

BioE 1330 - Homework 3

1. What's a "purely deterministic argument"? Give an example applying to image noise.

2. The mean value is obtained by the integral of a weighted average (similar to the center of gravity), that is, the probability of a value times the value itself. Why don't we need to divide by the number of values to normalize the mean?

3. Random distributions may have a Poisson distribution. If the distribution of an event is known, how can it be random?

4. Signal to noise ratio is a function of the modulation transfer function (frequency response) and the noise power spectrum. Real MTF's roll off at the top end (i.e. loose high frequencies). He also said that the more high frequencies that are lost (i.e. the worse the MTF), the worse the signal to noise. Many types of noise occur only at high frequencies. How can SNR be worsened by an MTF that loses high frequencies?

5. Why might the diameter of the heart appear to be larger in a planar radiograph than in a CT scan?

6. How are gamma rays and x-rays different? How are they the same?

7. Signal to noise ratio is related to contrast and the rate at which signal is received, but why should it be related to area?

8. The contingency table contains four conditions: true positives (identification of disease where it exists), true negatives (failure to ID disease where none exists), false positives (identification of disease where none exists), and false negatives (failure to ID disease where it exists). Place each of these terms on the appropriate location on the contingency table, identifying each cell by the letters a, b, c, and d as shown in the figure 3.14 in the book (p. 93).

A given test for prostate cancer has the following values in a study: $a=100$, $b=1$, $c=5$, $d=500$. What is the sensitivity, specificity, and prevalence?