

Section 2: Testing for correlation

Section test

- 1. A hypothesis test at the 5% significance level was carried out on a set of 50 pairs of bivariate data using the following hypotheses:
 - H₀: $\rho = 0$ H₁: $\rho > 0$

where ρ is the parent population correlation coefficient.

The correlation coefficient for the sample of data was found to be 0.241. Find the critical value. What is the conclusion for this test?

2. A hypothesis test at the 5% significance level was carried out on a set of 20 pairs of bivariate data using the following hypotheses:

 $H_0: \rho = 0$

H₁: $\rho \neq 0$

where ρ is the parent population correlation coefficient.

The correlation coefficient for the sample of data was found to be -0.413. Find the critical value. What is the conclusion for this test?

3. A hypothesis test at the 5% significance level was carried out on a set of 30 pairs of bivariate data using the following hypotheses:

H₀: $\rho = 0$

H₁: $\rho < 0$

where ρ is the parent population correlation coefficient.

The correlation coefficient for the sample of data was found to be -0.381. Find the critical value. What is the conclusion for this test?

4. Martha is investigating whether there is any correlation between the amount of time Year 4 children spend reading and their scores in a times tables test. Her null hypothesis is H_0 : $\rho = 0$

where ρ is the parent population correlation coefficient. What is Martha's alternative hypothesis?

She collects data from a class of 28 Year 4 children and finds that the correlation coefficient for this sample is 0.361.

What is the acceptance region for Martha's test at the 5% significance level? What is the result of Martha's test?



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5. Amir thinks that regions with lower smoking rates will have higher average life expectancies.
He carries out a hypothesis test on 10 regions.
His null hypothesis is H₀: ρ = 0
where ρ is the parent population correlation coefficient.
What is Amir's alternative hypothesis?

What is the critical region for Amir's test at the 5% significance level?

- A one-tailed hypothesis test was carried out on a sample of bivariate data. The *p*-value for the one-tailed test was calculated to be 0.0314. Which of the following statements is true?
 - (a) The null hypothesis is rejected at the 10% level but accepted at the 5% level
 - (b) The null hypothesis is rejected at the 5% level but accepted at the 2% level
 - (c) The null hypothesis is accepted at the 5% level but rejected at the 2% level
 - (d) The null hypothesis is accepted at the 10% level but rejected at the 5% level

It was later realised that the test should have been a two-tailed test. Which of the following statements is true for the two-tailed test?

- (a) The null hypothesis is rejected at the 10% level but accepted at the 5% level
- (b) The null hypothesis is rejected at the 5% level but accepted at the 2% level
- (c) The null hypothesis is accepted at the 5% level but rejected at the 2% level
- (d) The null hypothesis is accepted at the 10% level but rejected at the 5% level

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Solutions to section test

- This is a one-tailed test.
 From tables, for n = 50 and 5% significance, the critical value is 0.2353.
 The correlation coefficient is 0.241
 0.241 > 0.2353, so reject Ho.
 There is sufficient evidence to suggest that there is positive correlation.
- This is a two-tailed test.
 From tables, for n = 20 and 5% significance, the critical value is 0.4438.
 The correlation coefficient is -0.413
 0.413 < 0.4438, so accept Ho.
 There is not sufficient evidence to suggest that there is any correlation.
- 3. This is a one-tailed test.
 From tables, for n = 35 and 5% significance, the critical value is 0.3061.
 The correlation coefficient is -0.381
 0.381 > 0.3061, so reject Ho.
 There is sufficient evidence to suggest that there is negative correlation.
- 4. This is a two-tailed test, so the alternative hypothesis is $H_1: \rho \neq 0$.

At the 5% significance level with n = 28, the critical value is 0.3739 so the acceptance region is -0.3739 < r < 0.3739.

The correlation coefficient lies in the acceptance region, so accept Ho. There is not sufficient evidence to suggest that there is any correlation between the time spent reading and the test scores.

5. This is a one-tailed test, looking for negative correlation, so the alternative hypothesis is

 $\mathsf{H}_{\mathtt{1}}: \rho < \mathsf{O} \,.$

At the 5% significance level with n = 10, the critical value is 0.5494 so the critical region is $r \leq -0.5494$.

6. The p-value is greater than 2% but less than 5%. This means that the null hypothesis is rejected at the 5% level but accepted at the 2% level.

The p-value for the two-tailed test is 0.0628. This is greater than 5% but less than 10%. This means that the null hypothesis is rejected at the 10% level but accepted at the 5% level.