

1) In the Bayesian analysis, we actually use degree of belief regarding to model free parameters. To this end suppose that in the distance modulus of supernova type Ia, a prior for H_0 given by $P(H_0) \approx \exp(-(H_0 - 71)^2 / (2 \times 3^2))$. In this case the find best fit values of $\Omega_m, \Omega_\lambda, H_0$ and determine the confidence interval of mentioned parameters.(20 marks)

2) In a 1-dimensional random walk, if the probability of leaping to right or left is given by $p(x) \approx \exp(-[x - \bar{x}]^2 / (2\sigma^2))$, where $\bar{x} = 2, \sigma = 4$. Find the mean and variance of random walk position after N steps. (20 marks)

3) At first construct a random series and superimpose a combination of some sinusoidal trends. Use the FFT and Wavelet method on it and compare your results. (20 marks)

4) Used a numerical library and solve the following coupled differential equation. Compare your results with that of computed by Maple or some things like this to demonstrate the reliability of your results. (20 marks)

$$\frac{d^2 A(t)}{dt^2} + \left(-2 \frac{dR(t)}{R(t)dt} + 4 \frac{dS(t)}{dt} \right) \frac{dA(t)}{dt} + A(t) = 0$$

$$\frac{d^2 R(t)}{dt^2} + 3 \frac{dR(t)}{dt} + R(t) + \frac{d^2 S(t)}{dt^2} = 0$$

$$\frac{d^2 S}{dt^2} + 3 \frac{dS(t)}{dt} + \frac{dA(t)}{dt} \frac{dR(t)}{dt} = 0$$

$$A(0) = 0, A'(0) = 1, R(0) = 1, R'(0) = 0, S(0) = 0, S'(0) = 1$$

موفق باشید

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