http://www.stat.ucla.edu/~dinov/courses_students.dir/11/Winter/STAT13.1.dir/STAT13.html

STAT 13, Winter 2011, UCLA Statistics
HW 7; Problem Solution

HW 7.1

Estimating regression line slope:

$$\hat{b} = \frac{\sum_{i=1}^{N}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{N}(x_i - \bar{x})^2} = \frac{(0-30)(0.02-0.83)+(10-30)(0.25-0.83)+\cdots+(60-30)(1.74-0.83)}{(0-30)^2+(10-30)^2+\cdots+(60-30)^2}$$

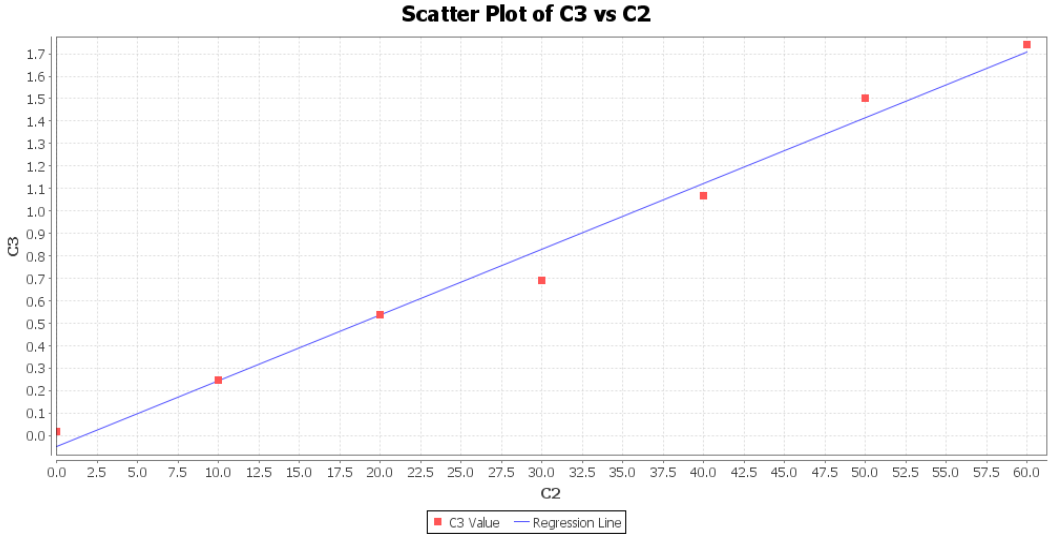
$$= 0.02925$$

Sample Size = 7
Dependent Variable = C3
Independent Variable = C2
Simple Linear Regression Results:
Mean of C2 = 30.000
Mean of C3 = .830
Regression Line:
C3 = -.047 + 0.02924999999999999 C2
Correlation(C2, C3) = .993
R-Square = .986

Intercept:
Parameter Estimate: -.047
Standard Error: .057
T-Statistics: -.831
P-Value: .444

Slope:
Parameter Estimate: .029
Standard Error: .002
T-Statistics: 18.440
P-Value: .000

SOCR result agrees with result by hand.



Amount of Leucine incorporate into protein is linearly increasing with rate of 0.02925 by the time.

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$$sd(e) = \sqrt{\frac{\sum_{i=1}^{N}(y_i - \hat{y}_i)^2}{n-2}} = \sqrt{\frac{\sum_{i=1}^{N}[y_i - (\hat{a} + \hat{b}x_i)]^2}{n-2}}$$

$$= \sqrt{(.02-(-.047))^2 + (.250-.245)^2 + \cdots + (1.740-1.707)^2 / 5} = 0.08393$$

"Note that here we estimate two parameters, the degree of freedom is n-2 and we need to divide by n-2"

HW 7.2

Sample Size = 20

Dependent Variable = C3

Independent Variable = C2

Simple Linear Regression Results:

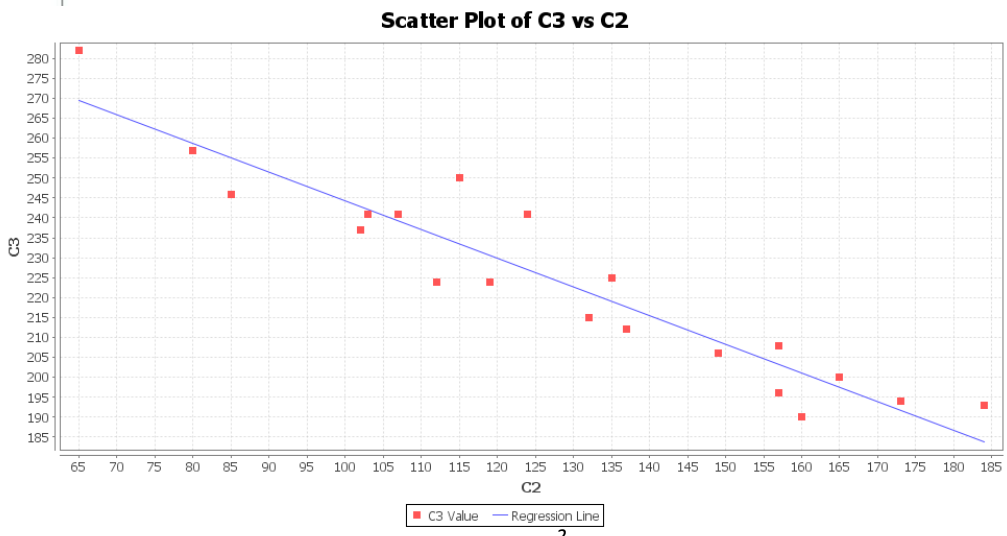
Mean of C2 = 128.050
Mean of C3 = 224.100

