LESSON 1-3

Problem Solving

Surveys, Experiments, and Observational Studies

Explain whether each situation is an experiment or an observational study.

1. A teacher plays music during all tests given in a one-month period and compares the class grades with a similar class that does not have music played during tests.

   _____

2. A real estate developer records the listing and selling prices of all homes in one area to determine the difference in the listing price and the selling price.

   _____

The study described below is a randomized controlled experiment. Describe the treatment, the treatment group, and the control group.

3. At Flower Power seed farm, a researcher collects data about how heat affects the germination of flower seeds. Fifty randomly chosen seeds were treated to temperatures above 100°F, and 50 other randomly chosen seeds were left at normal temperatures. At the end of the growing season, the heated group germinated 20% faster than the non-heated group.

   _____

   _____

4. An engineer wants to know if a fuel additive will affect the fuel efficiency of an automobile. He recruits 40 volunteers, and randomly assigns them to two groups. One group fills their cars with gasoline with the additive. The other group fuels their cars with plain gasoline. The group that uses the additive sees a 5% decrease in fuel efficiency.

   _____

   _____

Choose the method that would be least biased.

5. An ice cream company wants to measure the relationship between the quality of ingredients it uses and the taste of the product.

   A randomized comparative experiment

   B observational study

   C survey

   D randomized controlled experiment

6. An auto manufacturer wants to measure the fuel efficiency of a new hybrid car.

   F randomized comparative experiment

   G observational study

   H survey

   J randomized controlled experiment

Holt McDougal Advanced Algebra

Problem Solving

1. The teacher applies a treatment (playing music during tests) to some of the individuals (the class). This situation is an example of an experiment.

2. The real estate developer gathers data without controlling the individuals or applying a treatment. The situation is an example of an observational study.

3. Treatment: applying heat to flower seeds. Treatment group: 50 randomly chosen seeds that were heated. Control group: another 50 randomly chosen seeds left at room temperature.

4. Treatment: using a fuel additive. Treatment group: volunteers that use fuel with the additive. Control group: volunteers that use plain fuel.

5. A

6. G

Reading Strategy

1. survey

2. experiment

3. observational study

4. experiment

5. survey

6. the group of subscribers who ordered in the normal way

7. the group of products that went on sale at the normal time

2-1 SIGNIFICANCE OF EXPERIMENTAL RESULTS

Practice A

1. The light bulbs will burn out in the same amount of time.

2. a. It will take the same amount of time for the water to boil whether salt is added or not.

   b. There is a very slight difference between the two groups that is likely to be caused by chance, so the null hypothesis cannot be rejected based on this experiment.
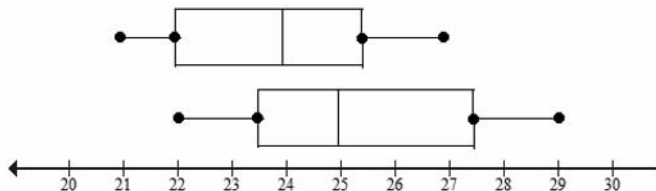
3. a. 3

   b. Yes; $|3| > 1.96$, so the null hypothesis should be rejected.

   c. It is not likely that Carly's claim is true because $|3| > 1.96$ and so the null hypothesis was rejected with 95% certainty.

Practice B

1. a. The test scores will be the same for both groups.

   b. There is a large difference between the two groups that is unlikely to be caused by chance. The school should reject the null hypothesis because the new curriculum is working to increase test scores at the school.

2. a. -2.5

   b. Because the absolute value of z is 2.5, which is greater than 1.96, there is enough evidence to reject the null hypothesis with 95% certainty.

3. The bounce heights will be the same for each company's product.

4. a. -1.5

   b. Because the absolute value of z is 1.5, which is less than 1.96, there is not enough evidence to reject the null hypothesis with 95% certainty.

Practice C

1. a. Any difference in the gas mileage between the groups was caused by chance.

   b.

   c. There is a difference between the two groups but it is not great enough to rule out the possibility that it was caused by chance, so the null hypothesis cannot be rejected based on this experiment.