Interpret the key results for Correlation

Learn more about Minitab

Complete the following steps to interpret a correlation analysis. Key output inc
correlation coefficient, the Spearman correlation coefficient, and the p-value.

In This Topic

Step 1: Examine the linear relationship between v (Pearson)

Use the Pearson correlation coefficient to examine the strength and direction o
between two continuous variables.

Strength

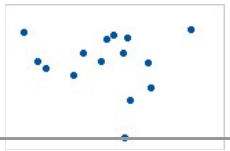
The correlation coefficient can range in value from −1 to +1. The larger the a
coefficient, the stronger the relationship between the variables.

For the Pearson correlation, an absolute value of 1 indicates a perfect linear
correlation close to 0 indicates no linear relationship between the variables.

Direction

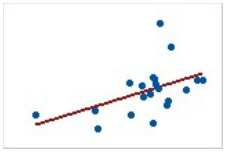
The sign of the coefficient indicates the direction of the relationship. If both v
increase or decrease together, the coefficient is positive, and the line that re
slopes upward. If one variable tends to increase as the other decreases, the
and the line that represents the correlation slopes downward.

The following plots show data with specific correlation values to illustrate diffe
strength and direction of the relationships between variables.



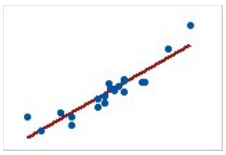
No relationship: Pearson r = 0

The points fall randomly on the plot, which indicates that there is no linear relationship bet



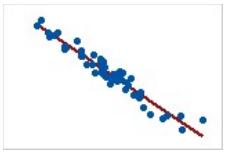
Moderate positive relationship: Pearson r = 0.476

Some points are close to the line but other points are far from it, which indicates only a mc
relationship between the variables.



Large positive relationship: Pearson r = 0.93

The points fall close to the line, which indicates that there is a strong linear relationship bet
The relationship is positive because as one variable increases, the other variable also incre



Large negative relationship: Pearson r = −0.968

The points fall close to the line, which indicates that there is a strong negative relationship
variables. The relationship is negative because, as one variable increases, the other variabl

Consider the following points when you interpret the correlation coefficient:

- It is never appropriate to conclude that changes in one variable cause ch
on correlation alone. Only properly controlled experiments enable you tc
relationship is causal.
- The Pearson correlation coefficient is very sensitive to extreme data valu
very different from the other values in a data set can greatly change the v
You should try to identify the cause of any extreme value. Correct any da
measurement errors. Consider removing data values that are associated
time events (special causes). Then, repeat the analysis.
- A low Pearson correlation coefficient does not mean that no relationship
variables. The variables may have a nonlinear relationship. To check for r
graphically, create a scatterplot or use simple regression.

Correlations

	Hydrogen	Porosity
Porosity	0.624783	
	0.0169	
Strength	-0.790146	-0.527459
	0.0008	0.0526

Cell Contents: *Pearson correlation*
P-Value

Key Result: Pearson correlation

In these results, the Pearson correlation between porosity and hydrogen is about 0.624783 there is a moderate positive relationship between the variables. The Pearson correlation b hydrogen is about -0.790146, and between strength and porosity is about -0.527459. The r these variables is negative, which indicates that, as hydrogen and porosity increase, streng

Step 2: Determine whether the correlation coeffic significant

To determine whether the correlation between variables is significant, compar significance level. Usually, a significance level (denoted as α or alpha) of 0.05 w indicates that the risk of concluding that a correlation exists—when, actually, n 5%. The p-value tells you whether the correlation coefficient is significantly diff coefficient of 0 indicates that there is no linear relationship.)

P-value ≤ α: The correlation is statistically significant

If the p-value is less than or equal to the significance level, then you can conc correlation is different from 0.

P-value > α: The correlation is not statistically significant

If the p-value is greater than the significance level, then you cannot conclude different from 0.

Correlations

	Hydrogen	Porosity
Porosity	0.624783	
	0.0169	
Strength	-0.790146	-0.527459
	0.0008	0.0526

Cell Contents: Pearson correlation
P-Value

Key Result: P-Value

In these results, the p-values for the correlation between porosity and hydrogen and betwe hydrogen are both less than the significance level of 0.05, which indicates that the correlati significant. The p-value between strength and porosity is 0.0526. Because the p-value is gre significance level of 0.05, there is inconclusive evidence about the significance of the associ variables.

Step 3: Examine the monotonic relationship betw (Spearman)

Use the Spearman correlation coefficient to examine the strength and directio relationship between two continuous or ordinal variables. In a monotonic relat tend to move in the same relative direction, but not necessarily at a constant ra Spearman correlation, Minitab ranks the raw data. Then, Minitab calculates the on the ranked data.

Strength

The correlation coefficient can range in value from −1 to +1. The larger the a
coefficient, the stronger the relationship between the variables.

For the Spearman correlation, an absolute value of 1 indicates that the rank-
perfectly linear. For example, a Spearman correlation of −1 means that the h
A is associated with the lowest value for Variable B, the second highest value
associated with the second lowest value for Variable B, and so on.

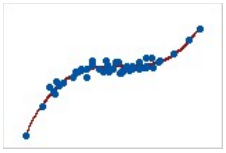
Direction

The sign of the coefficient indicates the direction of the relationship. If both
increase or decrease together, the coefficient is positive, and the line that re
slopes upward. If one variable tends to increase as the other decreases, the
and the line that represents the correlation slopes downward.

The following plots show data with specific Spearman correlation coefficient va
different patterns in the strength and direction of the relationships between va

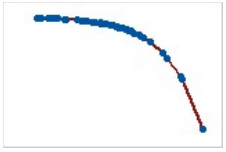
No relationship: Spearman rho = 0

The points fall randomly on the plot, which indicates that there is no relationship between



Strong positive relationship: Spearman rho = 0.948

The points fall close to the line, which indicates that there is a strong relationship between
relationship is positive because the variables increase concurrently.



Strong negative relationship: Spearman rho = 1.0

The points fall close to the line, which indicates that there is a strong relationship between
relationship is negative because as one variable increases, the other variable decreases.

It is never appropriate to conclude that changes in one variable cause changes
correlation alone. Only properly controlled experiments enable you to determi
relationship is causal.

Correlations

	Hydrogen	Porosity
Porosity	0.590058	
	0.0263	
Strength	-0.858728	-0.675468
	<0.0001	0.0080

Cell Contents: *Spearman rho*
P-Value

Key Result: Spearman Rho

In these results, the Spearman correlation between porosity and hydrogen is 0.590058, wh
there is a positive relationship between the variables. The Spearman correlation between s
hydrogen is -0.858728 and between strength and porosity is -0.675468. The relationship be
variables is negative, which indicates that as hydrogen and porosity increase, strength decr