2.5 Statistics: Hypothesis Testing: 1-hour Pack

EDEXCEL 9MA0 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A student records 10 pairs of values for the age of a car and its resale price. The product moment correlation coefficient is r = -0.681. The critical value of r for a one-tailed test with a 5% significance level and n = 10 is 0.5494.

(a) Write down suitable hypotheses to test for negative correlation. **(2)**

(b) Carry out the test and state your conclusion in context. **(3)**

(Total for Question 1 is 5 marks)

---

2 The proportion of a population with a certain characteristic was 0.25. A researcher believes that this proportion has decreased. In a random sample of 25 people, 2 have the characteristic.

(a) State the hypotheses for a one-tailed test. **(2)**

(b) Assuming H0 is true, find the probability of obtaining a value of X at least as extreme as 2, where X ~ B(25, 0.25). **(2)**

(c) Test the researcher's belief at the 10% level of significance, stating your conclusion in context. **(3)**

(Total for Question 2 is 7 marks)

---

3 A student records 6 pairs of values for the age of a car and its resale price. The product moment correlation coefficient is r = -0.718. The critical value of r for a one-tailed test with a 5% significance level and n = 6 is 0.7293.

(a) Write down suitable hypotheses to test for negative correlation. **(2)**

(b) Carry out the test and state your conclusion in context. **(3)**

(Total for Question 3 is 5 marks)

© Revision Library | revisionlibrary.co.uk

4 The random variable X has distribution $N(\mu, 2^2)$. A random sample of 36 observations of X has mean 26.87. A test of H0: $\mu = 26$ against H1: $\mu > 26$ is carried out at the 1% significance level.

(a) State the distribution of the sample mean under H0. **(2)**

(b) Calculate the p-value for the test, to 3 significant figures. **(2)**

(c) State the conclusion of the test, in context. **(2)**

(d) Find the critical value of the sample mean for this test, to 3 significant figures. **(2)**

(Total for Question 4 is 8 marks)

---

5 The proportion of a population with a certain characteristic was 0.2. A researcher believes that this proportion has increased. In a random sample of 15 people, 5 have the characteristic.

(a) State the hypotheses for a one-tailed test. **(2)**

(b) Assuming H0 is true, find the probability of obtaining a value of X at least as extreme as 5, where $X \sim B(15, 0.2)$. **(2)**

(c) Test the researcher's belief at the 10% level of significance, stating your conclusion in context. **(3)**

(Total for Question 5 is 7 marks)

---

6 The random variable X has distribution $N(\mu, 5^2)$. A random sample of 36 observations of X has mean 74.83. A test of H0: $\mu = 73$ against H1: $\mu > 73$ is carried out at the 1% significance level.

(a) State the distribution of the sample mean under H0. **(2)**

(b) Calculate the p-value for the test, to 3 significant figures. **(2)**

(c) State the conclusion of the test, in context. **(2)**

(d) Find the critical value of the sample mean for this test, to 3 significant figures. **(2)**

(Total for Question 6 is 8 marks)

© Revision Library | revisionlibrary.co.uk

7 A student records 10 pairs of values for daily temperature and the number of visitors to a park. The product moment correlation coefficient is r = 0.758. The critical value of r for a one-tailed test with a 5% significance level and n = 10 is 0.5494.

(a) Write down suitable hypotheses to test for positive correlation. **(2)**

(b) Carry out the test and state your conclusion in context. **(3)**

(Total for Question 7 is 5 marks)

---

8 The proportion of a population with a certain characteristic was 0.2. A researcher believes that this proportion has increased. In a random sample of 20 people, 8 have the characteristic.

