2.9 Statistics: Hypothesis Testing Depth: 10-minute Pack

EDEXCEL 9MA0 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

Hypothesis Testing Toolkit: Formulae and Standard Normal Critical Values

Original material written for Revision Library, styled on Edexcel A-level Mathematics (9MA0) Statistics content.

For a binomial test of H0: p = p0, use X ~ B(n, p0) and compute the relevant cumulative probability (a tail probability, or a p-value) directly, either from cumulative binomial tables or a calculator's binomial cdf function. For a normal test of H0: mu = mu0 with known sigma, standardise using z = (xbar - mu0)/(sigma/sqrt(n)) and compare z with a critical value, or convert to a critical region for xbar directly. For a correlation test of H0: rho = 0, compare the sample product moment correlation coefficient, r, with a critical value from a table of critical values for the sample size n (such a critical value will always be given where needed). Standard normal critical z-values used throughout this pack: one-tailed 10% (or two-tailed 20%) = 1.2816; one-tailed 5% (or two-tailed 10%, i.e. 5% in each tail) = 1.6449; one-tailed 1% (or two-tailed 2%) = 2.3263; two-tailed 5% (2.5% in each tail) = 1.9600; two-tailed 1% (0.5% in each tail) = 2.5758. When finding a binomial critical region, choose the region whose cumulative probability is as close as possible to the stated significance level, unless a question specifically requires the probability to remain below that level; the actual (achieved) significance level is almost never exactly equal to the nominal one, because the binomial distribution is discrete.

1 The random variable X has distribution $N(\mu, 3^2)$. A random sample of 36 observations of X has mean 71.8. 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. **(2)**

(d) Find the critical value of the sample mean for this test, to 4 significant figures. **(2)**

(Total for Question 1 is 8 marks)

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Mark scheme · 2.9 Statistics: Hypothesis Testing Depth: 10-minute Pack

Question 1

(a) X-bar ~ N(73, 3^2/36) **B1**

(a) standard error $3/\sqrt{36}$ = 0.5000 **B1**

(a) Answer: N(73, 3^2/36)

(b) z = (71.8 - 73)/0.5000 = -2.400 **M1**

(b) p-value = 0.00820 **A1**

(b) Answer: 0.00820

(c) compares p-value 0.00820 with 0.01 **M1**

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

(c) Answer: reject H0

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

(d) critical value = 71.84 **A1**

(d) Answer: 71.84

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