Assignment 8

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Question

Papoulli Chapter 8(Ex 8.32) : A computer prints out 1000 numbers consisting of 10 integers j = 0, 1, 2, 3, ..., 9
The number n_j of times j appears equals

$$n_j = 85 \;\; 110 \;\; 118 \;\; 91 \;\; 78 \;\; 105 \;\; 122 \;\; 94 \;\; 101 \;\; 96$$

Test the hypothesis that numbers j are uniformly distributed between 0 and 9, with $\alpha = 0.05$.

Theory

We are given a partition U $= [A_1, A_2, A_3, ..., A_m]$ of the space S, to test the hypothesis that the probabilities $P_i = P(A_i)$ of the events A_i equals m given constants P_{0i} using as data the number of successes k_i of each of the events A_i out of n trials.

$$q = \sum_{i=1}^{m} \frac{(k_i - np_{0i})^2}{np_{0i}} \tag{1}$$

(2)

$H_0 : p_i = p_{0i}$ all i against $H_1 : p_i \neq p_{0i}$ for some i
Accept H_0 iff $q < \chi^2_{1-\alpha}(m-1)$

Solution Page 1

Uniformly distributed integers between 0 and 9 means that they have the same probability of appearing. with m =10, $P_{01} = 0.1$ and $n = 1000$ it follows from () that

$$q = \sum_{j=0}^{9} \frac{(n_j - 100)^2}{100} \tag{3}$$

$$q = 17.76 \tag{4}$$

$$\chi^2_{.95}(9) = 16.92 \tag{5}$$

Since $17.76 > 16.92$, we reject the uniformity hypothesis.