

Quiz: November 5

This is a closed-book quiz, and no team-work or reference materials are permitted.

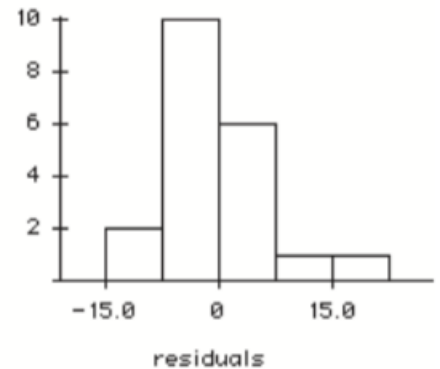
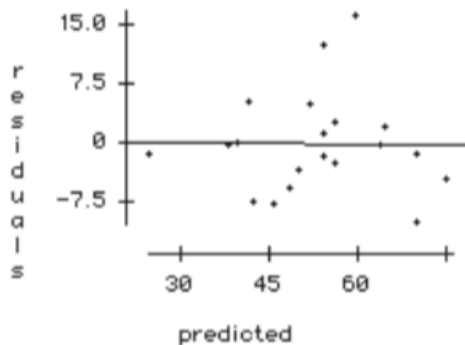
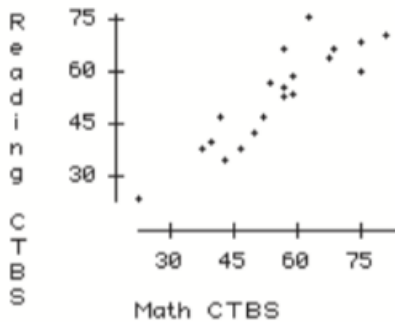
The Comprehensive Test of Basic Skills (CTBS) is used by school districts in the U.S. to assess student progress. Two of the tested areas are reading and math. To explore the relationship between reading and math scores, school administrators took a random sample of student data and constructed a linear regression model. Software output and diagnostic plots from their analyses are shown below.

1. Write the equation of the regression line. Be sure to clearly identify your variables.
2. Check at least 2 of the necessary conditions for regression.
3. Compute and interpret a 90% confidence interval for the true slope.

Dependent variable is: **Reading CTBS**
 No Selector
 R squared = 79.2% R squared (adjusted) = 78.1%
 s = 6.574 with 20 - 2 = 18 degrees of freedom

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	2969.3	1	2969.3	68.7
Residual	777.905	18	43.2169	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	5.23273	5.971	0.876	0.3924
Math CTBS	0.865835	0.1045	8.29	≤ 0.0001



Solution

1. The equation of the regression line is

$$\widehat{\text{reading}} = 5.23273 + 0.8658 \text{ math}$$

where the explanatory variable is the CTBS math score and the response variable is the CTBS reading score.

2. (i) Is the relationship linear? From the 1st scatter plot, the relationship between CTBS reading and math scores appears to be approximately linear.
- (ii) Is the variability in the residuals constant? The 2nd graph suggests this condition

many not be met as well as we would like. The variability appears higher near the center of the horizontal axis.

(iii) Are the residuals nearly normal? The histogram of the residuals has a slight skew, but it appears close enough to normal.

(iv) Are the observations independent? Not enough information is given for verifying this. But since the sample is randomly selected, it may be reasonable to assume independence.

3. Confidence interval = estimate $\pm t_{df}^* SE$

Here we have: estimate = 0.8658, $df = 18$, $t_{18}^* = 1.734$, $SE = 0.1045$.

Confidence interval = (0.685, 1.047)

We are 90% confident that for each 1 point increase in the CTBS math score the CTBS reading score will increase, on average, between 0.685 and 1.047 points.

Grading: Total points possible = 5.

(a)=1.5 points, (b)=1.5 points, (c)=2 points.

For (a): 1pt = correct equation; 0.5pt=clarify variables.

For (b): must include reasonable argument about any 2 conditions.

For (c): 0.5pt each for: (i) correct general formula for CI; (ii) correct t^* ;

(iii) correct calculation of CI; (iv) correct interpretation.