In the name of God

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ADVANCED TOPICS IN STATISTICAL PHYSICS II

Exercise Set 6

(Date Due: 1395/04/10)

1. According to following definition:

$$\int_{-\infty}^{+\infty} x^n \exp[-(x-\beta)^2]dx = (2i)^{-n}\sqrt{\pi}H_n(i\beta)$$

where H_n are the Hermite polynomials show that:

$$M_n(x',t,\tau) = \left[-i\sqrt{D^{(2)}(x',t)\tau}\right]^n H_n\{\frac{1}{2}iD^{(1)}(x',t)\sqrt{\tau/D^{(2)}(x',t)}\}$$

also show that above equation causes to correct function for $D^{(n)}$.

2. Calculate the Moments: Using Green's function approach show:

A :

$$M_i(t) = \langle x_i(t)\rangle = G_{ij}x_j$$

B :

$$\sigma_{ij} = \langle [x_i(t) - \langle x_i\rangle][x_j(t) - \langle x_j\rangle]\rangle = \int_0^t G_{ik}(t')G_{js}(t')g_{ks}$$

C :

$$\dot{\sigma}_{ij} = -\xi_{ik}\sigma_{kj} - \xi_{jk}\sigma ki + g_{ij}$$

D :

$$\ddot{\sigma}_{ij} = -\xi_{il}G_{lk}G_{js}g_{ks} - G_{ik}\xi_{jl}G_{ls}g_{ls}$$

3. Using the value of $D^{(1)}, D^{(2)}, D^{(3)}, D^{(4)}$, compute $\langle x^4\rangle$ as a function of $\langle x^3\rangle$ and $\langle x^2\rangle$ for data that you have.

4. By computing the $D^{(1)}$ and $D^{(2)}$ for $\Delta x \equiv x(t+\tau) - x(t)$, compute the correlation function, $C_x(\tau) = \langle x(t+\tau)x(t)\rangle$. Compare your results with that of given directly by data.

Good luck, Movahed