Regression Line:
C3 = 316.376 -0.7206262571781327 C2

Correlation(C2, C3) = -.942
R-Square = .887

Intercept:
Parameter Estimate: 316.376
Standard Error: 8.000
T-Statistics: 39.549
P-Value: .000

Slope:
Parameter Estimate: -.721
Standard Error: .061
T-Statistics: -11.885
P-Value: .000



Slope: For increasing one plant in each plot of *10 x 4 meters*^{2}, mean cob weight will drop by 0.721 grams.
Intercept: In average weight of grain per cob for a plot with about 128 plants is about 224.1.

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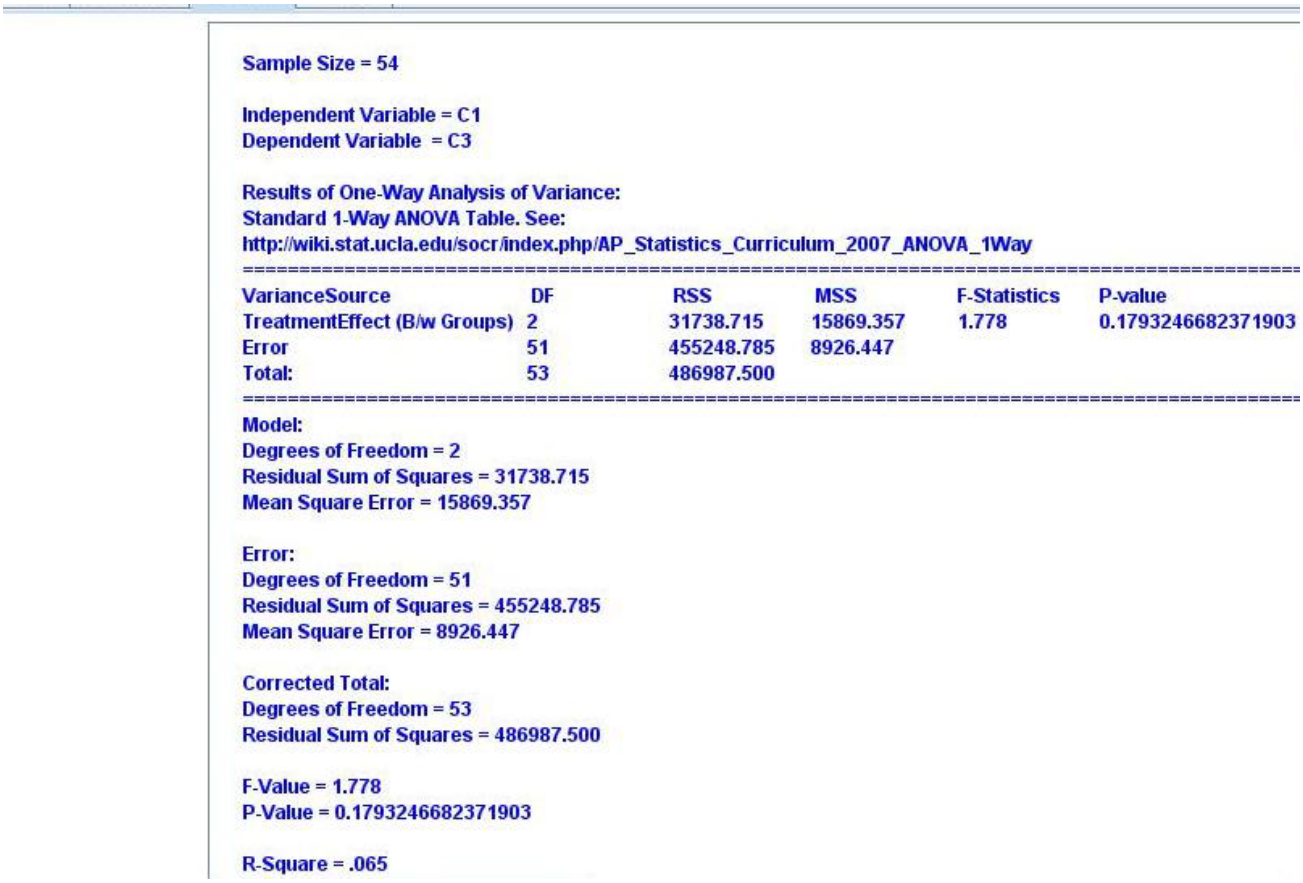
"Note that the intercept for a line is intercept of the line with y- axis but in context of this problem it does not meaningful to interpret the intercept as weight of grain per cob for a plot with 0 plants."
Correlation: The plant density has negative impact on weight of grin per cob.

