Theoretical Methods in Neuroscience I
Homework Sheet II

Problem 2.1

In the class, I worked out in details the two points correlation function for the velocity $\langle\langle v(t_1)v(t_2)\rangle_\xi\rangle_T$ of a Brownian particle subject to a constant force f_0 (look problem #2 in class notes #3). You are asked to integrate $v(t)$ to find $x(t)$, then calculate the variance $\langle\langle(x(t)-x_0)^2\rangle_\xi\rangle_T$.

Problem 2.2

For conventional light source, the actual number of photons arriving at a detector (for example the Retina) due to a flash of light obeys Poisson statistics. Accordingly, the probability of detecting n photons in a flash of light is given by

$$P[n|\bar{n}] = \frac{\bar{n}^n}{n!}e^{-\bar{n}} \tag{1}$$

where $\bar{n}$ is the mean number of photons recorded at the detector. Calculate $\langle n^2\rangle$ and show that for a Poissonian process both the mean and the variance are equal ($\langle n^2\rangle - \langle n\rangle^2 = \langle n\rangle$).