In the name of God

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ADVANCED STATISTICAL MECHANICS I

Exercise Set 1

(Due Date: 1400/08/23)

Different Probability density functions:
A : For A binomial distribution $P_{binomial}(k) = \frac{N!}{k!(N-k)!}p^k q^{(N-k)}$, compute $\langle k\rangle$, $\langle (k-\langle k\rangle)^2\rangle$, $\langle (k-\langle k\rangle)^3\rangle$ and show $P(k)$ for binomial is normalized.
B : For A Poisson distribution $P_{poisson}(k) = \frac{\lambda^k}{k!}e^{-\lambda}$ and $\lambda \equiv Np$, compute $\langle k\rangle$, $\langle (k-\langle k\rangle)^2\rangle$, $\langle (k-\langle k\rangle)^3\rangle$ and show $P_{binomial}(k)$ for binomial is normalized. Also show:

$$P_{poisson}(k) = \lim_{N\to\infty} P_{binomial}(k)$$

C : Show $P_{Gaussian}(k) = \lim_{\lambda\to\infty} P_{poisson}(k)$
where a Gaussian distribution is $P_{Gaussian} = \frac{e^{-\frac{(k-\lambda)^2}{2\lambda}}}{\sqrt{2\pi\lambda}}$

Good luck, Movahed