

ST512

Fall Semester, 2006

Exam 1

Name: _____

Directions: Answer questions as directed. Please show work.

1. (50pts) Jaw width, y , and body length, x , were measured on a random sample of $n = 41$ sharks. Summary statistics are given below:

Variable	mean	std deviation	Corrected sum of squares
y : Jaw width (in <i>in</i>)	$\bar{y} = 14.7$	$s_y = 3$	$S_{yy} = 360$
x : Body length (in <i>ft</i>)	$\bar{x} = 15$	$s_x = 2$	$S_{xx} = 160$

The least squares regression line is $\hat{y} = 1.2 + 0.9x$

- (a) (8pts) Is the sample correlation coefficient r_{yx} positive or negative?
- (b) (8pts) Report the sample correlation coefficient, r_{yx} .
- (c) (8pts) Estimate mean jaw width among sharks with body length $x = 15$ *ft*.
- (d) (8pts) Estimate the difference between the mean in part (c) and mean jaw width among sharks with body length $x = 20$ *ft*.
- (e) (8pts) Report and interpret (very briefly) the error mean square, $MS[E]$.
- (f) (10pts) Report standard errors for the estimates in parts (c) and (d).

2. (50pts) The weight (y , in g), age (x_1 , in $yr s$) and length (x_2 , in mm) are measured on a random sample of $n = 17$ whitefish. Consider several regression models for describing the association between weight and the predictors, *age* and *length*:

- Model 0: $\mu(x_1, x_2) = \beta_0$
- Model 1: $\mu(\text{age}, \text{length}) = \beta_0 + \beta_1 \text{ age}$
- Model 2: $\mu(\text{age}, \text{length}) = \beta_0 + \beta_2 \text{ length}$
- Model 3: $\mu(\text{age}, \text{length}) = \beta_0 + \beta_1 \text{ age} + \beta_2 \text{ length}$

(a) (20pts) Using the output at the end of the exam, report appropriate F -ratios and corresponding degrees of freedom for each of the model comparisons below. (Some may be found directly in the output, some require computation.)

i. Model 0 versus Model 1

ii. Model 0 versus Model 2

iii. Model 0 versus Model 3

iv. Model 1 versus Model 3

v. Model 2 versus Model 3

(b) (15pts) Which model is best?

i. Explain very briefly.

ii. Use the full model to estimate the mean weight among whitefish aged 10 *yr*s with length 380 *mm*

iii. Report the squared correlation between the observed weights and those predicted by the model you chose as best.

(c) (15pts) Below, write what should go in the blanks in the output labelled AAA, BBB and CCC:

- AAA
- BBB
- CCC

/***** BEGIN CODE AND OUTPUT *****/

PROC GLM;

MODEL weight=age length/SOLUTION;

RUN;

The SAS System
The GLM Procedure

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Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	181364.0227	90682.0114	10.21	0.0018
Error	14	124331.0361	8880.7883		
Corrected Total	16	305695.0588			

Source	DF	Type I SS	Mean Square	F Value	Pr > F
age	1	59033.9029	59033.9029	6.65	0.0219
length	1	122330.1198	122330.1198	13.77	0.0023

Source	DF	Type III SS	Mean Square	F Value	Pr > F
age	1	134.5398	134.5398	0.02	0.9038
length	1	122330.1198	122330.1198	13.77	0.0023

Parameter	Estimate	Standard Error	t Value	Pr > t
Intercept	-510.8786593	286.0797763	-1.79	0.0958
age	-1.1126251	AAA_____	BBB_____	CCC_____
length	3.0632745	0.8253630	3.71	0.0023