1.3) Hypothesis testing for zero correlation

Worked example

A scientist takes 19 observations of the masses of two reactants in an experiment.
She calculates a product moment correlation coefficient of $r = 0.54$.

The scientist believes there is a positive correlation between the masses of the two reactants.
Test at the 1% level of significance, the scientist's claim, stating your hypotheses clearly.

Your turn

A scientist takes 14 observations of the masses of two reactants in an experiment.
She calculates a product moment correlation coefficient of $r = -0.45$.

The scientist believes there is a negative correlation between the masses of the two reactants.
Test at the 5% level of significance, the scientist's claim, stating your hypotheses clearly.

$H_0: \rho = 0$
$H_1: \rho < 0 \therefore$ One-tailed test.
Sample size $= 14$
Significance level in tail $= 5\%$
Reject H_0 if $r < -0.4575$
$r = -0.45 > -0.4575$
The result is not significant.
Insufficient evidence to reject H_0.
Insufficient evidence to suggest there is a negative correlation between the masses of the two reactants.

Worked example

A scientist takes 20 observations of the masses of two reactants in an experiment.
She calculates a product moment correlation coefficient of $r = 0.54$.

The scientist believes there is no correlation between the masses of the two reactants.
Test at the 1% level of significance, the scientist's claim, stating your hypotheses clearly.

Your turn

A scientist takes 30 observations of the masses of two reactants in an experiment.
She calculates a product moment correlation coefficient of $r = -0.45$.

The scientist believes there is no correlation between the masses of the two reactants.
Test at the 10% level of significance, the scientist's claim, stating your hypotheses clearly.

$H_0: \rho = 0$
$H_1: \rho \neq 0 \therefore$ Two-tailed test.
Sample size $= 30$
Significance level in each tail $= 5\%$
Reject H_0 if $r < -0.3061$
$r = -0.45 < -0.3061$
The result is significant.
Sufficient evidence to reject H_0.
Sufficient evidence to suggest there is a correlation between the masses of the two reactants.

Worked example

The table from the large data set shows the daily mean temperature, $t\ °C$, and the daily total rainfall, $r\ mm$, in Leuchars for a sample of nine days in October 1987.

t	11.4	10.5	6.5	8.3	8.2	5.7	7.6	12.1	11.2
r	0	1	3.9	16.3	7.9	4.1	15.2	0	tr

Test, at the 10% level of significance, whether there is evidence of a negative correlation between daily mean temperature and daily total rainfall.
State your hypotheses clearly.

Your turn

The table from the large data set shows the daily maximum gust, x knots, and the daily maximum relative humidity, $y\%$, in Leeming for a sample of eight days in May 2015.

x	31	28	38	37	18	17	21	29
y	99	94	87	80	80	89	84	86

Test, at the 10% level of significance, whether there is evidence of a positive correlation between daily maximum gust and daily maximum relative humidity. State your hypotheses clearly.

$H_0: \rho = 0$
$H_1: \rho > 0$ ∴ One-tailed test.
Sample size $= 8$
Significance level in each tail $= 10\%$
Reject H_0 if $r > 0.5067$
$r = 0.1149 < 0.5067$
The result is not significant.
Insufficient evidence to reject H_0.
Insufficient evidence to suggest there is a positive correlation between daily maximum gust and daily maximum relative humidity.