AP Statistics

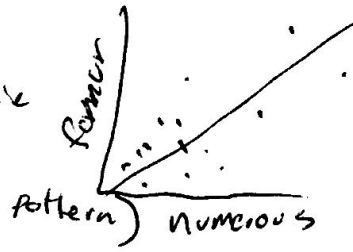
3·3 Residuals

Humerus bones from the same species of animal tend to be good predictors of an animal's Femur length (and therefore of its Height). When fossils of humerus bones are discovered, archeologists can often determine the species of animal by examining these values and the ratios of one to the other. The species *Kohlerius Primatium* once inhabited the northern regions of Minnesota. Suppose 20 fossil pairs from this species are unearthed at a site on Minnesota's Iron Range. Use the following information to determine the relationship between humerus and femur length. Then, construct a model to predict Femur Length from Humerus Length based on the observed relationship.

Humerus	Femur
49	218.8
14.2	63.6
11.6	42.9
6.7	42.7
42.3	265.6
13.5	96.9
9.5	32.4
6.0	28.9
36.3	170.9
13.4	60.9
9.4	68.3
4.6	40.7
16.4	85.9
13.2	144.2
7.5	48.6
3.8	13.8
14.9	88.1
11.8	53.6
7.2	32.2
3.4	22.2

Construct and interpret a scatterplot of the relationship between the humerus and femur lengths of the fossil pairs.

The scatter plot relating humerus and femur lengths has a strong positive association ($r = .935$). It appears to be linear. (residual has no pattern)



Calculate and interpret the correlation coefficient r:

$r = .935$ strength = strong, positive association direction

Calculate and interpret the coefficient of determination r^2:

$r^2 = .8746$ about 87% of the predicted femur lengths can be accounted for when using the LSRL relating Humerus and femur lengths

Use your calculator to find the equation of the line that best fits the (humerus, femur) data. Interpret the equation in the context of the problem. What do the slope and intercept tell you about the relationship?

LSRL Equation: $\hat{y} = 8.309 + 4.9067x$ (as the humerous length goes up, the predicted femur length increase by about 4.9 units)

Write in terms of the problem:

$\hat{y}$ = predicted femur lengths x = Humerous length

Use the model to predict the femur length of a Kohlerius Primatium whose humerus is 16.4 units long.

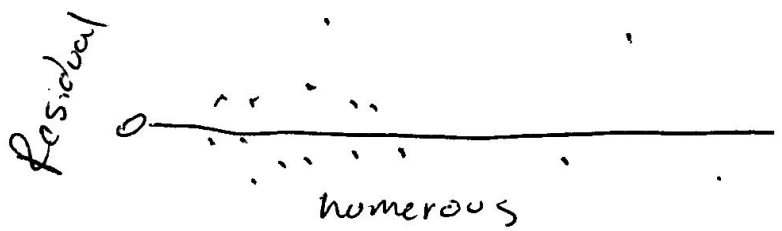
$\hat{y} = 8.309 + 4.9067(16.4) = 88.78$

Calculate the residual for this observation.

Obs − pred

$85.9 - 88.78 = -2.88$

Use your calculator to construct and interpret a residual plot for the (humerus, femur) prediction line.



scattered, no pattern

linear best fit