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Mathematical Statistics And Data Analysis 3rd Edition

Chapter 9 Testing Hypotheses and Assessing Goodness of Fit

1. A coin is thrown independently 10 times to test the hypothesis that the probability of heads is $\frac{1}{2}$ versus the alternative that the probability is not $\frac{1}{2}$. The test rejects if either 0 or 10 heads are observed.

- a. What is the significance level of the test?
b. If in fact the probability of heads is $\frac{1}{3}$, what is the power of the test?

Step 1 of 3

$$\text{Given: } H_0: p = \frac{1}{2}$$

$$H_a: p \neq \frac{1}{2}$$

And p = probability of occurring head

Rejection region W_0 (Either 0 head or 10 head occur)

It is the set of heads is then

$$W = \{X: \text{Either } X = 0 \text{ or } X = 10\}$$

Step 2 of 3

(a) So significance level of test

$$\alpha = P[\text{reject } H_0 | H_0 \text{ is true}]$$

$$= P\left[X = 0 | p = \frac{1}{2}\right] + P\left[X = 10 | p = \frac{1}{2}\right]$$

$$= \binom{10}{0} \left(\frac{1}{2}\right)^0 \left(1 - \frac{1}{2}\right)^{10} + \binom{10}{10} \left(\frac{1}{2}\right)^{10} \left(1 - \frac{1}{2}\right)^0$$

$$= \binom{10}{0} \left(\frac{1}{2}\right)^{10} + \binom{10}{10} \left(\frac{1}{2}\right)^{10}$$

$$= \left(\frac{1}{2}\right)^{10} + \left(\frac{1}{2}\right)^{10}$$

$$= 2 \left(\frac{1}{2}\right)^{10}$$

$$= \frac{1}{2^9}$$

$$= \frac{1}{512}$$

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