HW 7.3



Sample Size = 54

Independent Variable = C1
Dependent Variable = C3

Results of One-Way Analysis of Variance:
Standard 1-Way ANOVA Table. See:
http://wiki.stat.ucla.edu/socr/index.php/AP_Statistics_Curriculum_2007_ANOVA_1Way

VarianceSource	DF	RSS	MSS	F-Statistics	P-value
TreatmentEffect (B/w Groups)	2	31738.715	15869.357	1.778	0.1793246682371903
Error	51	455248.785	8926.447		
Total:	53	486987.500			

Model:
Degrees of Freedom = 2
Residual Sum of Squares = 31738.715
Mean Square Error = 15869.357

Error:
Degrees of Freedom = 51
Residual Sum of Squares = 455248.785
Mean Square Error = 8926.447

Corrected Total:
Degrees of Freedom = 53
Residual Sum of Squares = 486987.500

F-Value = 1.778
P-Value = 0.1793246682371903

R-Square = .065

There is no significant evidence to support effects of the type of meat on the sodium in hot dog. In other word mean amount of sodium in beef, poultry, and meat are same and we do not have enough evidence to claim any difference.

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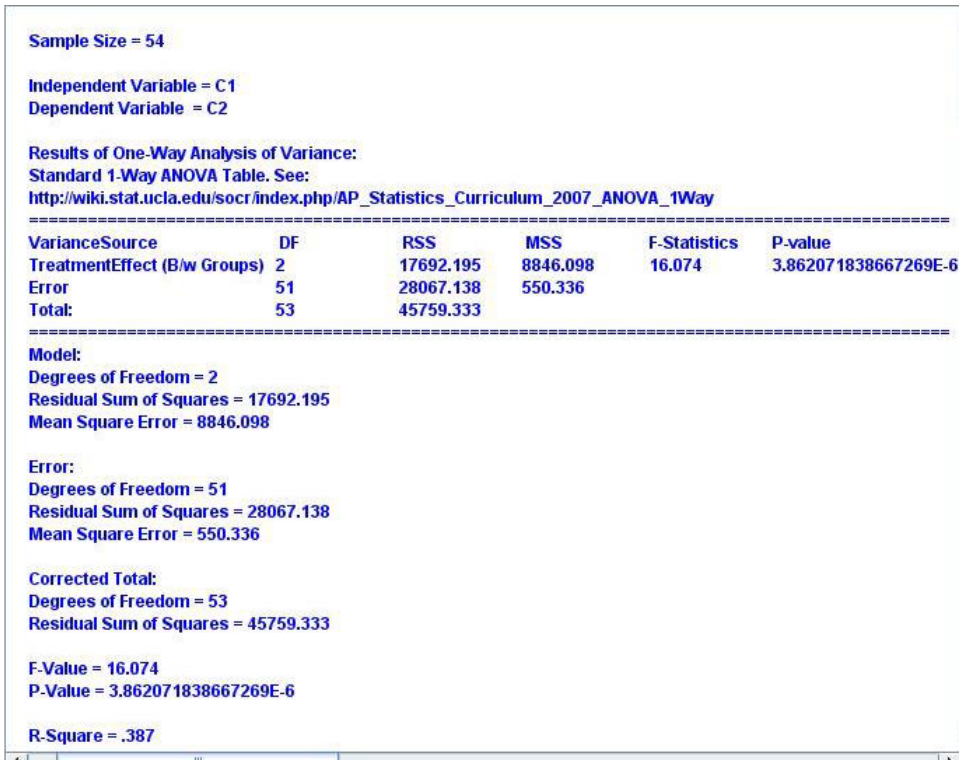

Sample Size = 54

Independent Variable = C1
Dependent Variable = C2

Results of One-Way Analysis of Variance:
Standard 1-Way ANOVA Table. See:
http://wiki.stat.ucla.edu/socr/index.php/AP_Statistics_Curriculum_2007_ANOVA_1Way

VarianceSource	DF	RSS	MSS	F-Statistics	P-value
TreatmentEffect (B/w Groups)	2	17692.195	8846.098	16.074	3.862071838667269E-6
Error	51	28067.138	550.336		
Total:	53	45759.333			

Model:
Degrees of Freedom = 2
Residual Sum of Squares = 17692.195
Mean Square Error = 8846.098

Error:
Degrees of Freedom = 51
Residual Sum of Squares = 28067.138
Mean Square Error = 550.336

Corrected Total:
Degrees of Freedom = 53
Residual Sum of Squares = 45759.333

F-Value = 16.074
P-Value = 3.862071838667269E-6

R-Square = .387

The data show significant effects of the type of meat on the calorie in hot dog. In other word mean amount of calorie in beef, poultry, and meat are not the same and we have enough evidence to claim the difference.

