ENHANCING STATISTICS TEACHER EDUCATION WITH E-MODULES

Mod 1: Part 2
Task Analysis Set 1

Task 1A. Sports Cars' Weight and Fuel Efficiency

Recall the equation of the least squares regression line is

$$\hat{y} = a + bx$$

Where the slope coefficient *b* and intercept coefficient *a* are determined from the sample data, specifically the means and standard deviations for each variable and the correlation coefficient between them:

$$b = r\frac{s_y}{s_x} \qquad a = \bar{y} - b\bar{x}$$

The means and standard deviations of sports cars' weight and fuel efficiency and the correlation between them are reported in the table below:

	Mean	Standard Deviation	Correlation
Weight	2997	357.6	-0.816
MPG	20.867	3.044	

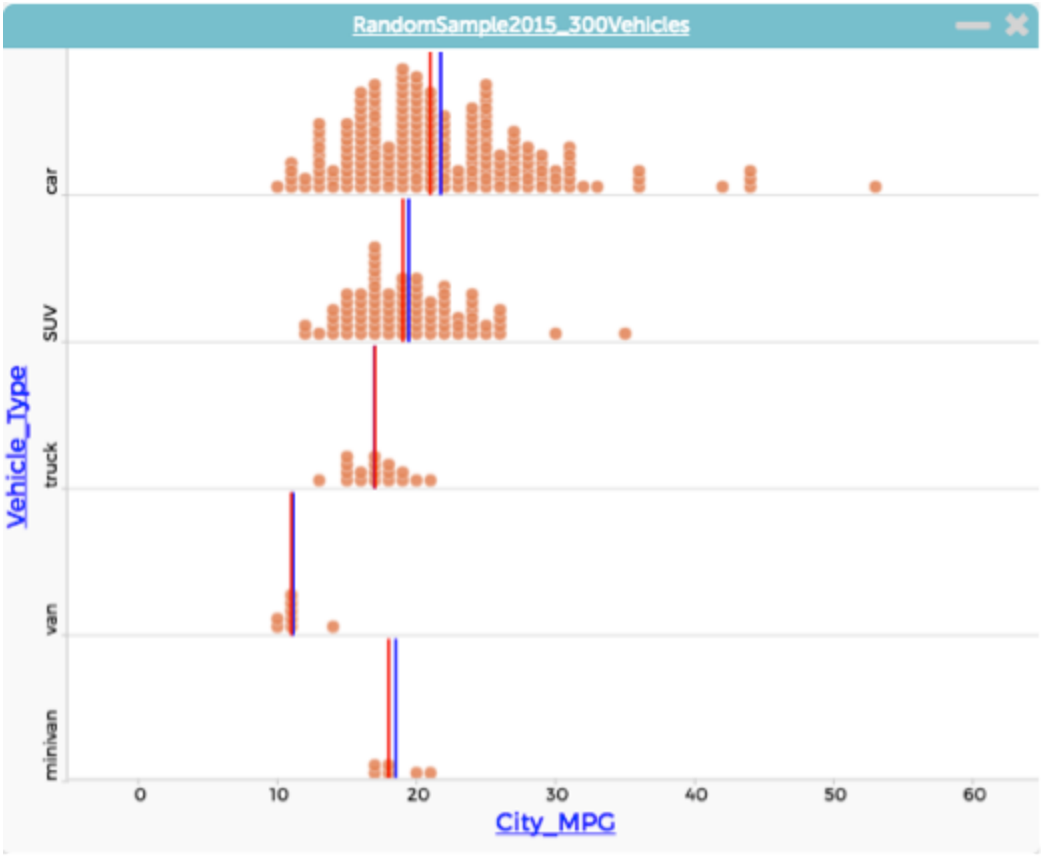
a) Use this information to determine (by hand) the coefficients of the least squares line for predicting a car's miles per gallon rating from its weight. Report the equation of this line.
b) Use the regression line to predict the city MPG rating for the Audi TT, whose weight is 2655 pounds.
c) By how many miles per gallon does the least squares line predict a car's fuel efficiency to drop for each additional 100 pounds of weight? (Use the slope coefficient to answer this question.)
d) What proportion of the variability in cars' miles per gallon ratings is explained by the least squares line with weight?

Task adapted from: p. 211 of Rossman, A. J., & Chance, B. L. (2001). *Workshop statistics: Discovery with data* (2nd ed.). Emeryville, CA: Key College Publishing.

Task 1B. Vehicle Data

To help us consider vehicles in the aggregate, we have downloaded a collection of 1226 vehicles manufactured in 2015 (https://www.fueleconomy.gov/feg/download.shtml), and assembled a multivariate data set to only include 16 attributes that would likely be of interest to most consumers. From the collection of 1226, a random sample of 300 vehicles was chosen.

Examine the graph below. Is there a difference in the City fuel efficiency in the five vehicle types? Which tends to be the highest or lowest? Explain.



Explore the full vehicle data set using CODAP by opening the following link: https://tinyurl.com/2015VehiclesSample

Pose your own question to investigate related to some of the variables of interest to you and do some exploration to try to answer it.

Task adapted from: Lee, H. S., Hollebrands, K. F., & Wilson, P. H. (2017). Chapter 4: Using multivariate data to investigate fuel economy in vehicles - Section 2: Investigating the aggregate and comparing subgroups. In *Preparing to teach mathematics with technology: An integrated approach to data analysis and probability* (3rd ed.). NC State University, Raleigh, NC. Retrieved from friday.institute/ptmt