coding interview

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1 File Handling

2 Random Variables

2a.

2b.

2c.

The null hypothesis that Y members were sampled uniformly at random with replacement, is equivalent to "the Z variables (counts of occurrences of each X's members) are multinomial (or binomial if m=2) distributed", and we can perform a multinomial statistical test.

2d.

2e.

The p-values are supposed to be chi-squared distributed, with the k=1 degree of freedom 1. Since the null hypothesis can also be tested by using Pearson's chi-squared test

$$\chi^2 = \sum_{i=1}^{m} \frac{(x_i - E_i)^2}{E_i} \tag{1}$$

where E_i is the expected number of cases in category i under the null hypothesis.

3 Time-series analysis

4a.

A practical way is to use the powerline 50 Hz frequency component in the recorded data. in the corresponding Matlab code, it is carried out by two methods: utilizing the auto-correlation function, and the power spectral density function.

4b.

The corresponding code is provided in $time_series_analysis.mat$ file.

4c.