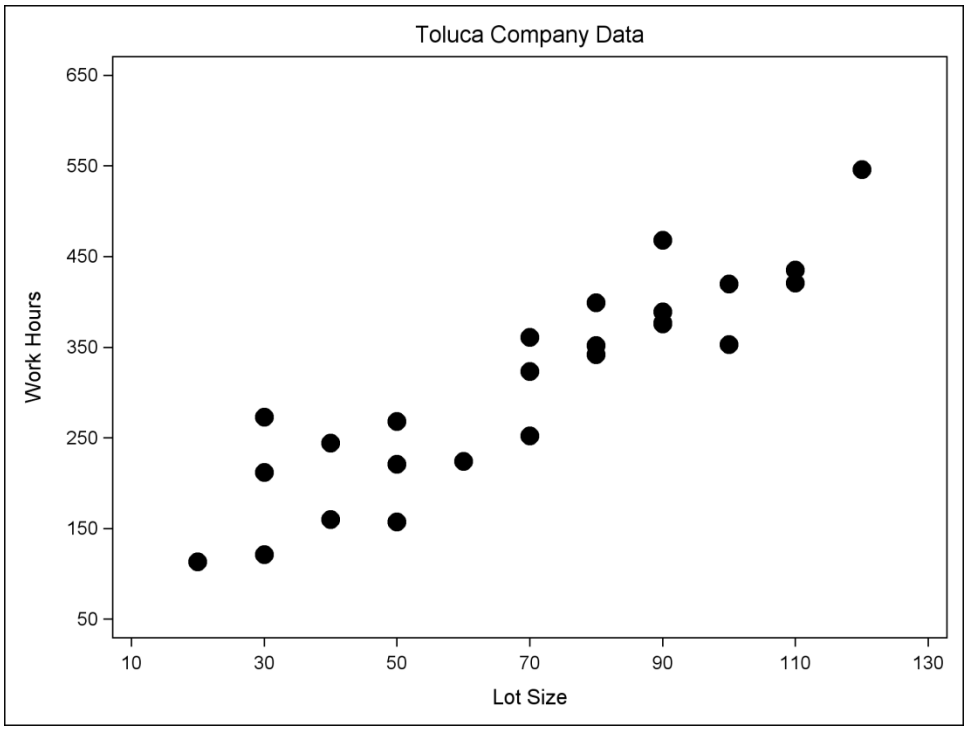
```
/*************************************************************/

/* Input data */
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;

/* Make a scatterplot of Y=workhours and X=lotsize */
proc sgplot data=toluca;
  scatter x=lotsize y=workhours ;
run;
```



```
/* Be professional -- make it look nice */
proc sgplot data=toluca;
  scatter x=lotsize y=workhours /
      markerattrs=(symbol=CIRCLEFILLED size=3pt);
  title1 'Toluca Company Data';
  xaxis label='Lot Size' values=(10 to 130 by 20);
  yaxis label='Work Hours' values=(50 to 650 by 100);
run;
```



```
/* Look at correlation between these variables */
proc corr data=toluca;
     var workhours lotsize;
run;
```

Toluca Company Data

The CORR Procedure

2 Variables:	workhours lotsize

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
workhours	25	312.28000	113.13764	7807	113.00000	546.00000
lotsize	25	70.00000	28.72281	1750	20.00000	120.00000

Pearson Correlation Coefficients, N = 25
Prob > |r| under H0: Rho=0

	workhours	lotsize
workhours	1.00000	0.90638 <.0001
lotsize	0.90638 <.0001	1.00000

```
/* Now fit simple linear model with Y=workhours and
X=lotsize */
proc reg data=toluca;
  model workhours = lotsize;
  title1 'Simple linear model';
run;
```

