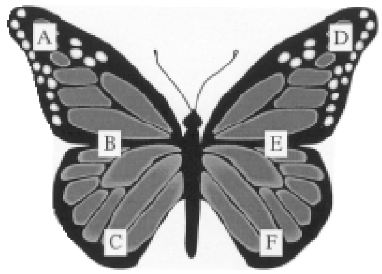
3. Researchers often mark wildlife in order to identify particular individuals across time or space. A study of butterfly migration is designed to determine which location on the butterflies' wings is best for marking. The six possible locations are those shown as A through F in the figure below. The butterfly in the figure is a monarch (Danaus plexippus).



Because marks in certain locations may be more likely to attract predators or cause problems than marks in other locations, the goal is to determine whether the six marking locations result in equivalent chances of successful migration. To test this, researchers plan to mark 3,600 butterflies and release them, then count how many arrive displaying each marking location at the end of the migratory path.

(a) Briefly describe a method you could use to assign the marking locations if you wanted to ensure that exactly 600 butterflies were marked in each location.

(b) Briefly describe a method you could use to assign the marking locations if you wanted to be independent from one butterfly to the next, and wanted each location assigned with a probability 1/6 each time.

(c) Using your method of assignment from part (b), explain how you would analyze the data collected from this study.

(d) If butterflies are marked using your method of assignment from part (a), would you change your method of analysis? Explain your reasoning.

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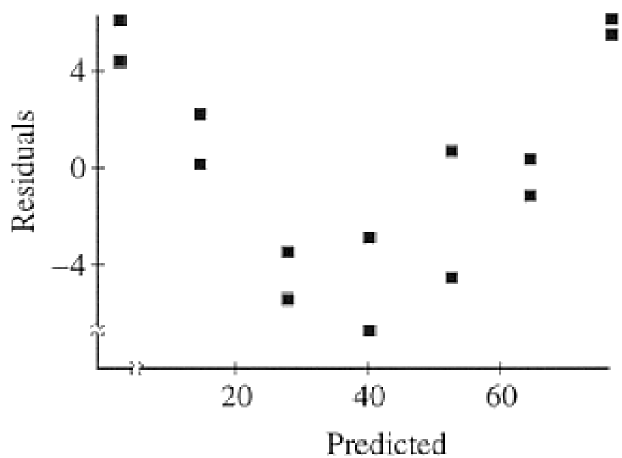
4. In a study of the application of a certain type of weed killer, 14 fields containing large numbers of weeds were treated. The weed killer was prepared at seven different strengths by adding 1, 1.5, 2, 2.5, 3, 3.5, or 4 teaspoons to a gallon of water. Two randomly selected fields were treated with each strength of weed killer. After a few days, the percentage of weeds killed on each filed was measured. The computer output obtained from fitting a least squares regression line to the data is shown below. A plot of the residuals is provided as well.

Dependent variable is: percent killed
R squared = 97.2% R squared (adjusted) = 96.9%
$s = 4.505$ with $14 - 2 = 12$ degrees of freedom

Source	**Sum of Squares**	**df**	**Mean Square**	**F-ratio**
Regression	8330.16	1	8330.16	410
Residual	243.589	12	20.2990	
Variable	**Coefficient**	**s.e. of Coeff**	**t-ratio**	**Prob**
Constant	-20.5893	3.242	-6.35	≤ 0.0001
No. Teaspoons	24.3929	1.204	20.3	≤ 0.0001



(a) What is the equation of the least squares regression line given by this analysis? Define any variables used in this equation.

(b) If someone uses this equation to predict the percentage of weeds killed when 2.6 teaspoons of weed killer are used, which of the following would you expect?

- ❍ The prediction will be too large.
- ❍ The prediction will be too small.
- ❍ A prediction cannot be made based on the information given on the computer output.

Explain your reasoning.

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