(a) State the hypotheses for a one-tailed test. **(2)**

(b) Assuming H0 is true, find the probability of obtaining a value of X at least as extreme as 8, where $X \sim B(20, 0.2)$. **(2)**

(c) Test the researcher's belief at the 5% level of significance, stating your conclusion in context. **(3)**

(Total for Question 8 is 7 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 2.5 Statistics: Hypothesis Testing: 1-hour Pack

Question 1

(a) H0: $\rho = 0$ **B1**

(a) H1: $\rho < 0$ **B1**

(a) Answer: H0: $\rho = 0$, H1: $\rho < 0$

(b) compares $|r| = 0.681$ with the critical value 0.5494 in the correct tail **M1**

(b) reject H0 **A1**

(b) there is evidence of negative correlation **B1**

(b) Answer: reject H0

Question 2

(a) H0: $p = 0.25$ **B1**

(a) H1: $p < 0.25$ **B1**

(a) Answer: H0: $p = 0.25$, H1: $p < 0.25$

(b) $P(X \leq 2)$ **M1**

(b) 0.0321 **A1**

(b) Answer: 0.0321

(c) compares 0.0321 with 0.1 **M1**

(c) reject H0 **A1**

(c) there is sufficient evidence that the proportion has decreased **B1**

(c) Answer: reject H0

Question 3

(a) H0: $\rho = 0$ **B1**

(a) H1: $\rho < 0$ **B1**

(a) Answer: H0: $\rho = 0$, H1: $\rho < 0$

(b) compares $|r| = 0.718$ with the critical value 0.7293 in the correct tail **M1**

(b) do not reject H0 **A1**

(b) there is insufficient evidence of negative correlation **B1**

(b) Answer: do not reject H0

Question 4

(a) X-bar ~ $N(26, 2^2/36)$ **B1**

(a) standard error $2/\sqrt{36} = 0.3333$ **B1**

(a) Answer: $N(26, 2^2/36)$

(b) $z = (26.87 - 26)/0.3333 = 2.610$ **M1**

(b) p-value = 0.00453 **A1**

(b) Answer: 0.00453

(c) compares p-value 0.00453 with 0.01 **M1**

(c) reject H0: there is sufficient evidence that the mean has increased **A1**

(c) Answer: reject H0

(d) z critical = 2.3263 **M1**

(d) critical value = 26.8 **A1**

(d) Answer: 26.8

Question 5

(a) H0: $p = 0.2$ **B1**

(a) H1: $p > 0.2$ **B1**

(a) Answer: H0: $p = 0.2$, H1: $p > 0.2$

(b) $P(X \geq 5) = 1 - P(X \leq 4)$ **M1**

(b) 0.164 **A1**

(b) Answer: 0.164

(c) compares 0.164 with 0.1 **M1**

(c) do not reject H0 **A1**

(c) there is insufficient evidence that the proportion has increased **B1**

(c) Answer: do not reject H0

Question 6

(a) X-bar ~ $N(73, 5^2/36)$ **B1**

(a) standard error $5/\sqrt{36} = 0.8333$ **B1**

(a) Answer: $N(73, 5^2/36)$

(b) $z = (74.83 - 73)/0.8333 = 2.196$ **M1**

(b) p-value = 0.0140 **A1**

(b) Answer: 0.0140

(c) compares p-value 0.0140 with 0.01 **M1**

(c) do not reject H0: insufficient evidence that the mean has increased **A1**

(c) Answer: do not reject H0

(d) z critical = 2.3263 **M1**

(d) critical value = 74.9 **A1**

(d) Answer: 74.9

Question 7

(a) H0: $\rho = 0$ **B1**

(a) H1: $\rho > 0$ **B1**

(a) Answer: H0: $\rho = 0$, H1: $\rho > 0$

(b) compares $|r| = 0.758$ with the critical value 0.5494 in the correct tail **M1**

(b) reject H0 **A1**

(b) there is evidence of positive correlation **B1**

(b) Answer: reject H0

Question 8

(a) H0: $p = 0.2$ **B1**

(a) H1: $p > 0.2$ **B1**

(a) Answer: H0: $p = 0.2$, H1: $p > 0.2$

(b) $P(X \geq 8) = 1 - P(X \leq 7)$ **M1**

(b) 0.0321 **A1**

(b) Answer: 0.0321

(c) compares 0.0321 with 0.05 **M1**

(c) reject H0 **A1**

(c) there is sufficient evidence that the proportion has increased **B1**

(c) Answer: reject H0

© Revision Library | revisionlibrary.co.uk