

**Unit 7 – Analysis of Variance**  
**Practice Problems - Week #12**

**Due Monday May 4, 2009**

Consider the little data set of  $n=12$  observations on page 62 of Lecture Notes 7. *Introduction to Analysis of Variance*.

Light (LIGHT)	Water Temp (TEMP)	Fish Growth (GROWTH)
1=low	1=cold	4.55
1=low	1=cold	4.24
1=low	2=lukewarm	4.89
1=low	2=lukewarm	4.88
1=low	3=warm	5.01
1=low	3=warm	5.11
2=high	1=cold	5.55
2=high	1=cold	4.08
2=high	2=lukewarm	6.09
2=high	2=lukewarm	5.01
2=high	3=warm	7.01
2=high	3=warm	6.92

- (1) By whatever means you like, create a data set that has the following variables, codings and meanings.

Variable	Coding
GROWTH	continuous
LIGHT	1 = low 2 = high
I_HIGH	= 1 if (LIGHT is 2) 0 otherwise
TEMP	1 = cold 2 = lukewarm 3 = warm
I_LUKE	= 1 if (TEMP is 2) 0 otherwise
I_WARM	= 1 if (TEMP is 3) 0 otherwise
HI_LUKE	= (I_HIGH) * (I_LUKE)
HI_WARM	= (I_HIGH)*(I_WARM)

- (2) Perform a two way analysis of variance so as to reproduce the following table

Source	Df	SSQ	MSQ	F	p-value
Due LIGHT	1	2.98	2.98	10.39	.018
Due TEMP	2	3.984	1.992	6.95	.027
Due Interaction	3	1.268	0.634	2.21	.191
Error	6	1.721	0.287		
<b>Total (Corrected)</b>	<b>11</b>	<b>9.953</b>	<b>-</b>		

- (3) Perform a regression analysis to obtain the following table and estimates

Source	Df	SSQ	MSQ	F	p-value
Due Model	5	8.2320	1.6464	5.74	.0276
Due Residual	6	1.7208	0.2868	-	
<b>Total (Corrected)</b>	<b>11</b>	<b>9.953</b>	<b>-</b>		

Predictor	beta	Se(beta)	T=beta/se	p-value
I_high	0.42	0.5355	0.78	0.46
I_luke	0.49	0.5355	0.91	0.395
I_warm	0.665	0.5355	1.24	0.261
Hi_luke	0.245	0.7574	0.32	0.757
Hi_warm	1.485	0.7574	1.96	0.098
Intercept	4.395	0.3787	11.61	0.000

- (4) Using the output from each of your anova and regression analyses, complete the following tables and notice that they are the same.

Estimated Mean Growth, by Conditions of Light and Temperature – **Anova Analysis**

	<b>Cold</b>	<b>Lukewarm</b>	<b>Warm</b>
<b>Low light</b>			
<b>High light</b>			

Estimated Mean Growth, by Conditions of Light and Temperature – **Regression Analysis**

	<b>Cold</b>	<b>Lukewarm</b>	<b>Warm</b>
<b>Low light</b>			
<b>High light</b>			

- (5) Compare your answer to #4 with the observed means.

**Observed** Mean Growth, by Conditions of Light and Temperature

	<b>Cold</b>	<b>Lukewarm</b>	<b>Warm</b>
<b>Low light</b>			
<b>High light</b>			