

**Math 110**  
 Quiz 2 Sample Solutions  
 February 7, 2010

Be sure to provide explanations for your answers as indicated.

- The average ACT science score for Texas in 2008 was 20.5 with an SD of 4.8. A total of 79,050 students took the test. Based on this information, estimate the number of students who scored between 25 and 30 inclusive. (*Hint:* How can you use information in the  $z$ -table to find the area under the normal curve that corresponds to “between 25 and 30 inclusive”?)

First, translate 25 and 30 to standard units:  $z_1 = \frac{25-20.5}{4.8} \approx .94$  and  $z_2 = \frac{30-20.5}{4.8} \approx 1.98$ . Second, look up these values in the  $z$ -table to obtain symmetric areas:  $A_1 \approx 65.2\%$  and  $A_2 \approx 95.3\%$ . Half the difference between these values is the percentage of students scoring between 25 and 30 inclusive. This is  $\frac{1}{2}(95.3 - 65.2) \approx 15.1\%$ . The answer is  $.151 \times 79,050 \approx 11,937$  student scored in this range.

Year	1961	1962	1963	1964	1965	1966	1967
Handguns/100,000	178.15	156.41	198.02	222.1	301.92	391.22	665.56
Homicides/100,00	8.6	8.9	8.52	8.89	13.07	14.57	21.36
Year	1968	1969	1970	1971	1972	1973	
Handguns/100,000	1131.21	837.6	794.9	817.74	583.17	709.59	
Homicides/100,00	28.03	31.49	37.39	46.26	47.24	52.33	

- The data in the table shown above is for the number of handguns per 100,000 people and the number of homicides per 100,000 people in Detroit from 1961 to 1973. A scatter plot for the data is shown above. (Data collected by J.C. Fisher from the StatsLib Datasets Archive at Carnegie Mellon University). The mean and SD for the number of handguns are 537.5 and 304. The mean and SD for the number of homicides are 25.1 and 15.74. The  $r$  value for the data is .73.

- Plot the SD line for the data on the scatter plot. Be sure to label the point of averages.

The formula for the SD-line is  $y = \frac{15.74}{304}(x - 537.5) + 25.1 = .052(x - 537.5) + 25.1$ .

The plot is shown in Figure 1.

- Plot the regression line for the data on the scatter plot.

The formula for the SD-line is  $y = .73 \frac{15.74}{304}(x - 537.5) + 25.1 = .038(x - 537.5) + 25.1$ . The plot is shown in Figure 1.

- Can you draw any conclusions from the data and the scatter plot? If so, what are they and why, if not, why not?

It appears there is an association between number of handguns per 100,000 and number of homicides per 100,000. However, we cannot draw any conclusions about causation. For example, it could be the case that greater availability of handguns was a factor in the rise of homicide numbers. Or, it could be the case that increased ownership of handguns was a response to the increased homicide rate. Further, there could be hidden confounding factors explaining the association.

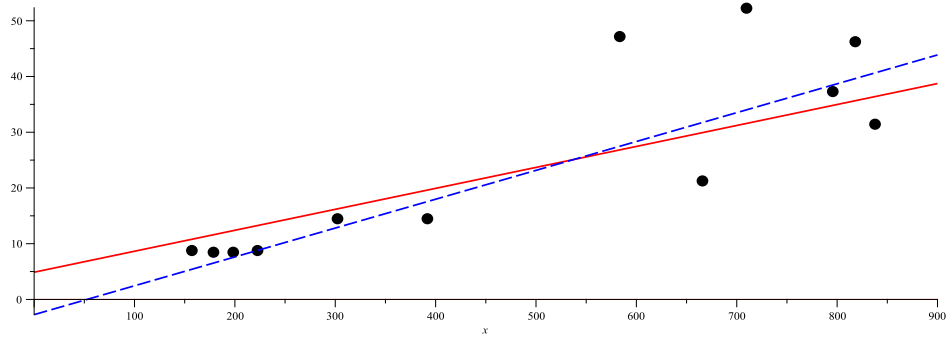


Figure 1: Scatter Plot for Detroit data. The SD line is in blue. The regression line is in red.