

The p-value is the probability of getting a result at least as extreme as the one obtained from the sample if the variables are not correlated.

Instead of using the critical value, you can compare the **p-value** for the PMCC to the significance level. You accept the null hypothesis if the p-value is greater than the significance level.

#### Key point



#### ICT Resource online

To investigate correlation using hypothesis tests, click this link in the digital book.

### Example 2

The number of hours spent training for a marathon and the number of hours taken to complete a marathon for a random sample of 30 marathon entrants are suspected to have a negative correlation. The hypotheses  $H_0: \rho = 0$  and  $H_1: \rho < 0$  are being considered at the 10% significance level. The PMCC for the sample is  $-0.3061$ , which has a p-value of 0.05 for a one-tailed test. State, with a reason, whether  $H_0$  is accepted or rejected.

The p-value is 5%. Since 5% is less than 10%, the result is significant and so the null hypothesis is rejected.

If  $\rho = 0$ , the probability of this PMCC is less than the significance level.

### Example 3

The latitude of a random sample of weather stations and the average daily temperatures recorded in a year are examined to see if there is any correlation. The hypotheses are being considered at the 5% significance level. A sample of 12 weather stations is taken and the PMCC is found to be 0.6581, which has a p-value of 0.02 for a two-tailed test. State the hypotheses of the test and determine the conclusion in context.

The null hypothesis is  $H_0: \rho = 0$  and the alternative hypothesis is  $H_1: \rho \neq 0$ .

The p-value is 2% which is lower than the significance level, so the result is more extreme than required. There is sufficient evidence to reject  $H_0$ .

It can be concluded that there is some correlation between the latitude of a weather station and the average daily temperatures recorded in a year.

1 Conduct a test to decide if there is sufficient evidence to reject the null hypothesis.

2 Reject the null hypothesis.

3 Conclude that there is correlation.

Note that the conclusion doesn't involve any statement about the strength of the correlation.

- 6 Education specialists want to find out if there is any correlation between the geographical location of a school and the likelihood that a student attending the school will get at least one A at A-level. A random sample of 46 schools is taken to test the hypotheses  $H_0: \rho = 0$  and  $H_1: \rho \neq 0$  at the 5% level. The PMCC is 0.1319, which has a p-value of 0.382. State, with a reason, whether  $H_0$  is accepted or rejected and determine your conclusion in context.

<p>5</p> <p><b>Statistical hypothesis testing</b></p>	<p>5.1</p> <p><b>Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, <math>p</math>-value;</b></p> <p>extend to correlation coefficients as measures of how close data points lie to a straight line.</p> <p>and</p> <p>be able to interpret a given correlation coefficient using a given <math>p</math>-value or critical value (calculation of correlation coefficients is excluded).</p>	<p><b>An informal appreciation that the expected value of a binomial distribution is given by <math>np</math> may be required for a 2-tail test.</b></p> <p>Students should know that the product moment correlation coefficient <math>r</math> satisfies <math> r  \leq 1</math> and that a value of <math>r = \pm 1</math> means the data points all lie on a straight line.</p> <p>Students will be expected to calculate a value of <math>r</math> using their calculator but use of the formula is not required.</p> <p>Hypotheses should be stated in terms of <math>\rho</math> with a null hypothesis of <math>\rho = 0</math> where <math>\rho</math> represents the population correlation coefficient.</p> <p>Tables of critical values or a <math>p</math>-value will be given.</p>
---	--	---