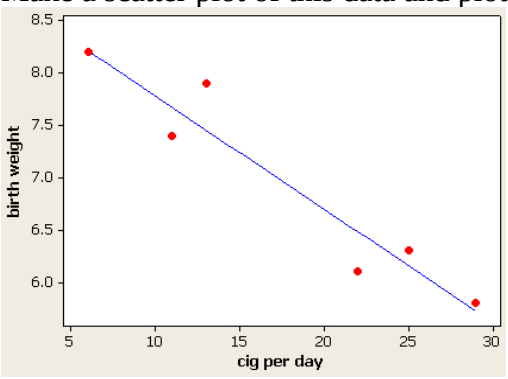
Lab #3
Regression, and Normal Probabilities

1. The NIH (National Institute of Health) is studying the relationship between the number of cigarettes smoked per day and the birth weight of babies born to mothers who smoke cigarettes. A sample of six is selected and is listed below

# cigarettes per day	22	13	29	11	25	6
Birth weight	6.1	7.9	5.8	7.4	6.3	8.2

   a. What is the regression equation predicting birth weight from number of cigarettes smoked per day?
   The regression equation is
   birth weight = 8.86 - 0.108 cig per day

   b. Make a scatter plot of this data and plot the regression equation onto the scatter plot.



   c. What is the coefficient of determination? What percentage of the variation of birth weight is explained by the number of cigarettes per day?
   Both questions are asking the same thing.
   R-Sq = 91.4%

   d. How much does the birth weight change if one more cigarette is smoked per day?
   This is asking for the slope; therefore the birth weight drops by 0.108 pounds per cigarette.

   e. What is the correlation coefficient between birth weight and number of cigarettes smoked per day? Calculate this from the coefficient of determination.
   The correlation r is sign(b)*√(0.914) = -0.956

   f. What birth weight would we predict for some one smoking ten cigarettes per day? What birth weight would we predict for a mother smoking 40 cigarettes per day?
   For ten cigarettes per day, we predict the weight will be
   8.8554 - 0.1078(10) = 7.78
   For 40 cigarettes per day, we predict
   8.8554 - 0.1078(40) = 4.54

2. Assume that the random variable X ~ N(0.987, 0.65). Find the probabilities:

   a. P(X < 0.43) **= 0.195744**
   b. P(X > 1.23) = **1 - 0.645741 = 0.354259**
   c. P(0.67 < X < 0.89) **= 0.440686 - 0.312884 = 0.127802**

3. Assume that the random variable X ~ N(54, 3).
   a. What is the value of C so that P(X < C) = 0.9082
      C = 57.9893
   b. What is the value of C so that P(X > C) = 0.0375
      C = 59.3414
   c. ~~If P(0 < X < a) = 0.3212, what is the value of a?~~
      ~~**C = 56.7598**~~
   d. ~~What is the value of C so that P(−C < X < C) = 0.8414~~
      ~~**C = 58.2294**~~
   e. ~~What is the value of C so that P(−C < X < C) = 0.7777~~
      ~~**C = 57.6613**~~

4. Calculate the following:
   a. X ~ N(246, 80), what is P(X < 357)?
      P(X < 357) **= 0.917355**
   b. What is 99th quantile of the distribution X ~ N(246, 80)?
      P(X < C) = 0.99 => **C = 432.108**
   c. X ~ N(333, 44), what is P(X > 357)?
      P(X > 357) **= 1 - 0.707280 = 0.292720**
   d. X ~ N(333, 44), what is P(246 < X < 321)
      P(246 < X < 321) **= 0.392531 - 0.0240054 = 0.368526**
   e. What is the 90th percentile of the distribution X ~ N(500, 66)?
      P(X < C) = 0.90 => **C = 584.582**

5. The distribution of actual weights of 8 oz. Chocolate bars produced by a certain machine are normal with a mean of 8.1 ounces and a standard deviation of 0.1 ounces. What is the proportion of chocolate bars made by this machine weigh between 8.2 and 8.3 ounces?

   X is Normal with mean 8.1 and standard deviation 0.1-- X ~ N(8.1, 0.1)

   P(8.2 < X < 8.3) = 0.977250 - 0.841345 = 0.135905

6. Choose a household at random from Bakersfield and let the random variable X be the number of persons living in the household. If we ignore the few households with more than seven inhabitants, the probability distribution of X is as follows:

x	1	2	3	4	5	6	7
P(x)	0.25	**0.32**	0.17	0.15	0.07	0.03	0.01

   a. **P(x = 2) = 1 - 0.25 - 0.17 - 0.15 - 0.07 - 0.03 - 0.01 = 0.32**
   b. **P(x ≠ 1) = 1 - 0.25 = 0.75**
   c. **P(2 < x ≤ 4) = 0.17 + 0.15 = 0.32**

7. The scores on a university exam are normally distributed with a mean of 62 and a standard deviation of 11. If the top 15% of students are given A's, what is the lowest mark that a student can have and still be awarded an A?

   X is Normal with mean 62 and standard deviation 11-- X ~ N(62, 11)

   P(X < C) = 0.85 → C = 73.4008

8. According to Opinion Research Corporation, the length of time spent in the shower by men follows a normal probability distribution with a mean of 11.4 min and a standard deviation of 1.8 minutes.

   X is Normal with mean 11.4 and standard deviation 1.8-- X ~ N(11.4, 1.8))

   a. **P(x < 10) = 0.21835**
   b. What is probability that the shower lasts at least 15 minutes?
      P(X > 15) = 1 – P(x < 15) = 1 - 0.977250
   c. What is the number of minutes of the 10% fastest showers?
      P(x > C) = 0.10 → P(x < C) = 0.90 → C = 13.7068

9. According to the College Board, the scores on the SAT Math exam have a normal distribution with a mean of 500 and a standard deviation of 100.

   a. **P(x < 450) = 0.308538**
   b. What is the percentile for a student who scores 600 on exam?
      P(x < 600) = 0.841345 (the 84.1345 percentile)
   c. What score would the student have to make to be in the top 1%?
      P(x < C) = 0.99 → 732.635