

AP Statistics Grade Boost Packet

1. The manager of a cultured pearl farm has received a special order for two pearls between 7 millimeters and 9 millimeters in diameter. From past experience, the manager knows that the pearls found in his oyster bed have diameters that are normally distributed with a mean of 8 millimeters and a standard deviation of 2 millimeters. Assume that every oyster contains one pearl.

The manager wants to know how many oysters he should expect to open to find two pearls of the appropriate size for this special order. Complete the following parts to design a simulation to answer the manager's question.

- (a) Determine the probability of finding a pearl of the appropriate size in an oyster selected at random. (Express this probability as a number between 0 and 1. Round this probability to the nearest tenth.)
- (b) Describe how you would use a table of random digits to carry out a simulation to determine the number of oysters needed to find two pearls of the appropriate size. Include a description of what each of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 will represent in your simulation.
- (c) Perform your simulation 3 times. (That is, run 3 trials of your simulation.) Start at the upper left most digit in the 1st row of the table and move across. Make your procedure clear so that someone can follow what you did. You must do this by marking directly on or above the table.

48747	76595	32588	38392	84422	80016	37890
71950	22494	00369	51269	87073	73694	97751
17857	52352	21392	22930	43776	10503	58249
80993	52010	88856	23882	73613	57648	47051
63016	73572	22684	02409	37565	52457	01257
40615	63910	09596	10241	03413	77576	74872
57431	29251	77848	98037	81230	38561	69580
06181	97842	48327	37976	81333	10264	77769

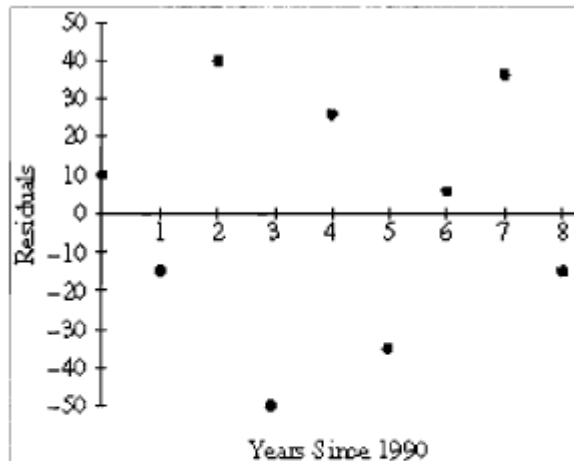
2. A company is considering implementing one of two quality control plans for monitoring the weights of automobile batteries that it manufactures. If the manufacturing process is working properly, the battery weight are approximately normally distributed with a specified mean and standard deviation.

Quality control plan A calls for rejecting a battery as defective if its weight falls more than 2 standard deviations below the specified mean.

Quality control plan B calls for rejecting a battery as defective if its weight falls more than 1.5 interquartile ranges below the lower quartile of the specified population.

Assume the manufacturing process is under control.

- a. What proportion of batteries will be rejected by plan A?
 - b. What is the probability that at least 1 of 2 randomly selected batteries will be rejected by plan A?
 - c. What proportion of batteries will be rejected by plan B?
3. Lydia and Bob were searching the Internet to find information on air travel in the United States. They found data on the number of commercial aircraft flying in the United States during the years 1990-1998. The dates were recorded as years since 1990. Thus, the year 1990 was recorded as year 0. They fit a least squares regression line to the data. The graph of the residuals and part of the computer output for their regression are given below.

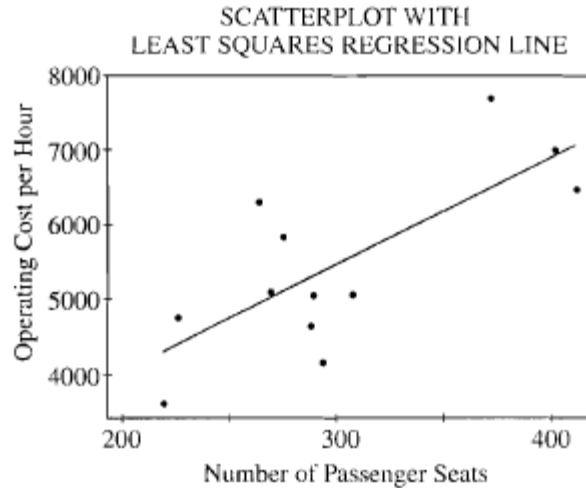


Predictor	Coef	Stdev	t-ratio	p
Constant	2939.93	20.55	143.09	0.000
Years	233.517	4.316	54.11	0.000

s = 33.43

- Is a line an appropriate model to use for these data? What information tells you this?
- What is the value of the slope of the least squares regression line?
Interpret the slope in the context of this situation.
- What is the value of the intercept of the least squares regression line?
Interpret the intercept in the context of this situation.
- What is the predicted number of commercial aircraft flying in 1992 ?
- What was the actual number of commercial aircraft flying in 1992 ?

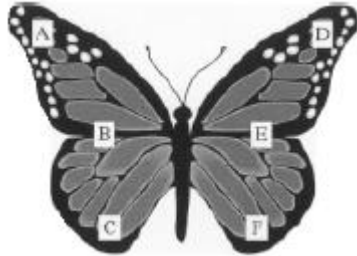
4. Commercial airlines need to know the operating cost per hour of flight for each plane in their fleet. In a study of the relationship between operating cost per hour and number of passenger seats, investigators computed the regression of operating cost per hour on the number of passenger seats. The 12 sample aircraft used in the study included planes with as few as 216 passenger seats and planes with as many as 410 passenger seats. Operating cost per hour ranged between \$3,600 and \$7,800. Some computer output from a regression analysis of these data is shown below.



Predictor	Coef	StDev	T	P
Constant	1136	1226	0.93	0.376
Seats	14.673	4.027	3.64	0.005
S = 845.3		R-Sq = 57.0%		R-Sq (adj) = 52.7%

- (a) What is the equation of the least squares regression line that describes the relationship between operating cost per hour and number of passenger seats in the plane? Define any variables used in this equation.
- (b) What is the value of the correlation coefficient for operating cost per hour and number of passenger seats in the plane? Interpret this correlation.
- (c) Suppose that you want to describe the relationship between operating cost per hour and number of passenger seats in the plane for planes only in the range of 250 to 350 seats. Does the line shown in the scatterplot still provide the best description of the relationship for data in this range? Why or why not?

5. 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.

- 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.
 - 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.
 - Using your method of assignment from part (b), explain how you would analyze the data collected from this study.
6. A preliminary study conducted at a medical center in St. Louis has shown that treatment with small, low-intensity magnets reduces the self-reported level of pain in polio patients. During each session, a patient rested on an examining table in the doctor's office while the magnets, embedded in soft pads, were strapped to the body at the site of pain. Sessions continued for several weeks, after which pain reduction was measured.

A new study is being designed to investigate whether magnets also reduce pain in patients suffering from herniated disks in the lower back. One hundred male patients are available for the new study.

- Describe an appropriate design for the new study. Your discussion should briefly address treatments used, methods of treatment assignment, and what variables would be measured. Do not describe how the data would be analyzed.
- Would you modify the design above if, instead of 100 male patients, there were 50 male and 50 female patients available for the study? If so, how would you modify your design? If not, why not?