inkMaths

QUESTION WORKBOOK

Hypothesis testing: correlation and the normal

Statistics · Year 12–13

8 questions · 31 marks

PRINT EDITION

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SECTION A · Warm-up

A1 Observations are drawn independently from $N(\mu, \sigma^2)$. State the distribution of the mean of n such observations. [2]

A2 The masses, in grams, of items from a production line are normally distributed with mean μ and standard deviation 3. A test of H_0: $\mu = 50$ against H_1: $\mu < 50$ uses a random sample of 36 items, whose mean mass is 48.8 g. Find the value of the test statistic. [3]

SECTION B · Standard

B1 The masses, in grams, of bags of flour are normally distributed with mean μ and standard deviation 4. A supplier claims that $\mu = 100$. A random sample of 25 bags has mean mass 98.6 g. Test, at the 5% significance level, whether the mean mass is less than the supplier claims. State your hypotheses clearly. [5]

B2 Bags filled by a machine have masses, in grams, distributed as $N(\mu, 4^2)$. A test of H_0: $\mu = 30$ against H_1: $\mu > 30$ at the 5% significance level uses the mean of a random sample of 16 bags. Find the critical region for the test, and state the conclusion when the sample mean is 31.2 g. [5]

B3 A random sample of 20 pairs of observations gives a product moment correlation coefficient of $r = 0.62$. The critical value from the table for a sample of size 20 at the 0.01 level is 0.5155. Test, at the 1% significance level, whether there is positive correlation between the two variables. [4]

B4 Explain why increasing the sample size makes a fixed difference between the sample mean and the hypothesised mean more likely to be judged significant. [2]

SECTION C · Stretch

C1 A student measures two variables on a random sample of 30 subjects and obtains a product moment correlation coefficient of $r = 0.42$. The table of critical values for a sample of size 30 gives 0.3061 at the 0.05 level, 0.3610 at the 0.025 level and 0.4226 at the 0.01 level. Test, at the 5% significance level, whether there is any correlation between the two variables, and state whether the conclusion would change at the 2% level. [5]

C2 The lengths, in centimetres, of components are distributed as $N(\mu, 2^2)$. A two-tailed test of $H_0: \mu = 50$ at the 5% significance level uses the mean of a random sample of 16 components. Find the critical region for the test, and state, with a reason, whether a sample mean of 51.1 cm leads to rejection of H_0. [5]