Time Frame: 50 minutes

Subject Matter: Correlation Coefficient TELL ME

Objective: TSWBAT compute the correlation coefficient between the two variables and classify analytically the relationships as either positive, negative, or zero.

Standards: DA – 3.6

 Materials: InterWrite Presentations and Worksheets

SHOW ME

Presentation of Information

The teacher will discuss the correlation coefficient.

* Range of correlation coefficient: - 1 to +1
* Formula for the Correlation Coefficient

$$r= \frac{n\left(∑xy\right)-\left(∑x\right)\left(∑y\right)}{\sqrt{\left[n\left(∑x^{2}\right)-\left(∑x\right)^{2}\right]\left[n\left(∑y^{2}\right)-\left(∑y\right)^{2}\right]}}$$

$$ where n is the number of data pairs$$

Example 1: Compute the value of the correlation coefficient for the data obtained in a study of age and systolic blood pressure of six randomly selected subjects. Classify analytically the relationship between the two variables as either positive, negative, or zero. The data are shown in the table.

|  |  |  |
| --- | --- | --- |
| Subject | Age (x) | Pressure (y) |
| A | 43 | 128 |
| B | 48 | 120 |
| C | 56 | 135 |
| D | 61 | 143 |
| E | 67 | 141 |
| F | 70 | 152 |

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Example 2: Compute the value of the correlation coefficient for the data obtained in a study on the number of absences and the final grades of seven randomly selected students from a statistics class. Classify analytically the relationship between the two variables as either positive, negative, or zero. The data are shown here.

|  |  |  |
| --- | --- | --- |
| Student | Number of Absences (x)  | Final Grade (y) |
| A | 6 | 82 |
| B | 2 | 86 |
| C | 15 | 43 |
| D | 9 | 74 |
| E | 12 | 58 |
| F | 5 | 90 |
| G | 8 | 78 |

Solution:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Student | Number of Absences (x)  | Final Grade (y) | $$xy$$ | $$x^{2}$$ | $$y^{2}$$ |
| A | 6 | 82 |  |  |  |
| B | 2 | 86 |  |  |  |
| C | 15 | 43 |  |  |  |
| D | 9 | 74 |  |  |  |
| E | 12 | 58 |  |  |  |
| F | 5 | 90 |  |  |  |
| G | 8 | 78 |  |  |  |
|  | $$∑x= $$ | $$∑y= $$ | $$∑xy= $$ | $$∑x^{2}= $$ | $$∑y^{2}= $$ |

$$r= \frac{n\left(∑xy\right)-\left(∑x\right)\left(∑y\right)}{\sqrt{\left[n\left(∑x^{2}\right)-\left(∑x\right)^{2}\right]\left[n\left(∑y^{2}\right)-\left(∑y\right)^{2}\right]}}$$

Example 3: Compute the value of the correlation coefficient for the data obtained in a study on the number of hours that nine people exercise each week and the amount of milk (in ounces) each person consumes per week. Classify graphically the relationship between the two variables as either positive, negative, or zero. The data are shown here.

|  |  |  |
| --- | --- | --- |
| Subject | Hours (x) | Amount (y) |
| A | 3 | 48 |
| B | 0 | 8 |
| C | 2 | 32 |
| D | 5 | 64 |
| E | 8 | 10 |
| F | 5 | 32 |
| G | 10 | 56 |
| H | 2 | 72 |
| I | 1 | 48 |

Solution:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Subject | Hours (x) | Amount (y) | $$xy$$ | $$x^{2}$$ | $$y^{2}$$ |
| A | 3 | 48 |  |  |  |
| B | 0 | 8 |  |  |  |
| C | 2 | 32 |  |  |  |
| D | 5 | 64 |  |  |  |
| E | 8 | 10 |  |  |  |
| F | 5 | 32 |  |  |  |
| G | 10 | 56 |  |  |  |
| H | 2 | 72 |  |  |  |
| I | 1 | 48 |  |  |  |
|  | $$∑x= $$ | $$∑y= $$ | $$∑xy= $$ | $$∑x^{2}= $$ | $$∑y^{2}= $$ |

$$r= \frac{n\left(∑xy\right)-\left(∑x\right)\left(∑y\right)}{\sqrt{\left[n\left(∑x^{2}\right)-\left(∑x\right)^{2}\right]\left[n\left(∑y^{2}\right)-\left(∑y\right)^{2}\right]}}$$

Classwork

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: March 22, 2011

In each of the following, compute the value of the correlation coefficient for the variables and classify analytically the relationship between the two variables as either positive, negative, or zero.

1. A manager wishes to find out whether there is a relationship between the number of radio ads aired per week and the amount of sales (in thousands) of a product. The data of the sample is shown.

|  |  |
| --- | --- |
| No. of ads (x) | Sales (y) |
| 2 | 2 |
| 5 | 4 |
| 8 | 7 |
| 8 | 6 |
| 10 | 9 |
| 12 | 10 |

1. A researcher wishes to determine if a person’s age is related to the number of hours he or she exercises per week. The data of the sample is shown here.

|  |  |
| --- | --- |
| Age (x) | Hours (y) |
| 18 | 10 |
| 26 | 5 |
| 32 | 2 |
| 38 | 3 |
| 52 | 1.5 |
| 59 | 1 |

1. A study is conducted to determine the relationship between a person’s monthly income in dollars and the number of meals that a person eats away from home per month. The data from the sample is shown here.

|  |  |
| --- | --- |
| Income (x) | Meals (y) |
| 500 | 8 |
| 1200 | 12 |
| 1500 | 16 |
| 945 | 10 |
| 850 | 9 |
| 400 | 3 |
| 540 | 7 |

1. The director of an alumni association of a small college wants to determine whether there is any type of relationship between the amount of an alumnus’s contribution (in dollars) and the years the alumnus has been out of school. The data follow.

|  |  |
| --- | --- |
| Years (x) | Contribution (y) |
| 1 | 500 |
| 5 | 100 |
| 3 | 300 |
| 10 | 50 |
| 7 | 75 |
| 6 | 80 |

1. A store manager wishes to find out whether there is a relationship between the age of her employees and the number of sick days they take each year. The data for the sample are shown.

|  |  |
| --- | --- |
| Age (x) | Days (y) |
| 18 | 16 |
| 26 | 12 |
| 39 | 9 |
| 48 | 5 |
| 53 | 6 |
| 58 | 2 |