

## Interpreting Minitab (computer) printouts

Does the weight of a bar of soap follow a linear pattern over time?

We estimate the model using least square method. The computation from the minitab is as follows:

The regression equation is  
Weight = 123 - 5.57 Day

Interpretation: the line intersects y axis at 123 with a slope of -5.57. that is on the day=0, weight is 123gm and for each increase in a day, the weight of the soap decreases on the average by 5.57 grams.

Predictor	Coef	SE Coef	T	P
Constant	123.141	1.382	89.09	0.000
Day	-5.5748	0.1068	-52.19	0.000

Interpretation: the sample estimates of y-intercept (alpha) and slope (beta) are 123.141 and -5.57 respectively. The corresponding test statistics are 89.09 and -52.10 indicating that these are too large values of t-statistics and lie on the extreme ends of t-curve. Thus we reject the null hypothesis of alpha =0 and beta=0. And conclude that the beta and alpha play a significant role in the regression model.

S = 2.94921    R-Sq = 99.5%    R-Sq(adj) = 99.5%

Interpretation: the standard deviation of the error terms is 2.94. A 99.5%. R-sqadj indicates that whenever we observe a variation in the value of y, 99.5% of it is due to the model (or due to change in x) and only .5% is due error or some unexplained factor. That is this data fits well to the linear model.

### Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	23694	23694	2724.11	0.000
Residual Error	13	113	9		
Total	14	23807			

Interpretation: In this case ANOVA tests the hypothesis that beta=0. In fact F is nothing but T-square. A low p-value suggest that beta plays a significant role in the model, this is just reassurance of the t-test.

### Unusual Observations

Obs	Day	Weight	Fit	SE Fit	Residual	St Resid
10	12.0	50.000	56.244	0.772	-6.244	-2.19R
15	22.0	6.000	0.496	1.418	5.504	2.13R

R denotes an observation with a large standardized residual.

Interpretation: the observation number 10 and number 15 are outliers. We need to go back and review what happened on those days, either soap is used too much or too less. To improve the model, we would like to delete those observations and recompute the line.

The following is from the book:

The following example looks at Blood Alcohol Content (y) after x number of beers

**Regression Analysis: BAC versus Beers**

The regression equation is  
 $BAC = -0.0127 + 0.0180 \text{ Beers}$

Predictor	Coef	SE Coef	T	P
Constant	-0.01270	0.01264	-1.00	0.332
Beers	0.017964	0.002402	7.48	0.000

$S = 0.0204410$      $R\text{-Sq} = 80.0\%$      $R\text{-Sq}(\text{adj}) = 78.6\%$

**Estimate of  $\sigma$   
SD of Y for fixed X**

$r^2 = SSM/SST$

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.023375	0.023375	55.94	0.000
Residual Error	14	0.005850	0.000418		
Total	15	0.029225			

Obs	Beers	BAC	Fit	SE Fit	Residual	St Resid
1	5.00	0.10000	0.07712	0.00513	0.02288	1.16
2	2.00	0.03000	0.02323	0.00847	0.00677	0.36
3	9.00	0.19000	0.14897	0.01128	0.04103	2.41R
.	.	.	.	.	.	.
16	4.00	0.05000	0.05915	0.00547	-0.00915	-0.46

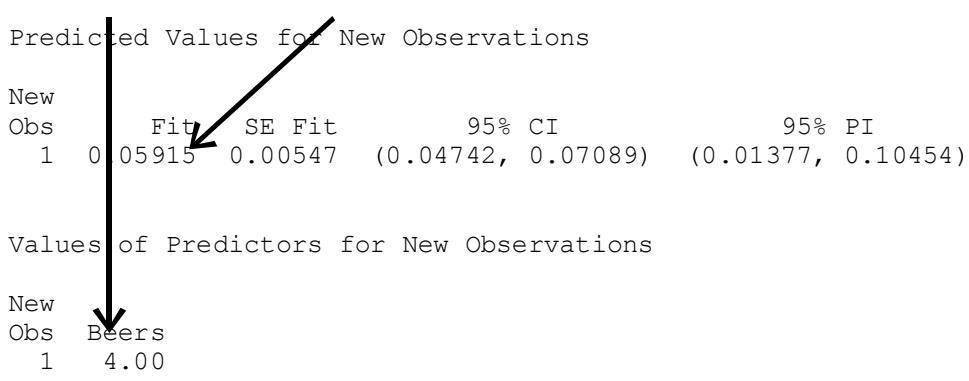
Predicted Values for New Observations

New Obs	Fit	SE Fit	95% CI	95% PI
1	0.05915	0.00547	(0.04742, 0.07089)	(0.01377, 0.10454)

Values of Predictors for New Observations

New Obs	Beers
1	4.00

R denotes an observation with a large standardized residual.



Estimates the variation in the estimated mean response for a given set of predictor values. The smaller, the more precise.

$t^2 = (7.48)^2 = F$

P-value for test  $H_0: \beta_1=0$

Test stat. for test  $H_0: \beta_1=0$

Standard error of  $\beta_1$

$b_0$      $b_1$

Estimate of  $\sigma$   
SD of Y for fixed X

$r^2 = SSM/SST$

Degrees of Freedom for CI's and Significance Tests (n-2)

$s^2$  or MSE

SSM

SSE

SST

x    y    y    y-y