HW 7.4

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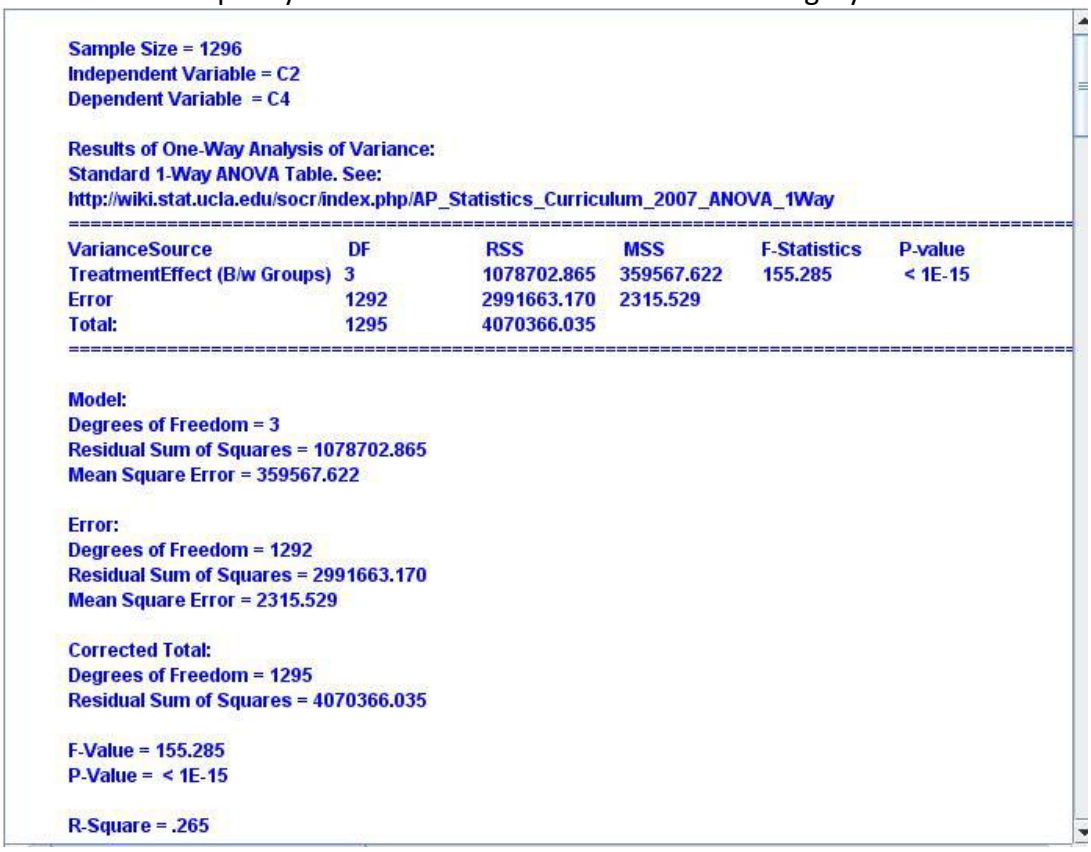
The data support effect of the CPI item on the CPI-value. This means we have enough evidence to reject equality of mean CPI-value in different CPI category.



Sample Size = 1296
Independent Variable = C2
Dependent Variable = C4

Results of One-Way Analysis of Variance:
Standard 1-Way ANOVA Table. See:
http://wiki.stat.ucla.edu/socr/index.php/AP_Statistics_Curriculum_2007_ANOVA_1Way

VarianceSource	DF	RSS	MSS	F-Statistics	P-value
TreatmentEffect (B/w Groups)	3	1078702.865	359567.622	155.285	< 1E-15
Error	1292	2991663.170	2315.529		
Total:	1295	4070366.035			

Model:
Degrees of Freedom = 3
Residual Sum of Squares = 1078702.865
Mean Square Error = 359567.622

Error:
Degrees of Freedom = 1292
Residual Sum of Squares = 2991663.170
Mean Square Error = 2315.529

Corrected Total:
Degrees of Freedom = 1295
Residual Sum of Squares = 4070366.035

F-Value = 155.285
P-Value = < 1E-15

R-Square = .265