STAT 2220 - Quiz #2
January 19, 2012

1. (2 points) Defects on an Alaskan pipeline were measured both in the field and in a laboratory. A regression analysis was conducted to determine whether the field instruments were giving appropriate measurements as compared to the lab instruments. The defect measurements in the field (X) ranged from 5 to 85. The defect measurements in the lab (X) ranged from 4.3 to 81.7. A regression of the field instruments on the lab instruments provided the following least-squares line:

$$\hat{y} = 4.99 + 0.731x$$

(a) (1 point) Suppose one defect produced a field measurement of 84 and a lab measurement of 83. What is the value of the residual for this defect?

$X = 84 \qquad Y = 83$

$\hat{Y} = 4.99 + 0.731(84)$

$= 66.394$

$res = Y - \hat{Y} = 83 - 66.394$

$\boxed{= 16.606}$

(b) (1 point) Is this prediction reliable? Why or why not?

Yes, the x value falls within the range of the initial data.

2. (3 points) As machines are used longer, their output production can become increasingly off target. Below are measurements for the age (X) and average value off target (in mm) (Y) for 7 machines:

Observation	1	2	3	4	5	6	7
Machine use	30	33	34	35	39	44	45
Off target	1.10	1.21	1.25	1.23	1.30	1.4	1.42

The following are also given:

$$\bar{x} = 37.1429 \quad s_x = 5.6988 \quad \bar{y} = 1.2729 \quad s_y = 0.1116 \quad r = 0.9731$$

(a) (2 points) Find the equation for the least squares regression line.

$b_1 = r \cdot \dfrac{s_y}{s_x} = 0.9731 \times \dfrac{0.1116}{5.6988} = 0.0191$

$b_0 = \bar{y} - b_1 \bar{x} = 1.2729 - 0.0191(37.1429) = \cancel{0.56349709} \quad 0.5635$

$\hat{Y} = \cancel{0.56349709} + 0.0191X$
$\qquad 0.5635$

(b) (1 point) Calculate and interpret the value of r^2 in the context of this example.

$r^2 = 0.9731^2 = .9469$

94.69% of the variation in mm's off target is explained by the regression on machine use

3. (3 points) Show that the sum of the residuals in the least squares regression must always be zero.

See assignment #2 solutions.