Simple linear model

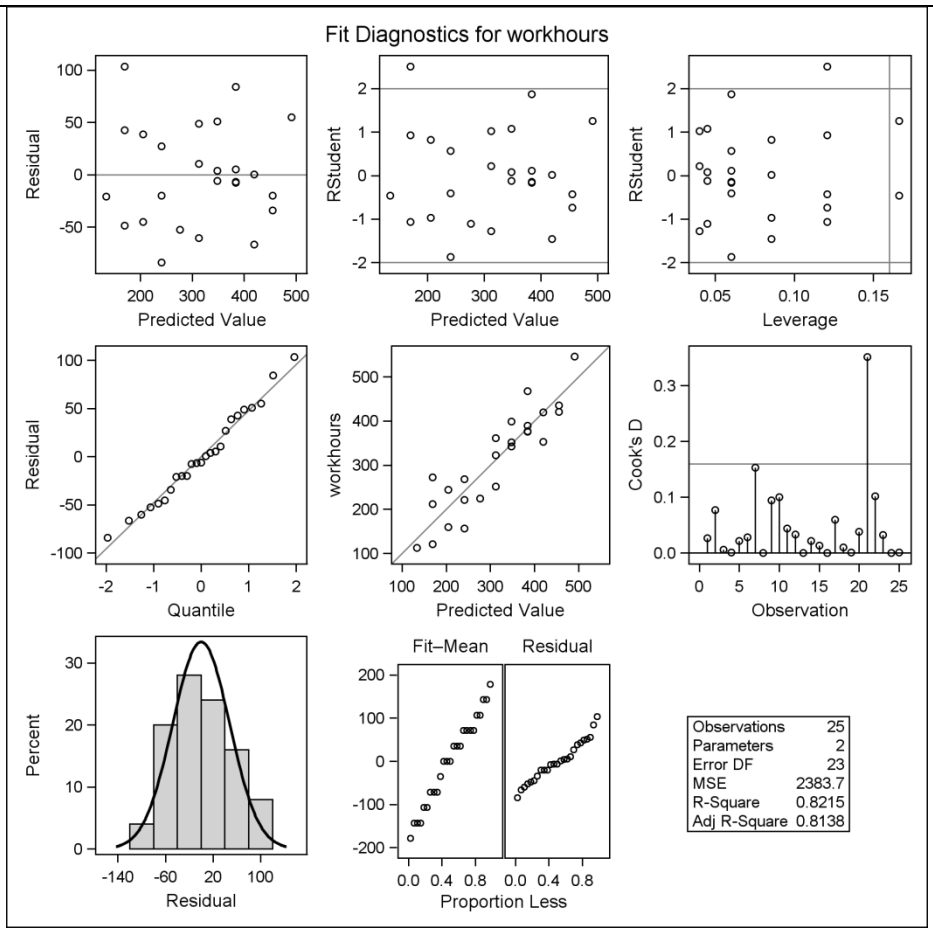
The REG Procedure
Model: MODEL1
Dependent Variable: workhours

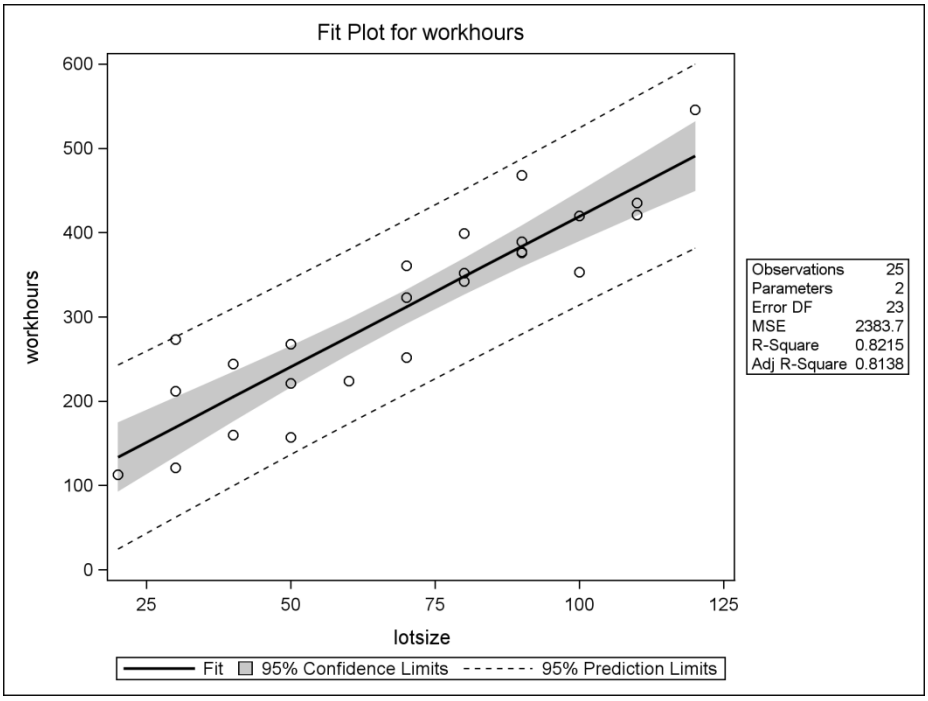
Number of Observations Read	25
Number of Observations Used	25

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			

Root MSE	48.82331	**R-Square**	0.8215
Dependent Mean	312.28000	**Adj R-Sq**	0.8138
Coeff Var	15.63447		

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


Fit Diagnostics for workhours
Residual
Predicted Value
RStudent
Predicted Value
RStudent
Leverage
Residual
Quantile
workhours
Predicted Value
Cook's D
Observation
Percent
Residual
Fit–Mean
Residual
Proportion Less
Observations 25
Parameters 2
Error DF 23
MSE 2383.7
R-Square 0.8215
Adj R-Square 0.8138


Fit Plot for workhours
workhours
lotsize
Observations 25
Parameters 2
Error DF 23
MSE 2383.7
R-Square 0.8215
Adj R-Square 0.8138
Fit
95% Confidence Limits
95% Prediction Limits

```
/* See predicted values */
proc reg data=toluca noprint;
  model workhours = lotsize;
  output out=PredictedValues p=Predict;
proc print data=PredictedValues;
  title1 'Predicted Values';
run;
```

Predicted Values

Obs	lotsize	workhours	Predict
1	80	399	347.982
2	30	121	169.472
3	50	221	240.876
…			
24	80	342	347.982
25	70	323	312.280